THE PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH
ABDERRAHMANE MIRA UNIVERSITY OF BEJAIA

FACULTY OF LETTERS AND LANGUAGES
DEPARTMENT OF ENGLISH
RESEARCH LABORATORY: LESMS

Dissertation Submitted in Candidacy for the Degree of Doctorate (LMD) in Didactics of English Language and Literature

Prepared by:
Ms. Siha BOUGHANI

FOSTERING EFL LEARNERS' DECISION MAKING SKILL THROUGH ADOPTING STATISTICS EDUCATION INTO ACADEMIC RESEARCH: CASE OF MASTER STUDENTS OF ENGLISH, AT THE DEPARTMENT OF ENGLISH, UNIVERSITY OF BEJAIA

DEFENDED: March 1st, 2021

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Academic Year: 2020-2021

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ABSTRACT

This study investigates the role that statistics education plays in fostering the EFL learners' decision making skill when conducting scientific research. The students, at Master level, are engaged into independent learning where they need to make their own decisions concerning their research, dissertation writing, selecting methodological procedures, choosing the right interpretations and so on. This is why, in this study, we suggest statistics education as a way to help them think logically and base their decisions on reason and argumentation during the research process.Our population, thus, is constituted of Master students of English at the Department of English, University of BEJAIA from whom 25 students have been selected to participate in the research experiment and 25 students have participated as a comparison group.This study follows the procedures of an experimental design where both qualitative and quantitative methods are used; the data gathered from the questionnaires and the error analysis are analyzed through descriptive statistics and the data from tests and scales are analyzed through inferential statistics. Finally, data from the interview are analyzed thematically. The results of this study have revealed that our sample has developed their decision making skills; the students have been able to make decisions thoroughly and following scientific research principles. Although the students have been prone to statistics anxiety most of the time, their knowledge of the importance of statistics in scientific research led them to make great efforts to understand and apply the lessons. Moreover, the results have entailed a syllabus for an "EFL Statistics Education" which bases on Master's students' needs.

Key words: Scientific research, decision making skills, EFL students, Master students' needs, statistics education.

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DEDICATION

To my ***mother,***

To my ***father***,

To all my family,

To all my friends and my colleagues,

To those who prayed for me and, supported, and helped me,

LIST OF ABBREVIATIONS, ACRONYMS, INNITIALISMS & SYMBOLS

AL: Applied Linguistics

ANCOVA*:* Analysis of Co-Variance

APA: American Psychological Association

AR: Action Research

Did.: Didactics

DM: Decision Making

DMS: Decision Making System

DP: Dependent Variable

DRS: Developing Research Skills

DSS: Decision Support Systems

EFL: English as Foreign Language

ES: Experimental Science stream in Algerian secondary school

ESP: English for Specific Purposes

F: Frequency

FL: Foreign Languages stream in Algerian secondary school

ICT: Information Communication Technologies

IRS: Information Rich Sample

IV: Independent Variable

L&T: Literature & Philosophy stream in Algerian secondary school

LCC: Literature Common Core stream in Algerian secondary school

LMD: Licence/ Master /Doctorat

M: Mathematics' stream in Algerian secondary school

M or $\bar{\mathbf{x}}$: the arithmetic mean (the average score)

M, Mdn. or$\tilde{\mathbf{x}}$: Median

M&E: Management and Economics stream in Algerian secondary school

MS: Middle School (Intermediate level)

N (in t-test tables): the number of the sample

N: Never (in frequency tables)

NA: No Answer

NESB: Non English Speaking Background

O: Occasionally (in frequency tables)

p: the p-value it refers to the level of significance

R: Rarely (in frequency tables)

RM: Research Methodology

SAQR: Statistical Analysis in Quantitative Research (Master 1 module)

SD or **Std**. Deviation: stands for the standard deviation.

S&T: Science and Technology stream in Algerian secondary school

SRM: Self-Regulated Model

TM: Technical Mathematics stream in Algerian secondary school

VF: Very frequently (in frequency tables)

WRP: Writing Research Paper (Master 1 module)

%: percentage

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GENERAL INTRODUCTION

I. STATEMENT OF THE PROBLEM

Academic research is one of the most important procedures that Algerian higher education employs to foster student responsibilities, critical thinking, and many other skills. Through the research process, learners learn diverse skills and different strategies that enable them to develop their learning process and prepare them for a suitable professional career. Madan and Teitge (2013) in their study about the benefits of research for undergraduate students argue that it is an important chance for the students to explore the career areas and determine their fields of interests. It also helps students develop a certain degree of reasoning and help them acquire different affective and practical experiences. This is also illustrated in Madan and Teitge (2003) who maintain that research allows the students to understand other researchers' reasoning and rationality and develop their own as well. Practical experiences in research enable the students to grow up emotionally (through experiencing different kinds of emotions (McLaughlin, 2003) and cognitively (by being more rational when thinking); and therefore, advance in their learning. Through the research process, the learners are asked to combine both intuition and reason to reach possible solutions to the problem under study. Learners find themselves in situations where they need to choose among alternatives that make them hesitant and unsure about their choices. This uncertainty might be due to the lack of arguments and pieces of evidence that support their choices and decisions. Therefore, developing a systematic way to making decisions ought to be the major concern of this research.

The traditional assessment techniques in research (Garfield, 1994; Gal & Garfield, 1997; Garfield & Gal, 1999) do not provide a clear assessment of the results. This makes their interpretation superficial and ambiguous because these traditional techniques do not provide any evidence or argument that supports these interpretations. Statistics is one of the most used methods in treating and analyzing the data of research studies in educational fields in recent years. It makes use of evidence-based reasoning which justifies any decision and any interpretation of the results. Consequently, helping students to learn statistics might enable researchers to develop their cognitive abilities such as understanding and to critically evaluate what is being learned. Moreover, teaching statistics does not only mean learning how to analyze and interpret the results obtained, but it also shows how to choose the accurate design and methodology including the methods and procedures for the whole study. Statistics education is also concerned with hypothesis construction and generalization of results and so on.

Therefore, this study is undertaken to test how introducing EFL students into statistics lectures can foster and develop the learners' decision-making skills during the research process. Our case of study targets Master’s students of English, Department of English at the University of BEJAIA. These students present the appropriately selected population as they are at the phase where they need to be enough acquainted with the notions related to the field of investigation because most of them are required to cover a research document (memoir) for the degree to obtain and be independent and responsible of any choice they may select for their future perspectives.

II. THE RESEARCH OBJECTIVES AND SIGNIFICANCE OF THE STUDY

This research intends to demonstrate a causal relationship between Statistics Education and learners' decision-making skills among English as Foreign Language (EFL) Master’s students. Furthermore, this study mainly highlights the importance of making decisions to Master’s students when engaged in an academic research project. Besides, it tries to elaborate the scientific way these students may use to make safe decisions based on proofs, pieces of evidence, righteous and logical arguments.

Moreover, the research work at hand has some other secondary aims including clarifications about the students' attitudes towards studying statistics. That is to say, most students who are studying English as a foreign language at the department of English, University of BEJAIA detain a Baccalaureate diploma in different streams such as Philosophy, Literature, or, Foreign Languages. As a matter of fact, the students find statistics as much difficult as mathematics. This study; therefore, aims at clarifying these points of view about learning statistics, and demonstrating that acquiring statistical skills can be achieved through EFL learners' commitment, devotion, and willingness.

In addition, the most important and major aim of the research is entailing a statistics syllabus that is based on EFL Master’s students' needs; and which may develop and foster their research skills and enhance their decision making in the research process.

III. THE RESEARCH QUESTIONS

In order to achieve the above aims and to demonstrate through conclusions the importance of the tackled field, this research seeks valid and reliable answers to the following questions:

1. What are the challenges that Master's students of English face when making decisions during their academic research process?
2. What are the factors that hinder Master EFL students' decision-making skills during the academic research process?
3. How can we develop the learners' decision-making skills during the academic research process?
4. What is the effect of statistics education on EFL learners' decision-making skills?
5. What is the role that teaching and learning statistics play in enhancing EFL learners' decision-making styles?
6. What would be the most suitable statistics syllabus for EFL Master's students?

IV. THE RESEARCH HYPOTHESES

Decision-making is one of the most important skills that are needed by higher education students as it helps students be responsible for their studies and encourages them to take risks when they are in front of different choices by using systematic and scientific thinking. Statistics in academic researches deals with giving evidence to any choice the researchers make and to any interpretation they conclude. It provides information about how to argue and how to draw conclusions from the battery of pieces of evidence used for the sake of raising the reliability and the validity of results. Therefore, the present investigation, as aforementioned, is to enable the students to make use of the received knowledge about the research process and create logical links between the different research steps and formulate the needed arguments that justify their decisions. Consequently, this research aims at finding out the causal relationship that exists between statistics education and decision-making skills during the research process, and thus suggests a syllabus action plan as a response to the students' needs. .

Based on the above ideas, this research expresses four main hypotheses that we seek to demonstrate:

1. The students' lack of decision-making skills during the scientific research process may be caused by their lack of knowledge about statistics and statistical procedures;
2. Adopting statistics into academic research may affect positively the research results as it can foster the students' decision-making skills.
3. Through following Statistical instructions, students can provide concrete evidence to each decision they make during their research process.
4. The EFL Master learners' needs can dictate the appropriate Statistics Syllabus as they present different profiles, different attitudes, and different perspectives.

V. THE SAMPLE AND POPULATION

Master, two students are engaged in academic research as a step towards graduation fulfillment. These level students, according to the prior data gathered to state the problem, feel at crossroads where they need to make different decisions on different issues they meet during the research process. This may cause them to waste time and sometimes abdicate their research paper because they could not find ways to their confusion and they were unable to make their decisions. Therefore, we strongly believe that preparing the students for such situations in their Master 1 level would be very helpful to avoid confusion when conducting real research and thus provide them with the necessary confidence and research foundations. Accordingly, our population is Master’s students of English at the Department of English (including both didactics and applied linguistics specialties), University of BEJAIA.

There were 127 students of THREE specialties: didactics of Foreign Languages and Applied linguistics at the department of English, University of BEJAIA. There were four Master 1 groups among which one group is studying applied linguistics, two groups studying Didactics of Foreign Languages (DLE), and one group studying Literature. The research targets only Applied Linguistics and DLE (94 students).

More specifically, the sample consists of Master one level we randomly (based on cluster sampling technique) select 25 students to represent the experimental group and 25 students for the control group.

VI. THE RESEARCH VARIABLES

Different definitions had traditionally been provided to statistics. Previous definitions claimed that it is the science of counting where the researchers collect data and calculate averages. However, the recent view of statistics shows that this field is more than counting; it is a purposive process that starts from the beginning of the research and guides the study until reaching conclusions. From another point, decision-making has become recently a center of many different research studies and has been explained by different theories from various fields like politics, cognitive sciences, psychology, economy, neuroscience, and so on. More specifically, many studies emphasize explaining mainly the way or the process people go through to make decisions. This focus is due to the importance that decision-making plays on human daily life. One may ask, how could we define this "decision making"? Decision-making, from a general point of view, happens when people are in front of different choices where they should choose one option that leads to the desired end. However, specific definitions have been attributed to it from diverse perspectives in different domains.

Consequently, this research emphasizes elaborating the causal relationship between two variables: Statistics Education and Decision Making Skills during the research process. We suggest statistics education as a way to overcome the decision-making problems of the EFL learners during their academic research. Thus, in this study, "Academic Research" and "statistics education" represent the independent variables; where the latter is supposed to affect positively the "decision-making skill" which represents the dependent variable.

VII. THE RESEARCH DESIGN AND METHODOLOGY

In order to test our hypotheses, a set of procedures is employed to collect the required data and treat them. Regarding the nature of the study which seeks to find out the causal relationship between our variables, we tend to use a quasi-experimental design (basing on cluster random sampling method) where we compare pre and post-studies of experimental and control groups. These groups are pre-divided by the administration but chosen randomly to represent the Master population. This study makes use of a mixed research methodology (both quantitative and qualitative methods are used).

In the pre-study, we start by analyzing some previous Master’s students' dissertations (82 works) in order to summarize the research decision problems and errors that the students could meet when making their research. Later on, we delve into investigating the participants' difficulties in making research and their attitudes towards introducing them to statistics. Then, we evaluate their decision-making skills before presenting the statistics lectures. During the experimentation and before introducing each phase of the research (data collection, data analysis, and interpretations), a test was assigned to the experimental group to determine the students' lacks and difficulties at each phase. In the end, we evaluate the students' decision-making skills after the completion of the experimentation (post-study), and then an overall test was designed to check the development of their decision-making skills and the reduction of the errors detected at the beginning of the research.

The results, thus, have been compared with those of the control group and the data of the experiment have been analyzed following the t-test and ANCOVA procedures. Furthermore, a questionnaire was administered to the EFL teachers at the department of English, the University of Bejaia to localize and evaluate the needs of the students at the statistical level. The findings of the whole study should be used to suggest a syllabus for statistics education based on the learners' needs. The appropriateness and validation of the syllabus would therefore be based on the development of the students' decision-making skills.

VIII. THE PROCEDURES FOR COLLECTING AND TREATING THE DATA

In order to apply the methodology designed above, a set of procedures are used. To measure the decision-making skills of our treatment group before and after the study, and then comparing it with the control group, we adopted a modified version of the "Decision Making Questionnaire" developed by French, West, Elander, and Wilding in 1993. Moreover, in order to support the results of the scale, pre and post questionnaires have been administered to both the experimental and control group to investigate the students' attitudes at different levels like the difficulties they might meet in research and their experiences in the different research works they have been engaged into; and finally, their attitudes towards studying statistics before and after the introduction of statistics lectures. In addition to these tools, tests are also used to collect data. Before and after introducing each phase of the research process, we have administered pre and post-tests to determine the learners' difficulties concerning the research process. Later on, after completing the participants' graduation, an interview was conducted with randomly chosen students (from our experimental sample) to investigate the role that their Master one lectures of statistics played in accomplishing their dissertations. For the elaboration of the syllabus and for the evaluation of the learners' needs and to set the requirements of Master's students concerning the use of statistics, we have relied on some previous Master research dissertations and on the teachers questionnaire to seek more details about the learners' needs in statistics and decision making. Data from the diagnostic tests are also employed to depict the needs of the learners. The implemented research designs and procedures are fully described in the designed part and chapter.

Then, the results obtained from these tools have been treated through descriptive and inferential statistics. The data are treated through the IBS SPSS Statistics 19 software.

IX. THE DESCRIPTION OF THE STUDY

This study consists of a General Introduction, three Parts: The theoretical Part and Practical Part, the Discussion and Implication part; and finally, a General Conclusion. Seven chapters cover the content of this dissertation:

1. *The general Introduction* includes a statement of the problem, the research aim, the research hypothesis, the research Variables, Research design, and Methodology in addition to research tools and procedures. Furthermore, the general introduction includes significance and the general description of the study.
2. *Part* I: This part is a theoretical part "*Concepts' Definitions and Theories*" where different definitions and explanations of the study concepts and variables are provided. It includes three chapters standing for the three variables of the study. Therefore, the first chapter is entitled "Academic Research" the second chapter labeled "Statistics Education" and finally "Decision Making Skills" as the third chapter. Each chapter provides a review of different theories, models, and approaches that clarify the research variables.
3. *Part II* entitled *Practice and Experimentation*: this part deals with the practical side of our dissertations. It consists of two chapters that are respectively: the research methodology chapter and the results chapter. Throughout these two chapters, we first review our methodology of research and the procedures followed to collect the data. Later we report the results obtained from all the research tools.
4. *Part III*: includes the discussion of the results and the research implications and limitations of this study. The discussion reviews all the results of the research tools in relation to the research questions and related to research works in the field. The Implication chapter presents the different suggestions that are related to the teaching, learning of statistics, and suggestions for future research in this field. Moreover, we present a syllabus related to the teaching of statistics to the Master's level. Finally, this part summarized the main limitations that may restrict the research findings.
5. *General Conclusion*: that concludes the whole study and provides an overall review of the study and the study findings.

The following figure summarizes the main parts and chapters included in this study:

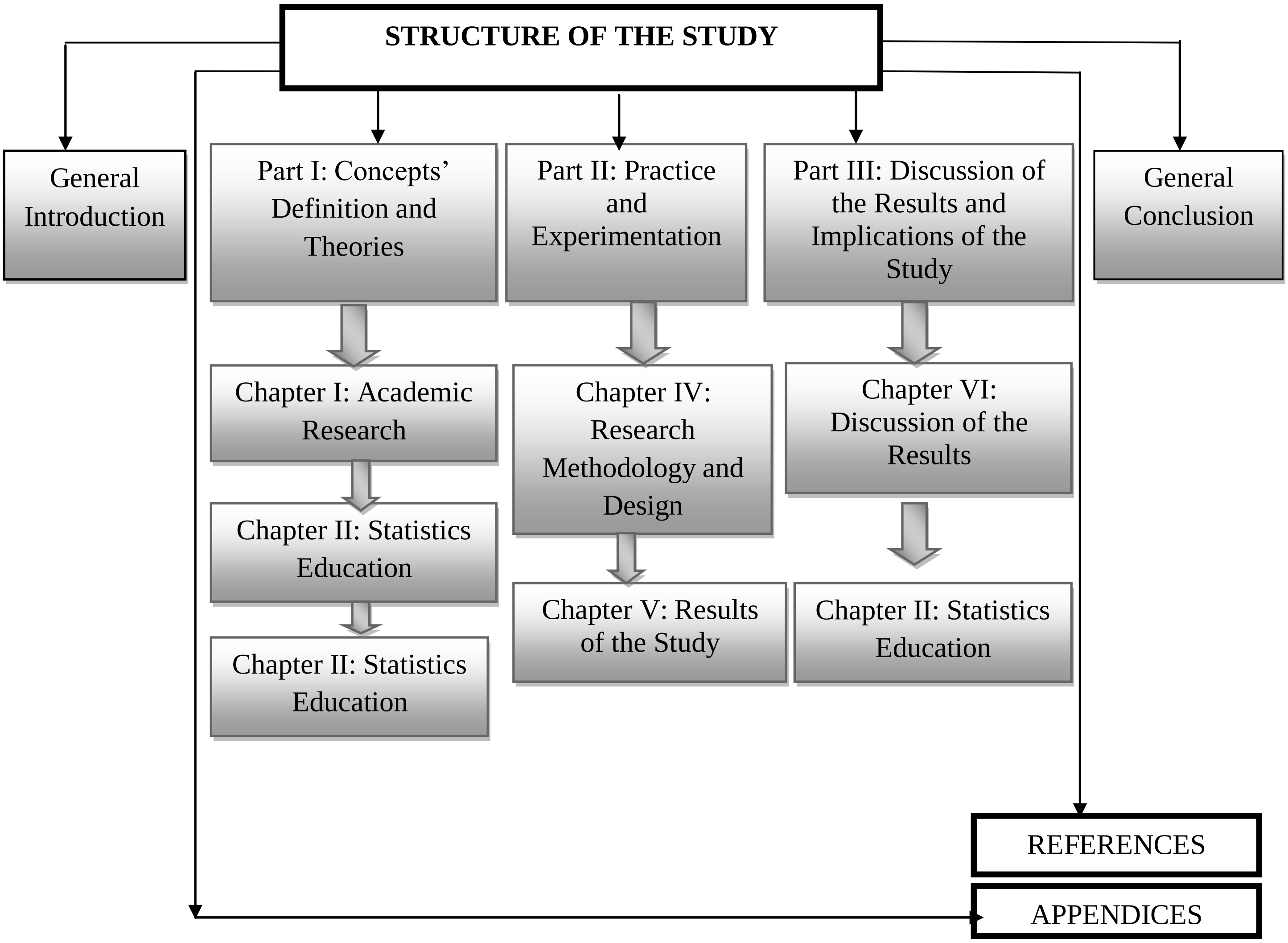


Figure 1: Structure of the Study

PART I: CONCEPT DEFINITION AND THEORIES

PRESENTATION

People assume that research is very important as it leads the human being to discover, explore and find out the truth; however, we believe that research has greater importance on the researcher as an individual and as a social participant. The importance of research cannot be limited to uncovering the truth that people do not know and answering the different questions that come to the minds of human beings. Yet, it plays a crucial role in developing the human mind and fostering human abilities and life skills. One of the significant skills that human being highly needs is the ability to choose among the different choices that life provides to them. Making decisions enable people to get over the different confusions and uncertainties and most importantly move forwards in life. Therefore, regarding its importance, developing this skill should be central in scientific research studies in the different life domains. On another side, statistics -which was regarded previously as the science of counting- became a vital field the recent centuries. Statistics is now considered as more than counting, it has been differentiated from mathematics and recognized as a very important field in natural and social sciences and many other domains.

In this part of our research, we try to support our thesis with the literature in these different fields and establish a logical relationship between statistics, decision making, and research. Therefore, this study involves three main chapters: the first chapter that is entitled: “Academic Research”, provides an overview of a variety of research studies on the different aspects that chart the scientific research in general and the academic research in specific. Furthermore, the second chapter which is named “Decision Making Skill” describes the main definitions and summarizes the most important theories in this area. Finally, the third chapter “Statistics Education” deals with different concepts in the field of statistics and demonstrates the role and the importance of this field in scientific research.

CHAPTER I: SCIENTIFIC RESEARCH

INTRODUCTION

The human being's attempts to discover the world around him have never stopped since his creation. Different ways had been employed to discover and investigate phenomena and to pursue the truth. For this reason, the value of research is recognized in all life sectors and it has been integrated into education and higher education. Research, in higher education, aims at developing the needed skills to face daily activities whether these are related to daily life or studies. In this chapter, we aim at collecting theoretical background concerning the research and scientific research. It includes the different definitions, the importance of such an endeavor, types of research and characteristics, the most known research methodologies and designs; the tools to collect data, and the philosophical principles especially when these are related to scientific researches.

I.1. DEFINING RESEARCH

Kothari (2004) cited multiple views about the research and different definitions. According to the author, research in general terms refers to the systematic, empirical and scientific "search for knowledge" (p.1). Similarly, another definition states that research is "a careful investigation or inquiry specially through search for new facts in any branch of knowledge" (Advanced Learner's Dictionary of Current English, 1952, p. 1069, as cited in Kothari, 2004, p.1). Moreover, Redman and Mory (1932, p.10) argued that research is a "systematized effort to gain new knowledge". From another point of view, Slesinger and Stephenson (1930) defined research as "the manipulation of things, concepts or symbols for the purpose of generalising to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art" (cited in Kothari, 2004, p.1). Furthermore, according to Ostle and Mensing (1976), research is "an inquiry into the nature of, the reasons for, and the consequences of any particular set of circumstances, whether these circumstances are experimentally controlled or recorded just as they occur" (cited in Kothari, 2004, p.9). Finally, Kothari's (2004) summative definition of research claims that it is:

> "the systematic method consisting of enunciating the problem, formulating a hypothesis, collecting the facts or data, analysing the facts and reaching certain conclusions either in the form of solutions(s) towards the concerned problem or in certain generalisations for some theoretical formulation" (pp.1-2).

From another point of view, Walliman's (2011, p.1 &7) definition stated that research is a task that aims at revealing and disclosing things that are interesting and are not systematically known in a given field. Moreover, according to the author, the research aims also at categorizing and grouping the world's concepts, events, and objects in general. The researcher may aim also at describing, explaining, evaluating, comparing, correlating, predicting, and controlling these (i.e. the events, concepts, and objects) or can combine two or more of them (pp. 8-9). The Shorter Oxford Dictionary's definition of research, as well, focuses on the importance of the "carefulness" when investigating or as exactly cited "discovering" the information or the facts or to discover the cause of something; the research is conducted in pursuance of a specific or a desired goal to be achieved (cited in Reardon, 2006, pp.16-17). Under the main objective, other sub-objectives may be targeted via the sub-activities of the research (Reardon, 2006, p.89). Perry (2005, p.8) shared the same idea with Walliman; the author explains that research starts with a question (or questions) that need to be answered. However, the answering process should involve a careful collection, analysis, and interpretation of the data. In this way, Gillham (2000, p.1) claimed that good research should be characterized by strong data and thus should avoid poor data collection methods (Dörnyei, 2003, p.1)

The same idea is explained by Dörnyei (2007) who referred to research as a way of finding answers to questions. Nonetheless, the author distinguished between everyday research and research in the scientific field. He reported Hatch and Lazaraton's (1991) definition of research in the scientific sense which is "the organized, systematic search for answers to the questions we ask" (cited in Dörnyei, 2007, p. 15); that is to say, research is the process of pursuing answers to questions but the process is limited by the rules of scientific and systematic inquiries. Scientific, according to Reardon (2006, p.126), bases on clarity and a well-justified methodology.

Moreover, Walliman (2011, p.15) asserted that research is not only about finding answers but also concerns with the researchers' abilities; as such, research refers to the process of acquiring and developing the researchers' skills like understanding, collecting, and interpreting the data to be used in order to understand the world.

Consequently, we may conclude from the above definitions that research aims at different goals that serve in discovering reality and uncovering the truth. The research process is supported with empirical, scientific methods and a well-built methodology that produce strong and empirical data.

I.2. IMPORTANCE AND AIMS OF RESEARCH TO EDUCATIONAL SETTINGS

Research is a systematic process of pursuing truth; it aims at answering the question and resolving problems. Given that there are many fields and various domains, the aim of research differs from one field to another. Kothari (2004, p.2) classified the research aims broadly into four main categories:

a) The research that aims at exploring situations and facts; this is mainly called exploratory (or formulating) research.
b) The research that aims at describing a phenomenon, individuals, groups, or situations; this is called descriptive research.
c) The research that aims at diagnosing the frequency of the occurrence of phenomena or the associating factors to these phenomena; this is called diagnosis research.
d) To test hypotheses in order to prove or disapprove them. The hypothesis mainly claims a causal relationship between variables. This is called hypothesis-testing research.

Depending on the goals of the studies, the significance of research mainly differs from a field to another and from a person to another. Research in general, according to Kothari (2004), maybe conducted for different reasons. A researcher may want to make research in order to gain a given degree at school or university, or the researcher enjoys or wants to challenge questions or problems and provide answers or solutions. Moreover, the research may be conducted for gaining respect or providing services to society, or growing the researchers' intellectual competencies (Kothari, 2004, p.2).

According to Walliman (2011, pp.8-9), a researcher may have different goals when undertaking research. A researcher may want to categorize objects or phenomena, describe a phenomenon through observation. Moreover, the researcher may try to explain complex phenomena or objects or events …etc, or evaluate the quality of objects and events and make judgments. Other aims include comparing cases to identify similarities and differences, correlating two variables or phenomena and discovering types of relationships, predicting future behaviors, and finally controlling events or situations. According to the author, a researcher may combine two or more of the aims in a single study.

I.3. CHARACTERISTICS OF GOOD RESEARCH

Research is a process that exists in all life aspects. Every day people undertake research even for the very simplest reasons and even for plain aims. Researchers, therefore, distinguish between everyday life and scientific research by attributing some characteristics to the latter. These features are summarized in the following points (as described by Kothari, 2004):

a) *Research is scientific* because it bases on scientific methods: a scientific method is defined as the "pursuit of truth as determined by logical considerations" (Kothari, 2004, p.9). In "scientific" research, the researcher employs mainly experiment, observations, and logical arguments in general. The logic enables the researcher to propose precise and accurate ideas and suggestions. It also facilitates the comparison between facts and observations. The experiments, from another side, are employed to test and to provide evidence to a hypothesis (es) that is (are) defended through research. The scientific method, then, stresses the importance of empirical evidence, accurate concepts, objectivity and ethicality, replication. Finally, the scientific method results in predictions and conclusions that are probabilistic and thus formulates scientific theories (Kothari, 2004, p.9). The scientific methods push the students to use the logical, rigorous, and impersonal modes of thinking (Lastrucci, 1967 as cited in Kothari, 2004).

b) *Research is systematic*: this refers to the fact that research is guided with a specific sequence of steps that should be followed in order to arrive at accurate conclusions (Kothari, 2004).

c) *Research is a logical process*: it is guided by the rules of induction and deduction. Logical reasoning helps the researchers especially in the process of making decisions (Kothari, 2004).

d) *Research is empirical*: this means that data are concrete and are related to real situations (Kothari, 2004).

e) *Research is replicable*: this means that the study can be repeated by others (Kothari, 2004).

Therefore, what distinguishes scientific research from everyday research tasks is the ability of the first to provide high-quality data that serves human life, science, the society through its accurate processes and its ability to conclude results that are reliable and can be generalized.

I.4. TYPES OF RESEARCH

When reading about the literature of research and types of research, one may meet various types, each type is classified according to the nature of the research, the type of the data, and so on. The following section demonstrates a sample of these types as described by some researchers:

a) *Descriptive VS Analytical Research*: This categorization bases on the aim of the research process. The former aims at presenting the phenomena or the variable in general as it is and the researchers have no control over the variables, this is why researchers employ surveys and fact-finding tools in order to achieve the results. The author claims that this type of research in social sciences is called: Ex post facto research. Conversely, analytical research bases on the critical analysis and evaluation of already existing information or knowledge (Kothari, 2004, p.3).
b) *Applied VS Fundamental (Basic) Research*: This categorization bases on the research process. The former's process aims at finding out a solution to a problem; and the latter aims at gathering information, generalizing, and formulating theories (Kothari, 2004, p.3). More specifically, basic research is a hypothetical type of research that bases on abstract constructs and acts as a starting point to the applied research. This last is applicable and practical and aims at resolving practical problems (Perry, 2005, pp. 73-74). Moreover, the applied research, according to Jupp (2006), refers to the research that employs the knowledge; yet, it does not search for it for the sake of knowledge; that is to say, the applied research makes use of the existing knowledge to create solutions to a problem but it does not aim at formulating theories and knowledge.
c) *Quantitative and Qualitative Research*: This categorization is made based on the type of data gathered. The former aims at describing the phenomena in terms of numbers. The other is investigating the kind and the quality of phenomena (Kothari, 2004, p.3). Quantitative research originates from the field of psychology that uses statistics in order to make generalizations to the whole population from the results obtained from small samples. This type makes use of the techniques that either test a hypothesis or only gather information about a phenomenon (Perry, 2005, p. 79). On the other side, qualitative research started in the field of anthropology and sociology. This type of research makes use of verbal information analysis to obtain data from the sample which is chosen purposefully through the information-rich sampling (Perry, 2005, p.

75) [for more details about this type of sampling see section two, pp. 68-69]. This type of research employs different qualitative techniques to gather data, for example, case studies, ethnography, conversational analysis, and protocol analysis (Perry, 2005, pp.77-79). Dörnyei (2007) stated that quantitative research employs research tools and procedures that collect numerical data which are analyzed with statistical procedures. Qualitative research -from another side- relies on tools that collect detailed and open-ended data which are analyzed with nonstatistical procedures.

d) *Conceptual VS Empirical*: Conceptual research bases on abstract data and it is performed by thinkers and philosophers when making research on abstract ideas. They aim to develop concepts and notions or to redefine pre-existing ones. The empirical bases on data that can be tested and verified and which comes mainly via performing experiments or observations (Kothari, 2004, p.4).

e) *One-time VS Longitudinal Research*: This category bases on the time need to accomplishing the research. The former is carried out in a one time period whereas the other is getting done in a long period (Kothari, 2004).

Kothari (2004), also, mentioned other types of research including, for example, field-setting research or laboratory research, or simulation research which are categorized according to the environment or the place of the research, and so on. The literature about types of research is very rich. These types may be interrelated as people can find in a field a longitudinal quantitative empirical research for example.

I.5. RESEARCH, DECISION MAKING AND LOGICAL THINKING

The role that research plays in the decision-making process has been widely investigated in different fields mainly in politics and management. The research facilitates collecting information about the nation's economy, business, industry, and all aspects of social life that helps in making sound decisions. On this concern, Kothari (2004) claimed that: “Through research we can devise alternative policies and can as well examine the consequences of each of these alternatives. Decision-making may not be a part of research, but research certainly facilitates the decisions of the policy maker” (Kothari, 2004, pp.5-6). This is the role that research plays in the external life; however, researchers when conducting research also meet different alternatives and choices that require him/her to make an appropriate choice or decision.

Accordingly, research is a logical process in which the steps follow a rational decision-making process. First, choosing the nature of research to undertake is based on the researchers' interest, this will point him toward the appropriate type of research to follow; and then, the research aims and objectives. These research aims indicate the type of the research design which, in turn, determines the data collection methods including different research tools and procedures and finally data analysis procedures and tests. In some cases, more than one design is employed in one study especially in human behavior studies (Walliman, 2011, p.13).

The logic employed in research comes in three main kinds according to Walliman (2011): deductive, inductive, or hypothetic deductive.

I.5.1. *Inductive reasoning*: the researcher makes specific observations from different experiences and formulates general conclusions. This type of reasoning is considered the earliest and the most used in recent years (p.17). However, inductive reasoning is limited by the fact that there are not a known number of the repeated observations to make the appropriate and reliable conclusion. The second limitation relates to the conditions and the circumstances in which the observations should be recorded in order to conclude. Therefore, in order to avoid these limitations, the researcher should ensure the use of a large number of observations and circumstances to guarantee the right generalization (p.18).

I.5.2. *Deductive reasoning*: this is first used by Plato. The researcher starts with a general statement (called a premise) and through the use of appropriate argumentations; the researcher generates a specific conclusion. This reasoning bases on the first premise which is very general, then a very specific case which is the second premise, and finally the specific conclusion that is extracted from the previous premise (the second). The author provided an example: All living things are dying (first premise), animals are living beings (second premise), and so animals are dying (conclusion). As a limitation, this reason starts with hypothetical statements that can be false. Therefore, the conclusions can be also falsified by different observations that can lead to the total rejection of the first statement (p.18-19).

I.5.2. *Hypothetic deductive reasoning*: this type joins the two above reasoning modes. It includes five main steps: first, identify the problem; second, generate hypotheses from different observations; and third, plan the implications of the hypotheses; fourth, test the hypothesis with the practical or the theoretical testing procedures; and finally, reject or refine the hypothesis based on the results. This reasoning is considered the core of scientific research as it combines experience and inductive and deductive reasoning (p.19).

Accordingly, the research can be beneficial not only in pursuing the truth and resolving problems. It also enhances human being skills and reasoning. Researchers learn how to pay attention to details, employ every single piece of information, and rely on logical processes in accepting o rejecting hypotheses and suggestions.

I.6. PHILOSOPHICAL APPROACHES TO SCIENTIFIC RESEARCH

Research is a concept that triggered human attention long ago, thinkers and philosophers tried to understand the world and answer the different questions they confront in their everyday life. The ways people thought about life are categorized by researchers into different approaches. In this section, we report the two main approaches and that is related mainly to the research purposes. These are:

I.6.1.*Positivism*

This approach bases on the fact that “the world around us is real, and that we can find out about these realities” (Walliman, 2011, p. 21). According to this approach, human beings gain knowledge through scientific methods which are based on the “sensory experience”. The scientific methods base on inductive and scientific reasoning and make use of the experiments and comparative analysis, quantitative analysis, and mathematical modeling. Research, from the positivist point of view, aims at uncovering the “universal laws and generalizations” where the research is an impartial and neutral observer (Walliman, 2011, pp. 21-22).

I.6.2. ***Relativism***

This approach has other names which are “Interpretivism”, “Idealism” or “Constructivism”. It bases on the idea that the world around us is constructed by the mind of the human being. That is to say, the world is real but there is no universal truth because the human being can experience it by himself through his perceptions and views which are affected by the beliefs, values, culture …etc. This doctrine believes that research should aim at disclosing the different interpretations of the truth (or the world) made by different people. The researchers are part of the research process, where they make use of inductive reasoning and value-laden data. The research methods employed by this approach are surveys and observations in addition to qualitative methods (Walliman, 2011, pp.21-22).

These two philosophical doctrines are used as the base for different research methods and different concepts in recent years. For example, many researchers investigated the meaning of subjectivity and objectivity basing on the positivists' and idealists' points of view (see for example Gelman & Hennig, 2017; Bornstein, 1999, and so on).

I.7. SOURCES AND TYPES OF DATA

Data is the basic unit of research. Researchers may meet different types of data that come from different sources. Walliman (2011) claimed that researcher can have access to two types of sources:

I.7.1. Classification of Data basing on its source

According to Walliman (2011), there are two types of sources: primary and secondary:

I.7.1.a.*Primary Sources*

These sources are those which provide raw data. The researcher can get primary data through experimentations, observations, and recordings (Walliman, 2011). According to Kothari (2004), primary data are those which are original (collected by the researchers themselves) and are afresh. Based on the different sources, Walliman (2011) distinguished between four types of data. First, a *measurement* that represents the data in form of numbers that specify a quantity (example of these are scores, polls ...etc). Second, *observation* is the data that is recorded via the researchers' senses or through the use of other instruments (like tape recorders, cameras …etc) about a given phenomenon, situation, or event. The third way of primary data collection includes *interrogation* which stands for the data that are collected from asking questions and inquiring (probing). Finally, the fourth type mentioned by the author is *participation*. This last type deals with data gathered from experiences (Walliman, 2011, p. 89). The collection of primary data happens through different research tools like observation, interviews, questionnaires…etc (Kothari, 2004). Further details are in the research process section of this chapter in hand (p. 20).

I.7.1.b.*Secondary sources*

They provide pre-existing data which come in a written form. The researcher takes information that is already recorded, analyzed, and interpreted by other authors. These data are found in magazines, articles, reports, documentaries, advertising, the internet …etc. (Walliman, 2011, p. 89 & pp.70-71). Secondary data, thus, are those which have already been collected by other researchers and have already been analyzed (Kothari, 2004).

- Secondary Data Analysis

When analyzing the secondary data, the researcher may aim at classifying and investigating the different models and patterns. It can aim also at investigating the development of a phenomenon or event through time or identify the repetition of certain results in different situations (Walliman, 2011, p.86). Therefore, the researcher needs to employ some specific procedures to meet these aims. According to Walliman (2011), there are three main tools to analyze secondary data:

1. *Content Analysis*: consists of quantifying (a quantitative procedure) the frequency of a given variable or a case in the text being analyzed (either an article, a documentary, an advertisement …etc) in order to compare it with other cases to identify its importance (p.86).
2. *Data Mining*: it is used in the case of large databases especially in the field of business management to discover patterns; it is used in the prediction of trends and behaviors. It employs statistical procedures to find out the data that are related to the database (p.89).
3. *Meta-Analysis*: this refers to the analysis of results analysis of a previous study through the employment of statistical procedures. The meta-analysis methods base on a set of steps to follow. First, the researchers define the issue that they want to investigate. Then, they collect the needed number of studies that worked on (or that involve) this issue. Next, they find the common method of measurement that detects a significant relationship in the studies. Later on, they decide upon the aim of analyzing the results of the studies like comparing the variation between the results of each study, or to specify the analysis on studying the development of one variable along with the different cases …etc. After that, the researchers apply the appropriate statistical procedure, and then finally, they report the results of their studies and discuss the different limitations. However, according to the author, this method is limited in the fact that it bases on the studying research published in journals for example, but the authors in journal studies report only successful results. Moreover, the researcher cannot justify the combination or comparison between the different methods and statistical procedures used by the authors of the works under study because of the huge numbers (Walliman, 2011, pp.90-91).

When using the secondary data, the researcher should ensure that the data are reliable through citing the right reference including the author and its source, and when have they been collected. Moreover, the author should make sure that the data are suitable in sense of the concepts used and the collection tools to be used. There should not be any opposition between the secondary data and the primary data. Finally, the secondary data should be adequate for the purpose of the study. The data are said to be inadequate if they are narrower or wider than the purpose of the study (Kothari, 2004).

I.7.2. Classification of Data basing on its quality

On another side, when talking about the classification of the data, researchers may talk about categorizing it based on its nature, features, and quality. Researchers argued that there are two types: qualitative or quantitative

I.7.2.a. ***Quantitative data***: they are the data that come in form of numbers or used to record the data. These data are analyzed using statistical procedures (Walliman, 2011, p.71 & Dörnyei, 2007). This includes for example scores of tests, a frequency of a given behavior, and so on (Dörnyei, 2007).

I.7.2.b. ***Qualitative data***: Those are the data that cannot be turned into numbers and those are expressed and described in words (Walliman, 2011, p.71). According to Dörnyei (2007), the qualitative data are transcribed into texts and written notes. From a general perspective, the qualitative data analysis follows some basic steps to ensure obtaining reliable data. Bromley (1986, p.26) suggested the following steps (as cited in Walliman, 2011, p. 130):

- Define the research problem/question;
- Clarifying the research concepts through a collection of previous research and theories;
- Suggest pre-solutions to the research problem or pre-answers to the research question;
- Search for evidence that supports or contradict the suppositions, then start eliminating the interpretations that contradict the proved data;
- Through a cross-examination, ensure the accuracy and the consistency of evidence and the sources of the data used.
- Check the validity and rationality of the evidence that leads to the conclusions.
- Prepare the report of the study

To conclude, novice researchers should be aware of these classifications to ensure employing the right methods to treat and analyze them and to be sure of the conclusions they get from the data.

I.8. RESEARCH PROCESS

The research is a complex and compound process that constitutes of different steps that need a careful and logical design and plan. Kothari (2004) claimed that the research steps are interrelated where the first steps, according to the author, dictate the nature of the latter steps; and any problem in the first steps leads automatically to problems in the following steps. This may block the research study or lead to unreliable results. Therefore, the researcher should be anticipating the needs of the next step. In this section, we present the most important steps that each researcher should take into consideration when planning and undertaking his/her research work:

I.8.1. Identifying Research Problem and Sources of Research Questions

The definition of “research questions” or “research problem” may seem very simple at the first glance; however, it is one of the most difficult steps of the research process. Research questions are problems that emanated from the surrounding environment, and that came out of the curiosity of the researcher. According to Perry (2005, p9-11), research question (s) in the field of applied linguistics hail from:

- The practical problems faced in the classroom
- The research may extract problems or questions from the literature in the field of the study (which the author called secondary sources).
- According to the author, when the researcher deepens the reading in the “Primary Sources”, their understanding of the missing points in their research studies will be fostered and they can get more research questions.
- Finally, questions may be aroused from other studies’ discussion and conclusion sections including the section of the limitation and the recommendation section.

According to Walliman (2011, p.32), the research problem should be researchable and testable, stated clearly and in a concise way and it should be of significant value. Kothari (2004) maintained that research problems can be a “state of nature” where the research describes the phenomenon or the situation as it is or can be problematic that is related to the relationship between variables. Therefore, the researchers should decide upon which kind of problem they want to target. When they come to identify the research problem, they should understand it systematically, and then state it with meaningful and technical concepts. Discussing the research problem with experts -especially in the case of novice researchers -, may help in developing concepts and specifying the research area. Moreover, reading and defining the leading and the related concepts of the problem through reading and summarizing the background studies may help in the better understanding of the problem and avoiding ambiguity in the research (Kothari, 2004).

I.8.2. Research questions

When the researcher sets up his/her mind on a given research problem, the first step to do is to specify this problem by the research questions which will be answered at the end of the study. The questions act as means to breaking the problem into sub-problems to enable testing it (Walliman, 2011, p.32-33).

I.8.3. Defining Variables

The research variables are directly related to the research design. For this reason, researchers should clarify them well before starting the research. Kothari (2004) defined a variable as a concept whose values are changeable. Researchers classified the research variables into different categories based on the roles they play in the research. Perry (2005, pp.49-51) classified the different research variables (constructs) into different classes:

- ***Dependent Vs Independent Variables***: the independent and dependent variables exist mainly in the studies that investigate a certain cause and effect relationship (or a prediction) between two variables (or constructs). Therefore, when investigating a cause and effect, there will be the variable that causes the variation or the change, and there will be a variable that will be subject to change. In this case, the variable that makes the change is called an independent variable (IV), and the one that changes is called an independent variable (DV). Some researchers call the independent variable (in some cases) the treatment variable (Perry, 2005).
- ***Moderating variable***: this variable exists between the independent and the dependent variables. It exists as a mediator (or as expressed by the author a go-between variable) that moderates the effect of the independent variable on the dependent variables. The author provides an example to clarify this type. He claims that a researcher may be interested in studying the effect of frequency of words and context richness on learners' vocabulary acquisition depending on the level of proficiency. Here the independent variables are the frequency of words and context richness, the dependent variable in

the vocabulary acquisition. Finally, the “level of proficiency” exists to moderate the effect that the IV has on the DV (Perry, 2005).

- ***Extraneous Variables***: when testing the cause and effect relationship, researchers may meet some other variable (s) (other than the IV) that may affect the dependent variable; this is called an extraneous variable. The extraneous, if not controlled, may cause bias in the research results; therefore, in order to avoid its effect, the researcher should choose the appropriate data collection and data analysis designs (Perry, 2005). Kothari (2004) claimed that the extraneous variable is the variable that does not have any relation with the study aim but it has an effect on the dependent variable and thus can result in a bias in the study.
- ***Observation Variable***: this exists in studies that aim at exploring through observations and are not generally found in the cause and effect research studies. The data describing this variable is usually presented in frequencies or through qualitative data (Perry, 2005).

Consequently, based on the importance of variables in research, the researchers should understand first the variables’ relationship that they want to investigate and should ensure that there is not a variable that may affect this relationship in order to achieve reliable results.

I.8.4. Setting Hypothesis

A hypothesis is one of the important research steps that should be clarified and stated early in the research process. It is defined by The Shorter Oxford English Dictionary as “a provisional supposition which accounts for known facts and serves as a starting point for further investigations by which it may be proved or disapproved” (cited in Reardon, 2006, p. 40). Accordingly, Walliman (2011, p.34), the hypothesis represents “reasonable guesses that can be expressed in the form of statement”. Moreover, Kothari (2004) defines it as “tentative assumptions made in order to draw and test its logical or empirical consequences”. Consequently, the hypothesis is set at the beginning of the research in order to guide and specify the research process to the researcher through suggesting a pre-solution or a pre-answer which the researcher will be busy proving or disapproving.

Kothari (2004, p.13) suggested some steps to novice researchers that will help them generate or develop a hypothesis for their studies. The steps are summarized in the following points:

- Discussing the research problems with expert and colleagues to generate new ideas and get different opinions;
- Search for the background and related studies that clarify the research problem and the research concepts to ensure a well understanding of the topic;
- Conduct a pilot or a primary study with a small number of participants who are related to the problem to explore their reaction towards the hypothesis.

The researcher should be aware that the hypothesis differs based on the nature of the study; therefore, Perry (2005, pp. 15-16) explained that the hypothesis depends on the research question(s) being investigated. He differentiates between two types of hypothesis:

- ***Relational hypothesis (es):*** this type is associated with studies that answer questions like "whether there is a relationship between two variables?" The relationship means when the first variable changes the other also changes. When the hypothesis is relational, it can be directional or nondirectional. The directional relational hypothesis identifies the direction of the relationship either positive or negative. A positive relationship means that one variable increases or decreases, the second variable also goes in the same ways as the first variable (if A variable increases, B variable increases too; when A variable decreases, B variable decreases as well). A negative relationship refers to the relationship where if A variable increases, B variable decreases, and vice versa, that is to say, they go in different directions. From another side, the non-directional relational hypothesis is established when the researcher is not sure which direction the relationship will take and the researcher does not state whether the relation is positive or negative.
- ***Causal hypothesis*:** here the hypothesis suggests that a variable (s) is the cause of another variable (s). This means that the first variable causes some changes in the second variable. According to the author, this hypothesis is characterized by the use of some words that identify cause and effect relationship; for example, words like "the influence, the effect, the impact, the change …etc". Just like the relational, causal hypothesis can be also directional or non-directional. If the change caused by one variable in another variable has a certain direction (either positive or negative effect), this is a directional hypothesis; whereas, if the researcher suggests that there is a cause and effect relationship between the two variables without mentioning which direction, it is then a non-directional hypothesis.

The researcher should be aware that some research studies are not supposed to have hypotheses regarding the research problem (s) or question (s). The research studies that mainly do not have hypotheses are the exploratory or formulative works in which the researcher aims at formulating a general rule and not to test a specific suggestion (Kothari, 2004).

Accordingly, the hypothesis plays an important role in the study. It organizes the work and limits the inquiry to no more than what is needed to be tested. Moreover, it helps clarify the different data collection and analysis methods that are needed for this specific type of hypothesis. Through the use of argumentation, the hypothesis is going to be rejected or proved (Walliman, 2011, p.34 & p.39).

I.8.5. Research Designs

After generating the research hypothesis (es), the researcher requires a good plan to collect the needed arguments and evidence to support or oppose that hypothesis. This plan is what is called a research design. Selltiz, Jahoda, Deutsch, and Cook (1959, p.50) claimed that: “A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure” (Cited in Kothari, 2004, p.31). That is to say, research design covers the whole study from the data collection to the data analysis and takes into consideration the time and cost of the study. From this point of view, Kothari (2004, p.31) continued in explaining the research design. He claims that it represents the “decisions regarding what, where, when, how much and by what means concerning an inquiry or a research study”. This latter includes different aspects: the data collection means, the skills needed description of how the research tools and data collection procedures will be implemented, and finally the time and the cost needed for the study (Kothari, 2004). However, these steps can be developed in different research areas because each specific research problem needs special planning.

Therefore, research designs that are usually used in the field of Applied Linguistics (AL) according to Perry (2005) are:

- Designs that are intended to answer the research question “what”: the type of research that is interested in answering this question is “Exploratory research” either qualitative or quantitative (Perry, 2005, p.82). What characterizes this design is that it does not base on the setting of a hypothesis at the beginning to be confirmed, but to form a hypothesis during the investigation or to fill in the missing information.

- Designs that intend to find out a simple relationship between phenomena: this refers to a correlation relationship between variables in the field of Applied Linguistics, where this correlation is calculated by some statistical procedures (Perry, 2005, p.84).
- Designs that aim at answering the "WHY" questions: these base on the causation relationships. It can be a qualitative investigation or quantitative. These designs deal mainly with independent and dependent variables (Perry, 2005, pp.86-88).

In the same issue, Kothari (2004) classified the research design basing on the type (or aim) of the research:

- ***Designs for Exploratory Research*****:** Kothari (2004) claimed that the research which aims at exploring a phenomenon in order to formulate a question or develop a working hypothesis may have three types of designs: First, the Literature Survey Design: in this type of designs, the researcher conducts a bibliographical investigation on previous literature about the area of the study. Second, the Experience Survey Design in which the researchers conduct a survey study with people who had direct contact with the problem in order to get more ideas about the problem and suggest kind of relationships between variables. Finally, the third design deals with the Analysis of "Insight Simulating" Examples: here the researcher will be dealing with different instances (examples) of the phenomenon being studied through the analysis of records, interviewing, and other research tools that enable the researcher to get maximum of data (Kothari, 2004).
- ***Designs for Descriptive and Diagnostic Research*****:** descriptive research aims at describing the features of a given individual or group of individuals. The diagnosis research deals with the investigations of associations between variables or the frequency in which a phenomenon happens. These two research fields require an attentive definition of the population and the design to avoid at maximum any kind of bias. The author explains the most important things that the researcher should include in descriptive and diagnostics kinds of research works. First, the researchers should formulate clearly and precisely the aim of the research. Second, they should decide upon the data collection methods and techniques to be used. Third, they decide upon the sample. Fourth, explaining where to find the data and the needed time to collect it. Fifth, how to process and analyze the data and finally, how to report the data (Kothari, 2004).

- ***Design for Hypothesis Testing Research*****:** this type of research is also called "experimental research". In this type of research, researchers are mainly investigating a cause and effect (or causal) relationship between variables. Therefore, this type of research employs experimental designs that permit getting higher reliable results and avoid at maximum the research bias. In order to reach the desired results, the experimental design has three main principles: the principle of replication in which the study could be replicated at any moment. Then the principle of randomization helps the researcher to avoid the extraneous variables and their effects. Finally, the principle of local control which also preserves the study from the extraneous effects. Therefore, when the researcher plans for an experiment, these three principles should be focused on. The author cites the different types of experimental design. These include An Informal Experimental Design these types include by turn three main sub-types: 1) before and after without a Control design which means that the measurement is done before and after the treatment with an experimental group only (there is not a control group). 2) After only with control; it means the researchers implement the measurement just after the treatment for both experimental and control groups. 3) Before and After with a control group; here the researcher measures the dependent variables before and after the treatment for both control and experimental groups, then a comparison is established between them. The second type is Formal Experimental Design which includes: 1) completely randomized sampling which has two principles the total random selection of the subjects in addition to the principle of replication. The data obtained from these data are analyzed through one-way ANOVA. 2) The randomized block design differs from the first type in that the randomized block design the third principle (in addition to randomization and replication) which is the local control. According to this design, the researcher divides the subjects into two equal blocks (or groups with an equal number of subjects) which are homogeneous in respect to a given variable. The data are usually analyzed through two ways ANOVA. Other design which considered as formal experimental design are: Latin Square Design (which are used in agricultural research) and Factorial Designs (that try to investigate the effect of various factors on a dependent variable) (Kothari, 2004).

From another point of view, Walliman (2011, p.9-13) categorizes the research designs into different types and the choice among these is based on the research aim and the type of the problem. These designs have a set of data collection and data analysis methods that are suitable to them. Among these designs we find:

a) ***Historical design*****:** this includes the employment of scientific and logical methods to analyze historical data (that are taken from the archeological remains, past documentaries), then to check their authenticity, and finally to draw conclusions about past events. Moreover, this design may have the aim of generating solutions to contemporary and modern problems based on the past-based-data (Walliman, 2011, pp.9-10).

b) ***Descriptive design*****:** this design aims at depicting a phenomenon or a situation and presenting it as it is and predicting that the same phenomenon is going to happen again in the same conditions. This focuses on the use of observation as a means of data collection. The observation may come in different forms including questionnaires, interviews, in addition to visual, sound, and smell recording (Walliman, 2011, p. 10).

c) ***Correlative design*****:** this is used to test a kind of relationship between concepts or variables. When talking about the variables, Walliman (2011, p.10) claims that there are two types: either an association which represents a connection and involvement of each variable/ concept with the other; or, a causal relationship in which one variable may have an effect or influence (which is called independent variable) on another (which is the dependent variable). The correlation (either association or cause and effect) can be positive or negative or there is no correlation.

d) ***Comparative design*****:** is used to compare parallel or past and present situations that the researchers have no control over them using the analogy to identify relationships and predict other relationships. The author claims that this design is used "to explore and test what conditions were necessary to cause certain events so that it is possible" (Walliman, 2011, p.11).

e) ***Experimental design*****:** bases on the manipulation of isolated and controlled conditions to investigate events. Mainly this is employed in cause and effect research to identify whether it is the independent variable that caused the change in the dependent variable. This design works with a hypothesis (prediction). Besides, there are different kinds of this design including pre, quasi, and true experimental designs (Walliman, 2011, p.11). The author goes further in explaining that experiments tend to isolate the phenomenon under study from its setting to ensure treating it without having the effects of extra variables. It can be true, pre or quasi-experimental designs. The experimental designs have three main characteristics: first, manipulation of the independent variable and measure the level of change in the dependent variable; then, the researchers try to control for any extraneous variable (that could have an external effect on the dependent variable); and finally, the randomization of the sample. Based on these characteristics, the experimental designs can be divided into three types: true experimental that has the three characteristics; then, when the randomization is not employed, the design is called quasi-experimental. Finally, when the control characteristic is missing, it is called a pre-experimental design (Perry, 2005, pp.89-90 & Walliman, 2011, p.106). The "ex-post factor" is considered a part of the experimental design, but specifically deals with the phenomenon after being happened. Therefore, the researcher cannot have control over the phenomenon (Perry, 2005). According to Kothari (2004), the experimental design is used when testing a hypothesis and the researchers manipulate the dependent variable (s); however, when the independent variable is not manipulated, the research is then called a non-experimental hypothesis. The researcher can choose another group to compare it with the experimental group; this group is called the control group (Kothari, 2004).

f) ***Simulation design*****:** it bases on the manipulation of the environment (like the experimental design) but works with an artificial (non-natural) environment through the use of either mathematical or physical dimensional materials (Walliman, 2011, p.11).

g) ***Evaluation design***: works with the descriptive type of research. It aims at examining the usefulness of projects based on awareness, costs, and benefits. The results of this design provide prescriptions for the enhancement of the situation (Walliman, 2011, pp.11-12).

h) ***Action Design*****:** this is special to a specific problem in a given situation and it does not separate the problem from its environment. The results of the design are directly implemented in the context to measure their effectiveness. The generalization of the results is impossible because the design is specific to a specific problem in a specific situation (Walliman, 2011, p.12).

Other types of designs are used in specific fields like ethnographical designs, Feminist designs, cultural, and so on (Walliman, 2011, pp.12-13).

Consequently, and from a general point of view, the research study should be supported with a good research design to ensure obtaining reliable and valid results. For this reason, Kothari (2004) provided some characteristics which should exist in a good design:

- A good design should be flexible, economical, efficient, leads to reliable results, and should reduce bias;
- It should help the researchers to reach maximum data and treat different aspects of the problem;

- The research design should provide a whole control over the effect of the extraneous variable(s).
- It should be representative of the population and should help the researchers avoid sampling errors;
- It should help researchers control systematic bias.

To conclude this section, the research design step acts as a plan for the data collection and data analysis because it guides the whole study and it is responsible for the reliability of the results. Therefore, the researchers are required to be very analytical and very careful when deciding upon the design to be used.

I.8.6. Determining the Sample and the Population of the Study

According to Kothari (2004), when the researchers are in front of a large number of items of participants, they seem to be obliged to select a reasonable and manageable number to work on them. The complete number of items is called “population” or “census inquiry” and the selected number of items is called “sample”. When the researcher works with the whole population, the results of the study cannot be caused by chance; therefore, researchers would claim that the results are highly accurate. However, researchers claim that research bias increase in cases where there is a very large number of items to be observed, and therefore, the researcher will not be able to discover the source of the bias. There are different ways to select a sample, and the researcher should decide on one way depending on the situation of the research and the research problem and its nature. The different methods of selecting the sample are called a sample design (Kothari, 2004). More details about the sampling procedures and techniques are provided in chapter two, pp. 68-70.

I.8.7. Data Collection Methods and Procedures

Before going in-depth with the different data collection tools and procedures, it is highly important to remind ourselves about the accurate definitions of the related concepts. Kothari (2004) distinguished between the concepts of research methodology, method, and techniques (p.7).

According to the author, the method refers to the procedures used to conduct the research. The author clarifies this point of view by claiming “the behavior and instruments used in selecting and constructing research technique” (p.7). The research techniques refer to “the behavior and instruments we use in performing research operations such as making observations, recording data, techniques of processing data and the like" (p.7). From another side, the concept of research methodology is used when referring to the systematic way that embeds all the methods and techniques that are used to solve the problem understudy. The research methodology deals mainly with the research design that enables the researcher to know whether a given method or technique is adequate and relevant to a given situation because it bases on empirical and scientific bases. In summary, Kothari (2004) summarizes the main points about research methodology by claiming:

> … when we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others (p.8).

Therefore, the research methodology helps the researcher to design the study logically through learning the reasons behind using every specific research tool instead of others. This is according to the author will enable the researcher to evaluate his/her study in general and the results in specific (Kothari, 2004)

Accordingly, the research needs a well-designed methodology with appropriate tools to measure and to collect the data which is appropriate to the problem or the questions being investigated. Consequently, the researchers should have a clear understanding of the different research methods, tools, and the type of outcome they could collect. In this concern, Kothari (2004, p.8) distinguished three types of research methods that any research should include:

- The data collection methods: which are employed in order to reach the participants and collect the needed data (discussed in this section).
- The statistical methods: which are the techniques that are used to analyze the data gathered and explain the relationships between variables (these are discussed in chapter two: "Statistics Education").
- Evaluative methods are used to evaluate the accuracy and the reliability of the data obtained (they are also discussed in the second chapter).

Therefore, when collecting the data, researchers need to make use of some tools that aid them in collecting strong evidence to reach the desired goal (s). The researchers then make use of different methods and procedures. According to Walliman (2011, p.1), research methods are the different tools and techniques that are used to complete a research. According to the author, a well understanding and a good choice of these tools are very important in reaching better effects and better results. According to Perry (2005, p.52), the researcher may employ two types of aids: either instrumental or observational.

I.8.7. a. ***Observational Procedures***: these procedures base on the personal observation of the subjects or the objects. It is the technique that is mostly used to collect data in behavioral research studies (Kothari, 2004). Data may be recorded by video, cameras, or audiotapes. The data can be collected by one or more observers (Perry, 2005, p.52). According to the author, these procedures are flexible and they enable the researcher to explore some unexpected phenomena if met during the investigation. However, they have some limitations. Among these is that they take more time and they are costly. Moreover, the number of participants is limited; and finally, because the researcher is taking part in the investigation, the personal attitude, opinion, emotions, and so on can affect the researchers' decision and interpretations (subjectivity) (Perry, 2005, p. 111). These procedures appear in the following forms:

- *Observation*: Perry (2005) makes a distinction between two types of observation: Self as an observer: where the participants are observing their behavior (cognitive and emotional just like the protocol analysis) (Perry 2005, p. 112). Outside observer: a person (persons) other than the participant is (are) making the observation process. This type is divided into two types: Participant observation: where the researcher integrates his/herself with the observed group. Non-participant observations where the researcher does not incorporate with the group or the participants s/he is observing (p.116). In addition to these, there is also partial observation (Perry, 2005, p.117). According to Walliman (2011), when the researchers observe without being involved, they can record the participant reactions towards the different questions or phenomena and know whether there are different reactions to what they say or intend. This technique can be either qualitative or quantitative. On another side, when the researchers immerse themselves in the situation (participant observation) they do not only observe from the outside but they experience the situation with the participants with their own senses as it is carried out in the natural setting (Walliman, 2011, p.101 & p.102). Kothari (2004) claimed that this technique is usually expensive and the data gathered from subjects are specific and very limited (as a researcher cannot observe a lot of things at the same time); moreover, the researchers may fail to notice some (important) factors that they could not see when making the observations.

- *Interview*: Kothari (2004) defined an interview as the process of providing verbal stimuli to get verbal responses. The researcher interacts personally with the respondent via a number of questions (contrary to the observation which happens without asking questions). The difference between a questionnaire and an interview is that in the interview, the researcher can supervise and control the questions and change them whenever needed. The interview can be structured where it is predefined by a set of questions or unstructured which has only a plan of the interview and the researcher can change the interview as needed (Perry, 2005, p.119). Furthermore, Walliman (2011) added a semi-structured interview that combines standardized and open questions.

There different forms of interview, it can be individual or personal face to face or by telephone or it can a group interview called "focus group". The research may audio or video record the interview and then transcribed it to be analyzed (Kothari, 2004 & Wallman, 2011).

I.8.7. b. ***Instrumental Procedures:*** they are the impersonal devices that are used by the researcher to collect data. The data can be gathered in visual or written formats or through the use of technological aids (Perry, 2005, p.52 & p.120). Due to these procedures, the researchers are able to reduce time, cost and reach a large number of participants (Perry, 2005, p.120); however, as a limitation to these procedures, is that the researcher cannot monitor or change the question once they have been delivered to the respondents (Perry, 2005, p.122). The instrumental procedures include:

- *Questionnaires*: Questionnaires are one of the most employed and widespread research instruments in different fields especially in second language research (Dörnyei, 2003, p.1). It takes many other names like inventories, surveys, schedules, studies, profiles, indexes, indicators, or sheets (Aiken, 1997, cited in Dörnyei, 2003, p.5). For Kothari (2004), Schedules differ from the questionnaire in that schedules contain a set of questions to be distributed to the respondents under the supervision of some trained enumerators. Moreover, According to Dörnyei (2003), questionnaires are not used to measure or evaluate, but they are used to explore information about the respondents including their attitudes, opinions, etc. Based on this, Dörnyei (2003, p.8) classified the role of questionnaires into three categories:

- Factual questions: which come usually to classify respondents based on who they are. These mainly include questions about gender, ethnicity, level of the respondents in a given area, etc.
- Behavioral questions: these investigate the behavior of the respondents. The author provides the example of asking the students the frequency of using a given strategy. Other questions include lifestyle, habits, and personal history.
- Attitudinal questions: they target finding out the people’s opinions and thoughts about something. the main concern of this class are: attitudes, opinions beliefs, interests, and values (p.8)

As an advantage of this instrument, Perry (2005) claimed that they can collect a lot of information in a short time as they can be done on paper or computer. Nevertheless, the questionnaire is not flexible and cannot be changed when needed as is the case with interviews. They can take different formats: closed format (with a list of the propositions that the respondents will choose), or open format that give space to respondents to express their opinions. Another limitation of the questionnaire is what is called the response rate (the number of handed questionnaires is not the same as the received number) that can affect negatively the results (Perry, 2005, pp. 122-123). In addition to these, Kothari (2004) added that questionnaires are limited by the low return rate (when the researchers do not always get back all the questionnaire they distributed); moreover, the respondents should have a certain degree of education to be able to answer the questionnaire; and finally, the respondents may provide answers that do not correspond to the question or are ambiguous.

- Scales: According to Kothari (2004), scaling refers to the process of ranking the different degrees of opinions, attitudes, and other variables and then assigning numbers to them. According to the author, there are different types of scales; these are summarized in the followings:
  - Arbitrary scales: they are created by the researchers themselves where they base on the personal decision when selecting the items of the scale. These scales are not expensive, and they are fast in creation and use (Kothari, 2004).
  - Differential Scales (Thurnstone-type scales): the selection of the items is performed by a panel of judges. They tend to select the items that are measuring the topic being investigated and the juries make sure that the items are clear and are not ambiguous. Contrary to the arbitrary scales, this type is costly and requires

much effort to be developed. Moreover, this type of scale I not highly objective because it bases on the judges' own perceptions (Kothari, 2004).

- Summated scales: they are also called Likert-type scales. They consist of a number of items on which the respondents will react on with their degree of favorability or agreement (Kothari, 2004).
- Cumulative scales: (known also by Louis Guttman’s scalogram). This type of scale consists of a list of statements on which respondents are going to express their level of agreement or disagreement. These statements are related to each other where if for example a respondent replies favorably to statement three, the reply on items two, and one is going to be favorable. Besides, the one who replies favorably to statement four, items 3,2, and 1 are going to be favorable too, and so on (Kothari, 2004).

- *Tests*: According to Dörnyei (2003, pp. 6-7), a test is used usually to measure the ability, the behavior, or the knowledge of a given person (s). In research, through test results, the researcher may make inferences about the development or the change in a given dependent variable (s). Moreover, Perry (2005) defined tests as the “instruments designed to assess what participants can remember or do physically or mentally” (p.125). Test have many names and formats, we can have standardized tests that are designed to be taken under strict instructions; an example of these tests: TOEFL and IELTS. Another type of test is the norm-referenced test where the obtained scores are given a certain meaning when compared with “some norming group”. This latter refers to a group of people that represent the population who might take the test; therefore, the person’s score is compared to the average of the norming group, if it above or below this average. Finally, the third type of criterion-referenced test” in which one or more criteria are established to decide whether the obtained score is good or not. Through these criteria, the population is divided into different classes like high, low, and average (Perry, 2005, pp.125-128). Different test names are listed in Kothari (2004) included for instance: Word Association Tests, Sentence Completion Test, Quizzes & examinations … etc.
    - *Case studies*: They are a type of qualitative strategy for data collection. It deals with the description of the occurrence of a phenomenon in its natural environment from the perspective of the participants (Gall et al., 1996, cited in Perry, 2005, p. 77). The case study, as claimed by Kothari (2004), deals with the observation

(carefully and completely) of a social unit which can be an individual, a family or an institution, a cultural group, or the whole society (Kothari, 2004 & Jupp, 2006). This procedure enables the researcher to obtain real data that comes from personal experiences and it leads to hypothesis formulation; however, case studies do not provide any possibility for the generalization of the results. Moreover, the data can be biased either by the participants who may provide inappropriate data that do not reflect reality (because they think that this is the answer the researcher wants to reach); or the data can be biased by the researchers themselves who might think that they know everything about the units and tend to employ their prejudice and answering the research questions by themselves (Kothari, 2004).

- *Ethnography*: A great deal of data is gathered from different sources (including transcriptions, interviews, observations, recording …etc) (Perry, 2005, p. 77).
- *Conversational Analysis*: Contrary to the above type, this type uses only one source of real data (transcripts of recorded data) (Perry, 2005, p. 78).
- *Protocol Analysis*: the researchers ask the students to explain their thought when making or doing a difficult task. This strategy is first used in the field of cognitive psychology, where researchers tried to understand the cognitive phenomena. They usually call this strategy "think aloud" (Perry 2005, p. 77).

Other methods discussed by Walliman (2011) included Diaries and Accounts which are both qualitative tools. Diaries include asking the participants to share their experiences and feelings or interpretation of what has been lived or experience. Whereas Accounts involves different forms like conversations where the researcher explains the different behaviors of the participants (gestures), personal records of experiences …etc. Moreover, Kothari (2004) added Schedules as a procedure to collect primary data. Schedules are like questionnaires but are filled by enumerators who are specialists in the schedules. The schedule consists of a list of questions (like a questionnaire) that are distributed by the enumerators to respondents and record their answers after explaining the aim of the schedule and the purpose of the study (Kothari, 2004).

I.8.8.Data Analysis

The data analysis includes certain steps like summarizing and classifying the data through coding and tabulation and then concluding mainly through statistical inferences (Kothari, 2004). The process of coding refers to when the researchers turn the results which are in form of categories into numbers that shall be tabulated and calculated. The tabulation is done after the coding and the editing; the data are put into appropriate tables. After the tabulation, the process of the analysis is done through the calculations of different measures (percentages, means, coefficients …etc). When the researchers are interested in a relationship or a difference between variables, the data should be tested with statistical procedures to determine whether the relationship or the difference is significant or not. After testing the significance, the researcher will either prove or disapprove of the research hypothesis (Kothari, 2004).

I.8.9. Results, Interpretation, Discussion of Results and Conclusion

The results of any research are analyzed depending on the nature of that study, the research design, method (s) and the research tools employed throughout the study (Perry, 2005, p.53).Once the data are analyzed, researcher should discuss the research results based on the research questions that are set at the beginning of the research. Moreover, the researcher discusses the research results in relation to the previous studies' findings. Finally, the researcher should mention the strengths and weaknesses of his/her study (Perry, 2005, p.53-54). From Kothari's (2004) point of view, the Interpretation phase has to do with making inferences from all the data that has been dealt with in the result section. The researcher tries to present the data from a wider point of view through establishing links between the results of different tools that are employed and then linking the own results with the results of other researchers.

According to Perry (2005), the researcher should ask the following questions when concluding the study:

- Are the research question and the hypothetical question being answered in a logical way?
- Is the study consistent and reliable from the beginning till the end? Are the aims of the study had been targeted till the end?
- Can the results be generalized?
- Are the results being consistent with the research design used?
- Are the results consistent with the previous literature?
- What are the limitations of the study?

Consequently, concluding the study gives another chance to the researcher to revise all what has been done through the study. Therefore, the researchers are asked to review carefully and note down the more important things in research in order to avoid any type of contradictions.

I.8.10. Generalizations and Report preparation

When testing a hypothesis and the researcher comes to approve the hypothesis several times, the research may conclude that the results are generalized to the whole population and can be used to formulate a theory. When the study has no hypothesis, the research findings should be explained based on some existing theories and this is what is called “interpretation”. This latter leads to asking some new questions that can be the starting point of other research studies (Kothari, 2004). Finally, the research report should include all the steps with a clear explanation. The results and evidence-driven from the data should be well explained. The researcher should take into consideration the layout of the report which includes an introduction (pre-stage), main text, and the conclusions (end matter) (Kothari, 2004).

I.9. RESEARCH PROJECTS AT THE UNIVERSITY LEVEL

The research project is one of the traditions that every University in the world is celebrating because of its importance. According to Reardon (2006, p.5), research projects are used because they help students to acquire the needed theoretical and practical skills of research. Moreover, they enable the students to develop scientific, professional, and practical skills. Research projects, once accomplished, will reflect the researchers’ ability in defining, designing, doing, and delivering the research parts (Reardon, 2006).

I.10. THE NEEDED QUALITIES IN GOOD RESEARCHERS

Reardon (2006, p. 8-10) listed some of the characteristics that a researcher should have or should develop in order to be able to conduct research. These qualities are:

- Being enthusiastic and having an interest in the research.
- Being responsible, honest, and act with intelligence and integrity.
- Being persistent and having the ability to concentrate for a long time; in addition to the ability to concentrate and pay attention to details and the ability to be accurate.
- Avoiding the predisposition and prejudice by being objective and open-minded; every decision made should be based on the research or as claimed by the author, it should be “a consequence of the research, not in order to shape and form it” (p.9).

- Being analytical and having the ability to synthesize; to use both inductive and deductive reasoning.

Moreover, Kothari (2004) listed some other qualities that any researcher should have to be qualified to conduct research. Among the features:

- Being able to plan for tests and experiments and perform the basic calculations (like for the means, mode, and median …etc) and to be capable of applying the different research techniques.
- Being aware of the different assumptions and cases of employing the different tests and techniques.
- The researcher should be a good decision maker and knows how to select different decisions. He (or she) should also know that these decisions should be evaluated by experts before implementing them.

Furthermore, Dörnyei (2007) cited four main characteristics that every researcher should have in order to be a good researcher: "genuine curiosity, lot of common sense, good ideas and something that can be best described as a combination of discipline, reliability and social responsibility" (p.17). As for genuine curiosity, the author explained that a good researcher have always the motivation to uncover a topic of interest and intuition. This curiosity will boost their motivation, hard work, and creativity. The second quality in good researchers is common sense; this one helps the researcher to keep following the same track and the same objective in a clear way to avoid any kind of bias. In the field of Applied Linguistics, the author claims: "the best researchers in the field tend to be very normal people, they have a high level of common sense that helps to keep their feet firmly on the ground" (Dörnyei, 2007, p.17). The third characteristic is that the researcher should have good ideas and creative thinking; in the field of applied linguistics, Dörnyei (2007) stated: "many of the best-known studies in Applied Linguistics (AL) are not all complicated in terms of their research methodology but are based on fairly simple but original insight" (p.17).

Finally, a good researcher should be responsible and disciplined. The researchers may face some situations and temptations where they should keep being disciplined, responsible, and keep working in the systematic and right way. In addition to discipline and responsibility, communication and social responsibility are also very crucial in research as this latter does not only concern the researcher himself but also the whole society. For communication, the researcher should know how to transmit his research findings to the other in a clear way (Dörnyei, 2007).

I.11. IMPORTANCE OF PLANNING RESEARCH PROJECTS

Planning the research refers to the process of identifying the specific elements of the research with a careful determination of every activity in the research. Planning to the research project according to Reardon (2006, pp.89-90):

- Helps in clarifying the research ideas and discover shortcomings and limitations,
- Gives a review of the study that the researcher may come back to once s/he feels lost when advancing in the research levels.

I.12. ERRORS COMMITTED WHEN MAKING RESEARCH

As it is defined above, the research consists of careful activities in which the researcher may pay great attention to them in order to avoid any misleading step that will cause bias in the results. According to Jupp (2006), the research problems are:

- A diverse range of pitfalls encountered during the research process. These can include getting started, framing general and specific research questions, and discovering that one's data do not address the research questions that have been set (p. 266).
- Accordingly, Reardon (2006, pp. 185-186) listed a number of questions that demonstrate the problems that may be committed in the study. Mainly the research problems that can be extrapolated from the question happen at the following levels:
- Errors or mistakes in the selection of the research methods;
- Drawing conclusions basing on insufficient data;
- Making generalizations without enough evidence;
- Basing on interpretations and notes on subjectivity or preconception;
- In studies that use samples to represent a population, the problem that may raise is that the sample may not be representative of the population;
- Incompetence in using technological software or hardware.

Moreover, Kothari (2004) claimed that when the researchers make errors in the selection of the sample, they will fall into what he called the Systematic Bias. This type of error results from the wrong sampling procedures. This bias cannot be solved by raising the sample size;

instead, the researcher should detect the exact mistake and correct it (Kothari, 2004). The causes of the systematic bias usually are according to Kothari (2004):

- A selection of a sample that does not represent the whole population (inappropriate sample frame);
- When the research tools do not measure what they should measure, a systematic bias takes place in the study (an inappropriate measuring device);
- When the respondents do not respond to the research questions or tests;
- When the respondents produce behavior other than natural behavior when they know that they are under observation;
- The mistake may be committed by the researcher himself unconsciously when reporting the study and especially the results.

Moreover, Kothari (2004) cited also another type of error that can affect the reliability of the research study and which he names a “Sampling error”. This latter refers to “the random variations in the sample estimates around the population parameters” (Kothari, 2004, p. 58). This means that the researcher may find that the calculated measure from the sample (either mean, standard deviation …etc) does not represent the measures of the population characteristics (parameters). The sampling error can be small if the population is homogeneous, and this kind of error can be decreased by choosing large sample size. Given that systematic error happens when the sample size is large, the researcher may be confused about what to do. The author claims that the research –for the researchers to save their studies- should choose a better sample design which decreases the sampling errors and control the systematic bias (Kothari, 2004).

Furthermore, Kothari (2004, p.72) reported the errors that researchers can make while measuring the data. The sources of the error at this level can be either from the respondent (as is mentioned above) who have little knowledge about the topic or do not reflect their real feelings (especially if negative) toward the topic. Besides, the other source is the situation of the study (or the measurement) which does not help in reaching the real data. Besides, the measurers (or the researchers) themselves may lead to biased data when they do not report exactly what is being revealed by the respondents (for example they do not record in an interview and they forget some main points that are very important for research). Finally, as it is mentioned before, one source of measurement errors in the research tools themselves when the research instruments are defective and limited. The problems with instruments can rise from the linguistic side especially when the question (s) is not clear (ambiguous) or they are beyond the level of the respondent, or it can be because the space provided to answer is not enough or the type of the question does not reflect the needed information.

I.13. ETHICS IN RESEARCH

Ethical issues in the research relate to two sides in the study; the first relates to the ethics with people around the researcher (including the personal integrity and honesty) and ethics in the data collection, analysis, and interpretation of research (Walliman, 2011, p.42-43).

The researcher should be ethical when making research and most importantly should avoid plagiarism. This later is defined by Walliman (2011, p.444) as the process where the researcher is “directly copying someone else’s work into your own report, thesis, etc. and letting it be assumed that is your own”. Plagiarism can be avoided by using citations in which the researcher acknowledges the appropriate references and true authors of the ideas and works in general (Walliman, 2011).

On the other side, ethics in data collection, analysis, and interpretation oblige researchers to ensure the objectivity of their works through the use of scientific methods and should clarify any source of bias in the study. Moreover, when the study bases on personal judgment, researchers should define clearly the basis of the judgments. Most importantly, the researchers should not reject or ignore any argument that is against their beliefs or the study (Walliman, 2011, p.45). Researchers, in order to avoid plagiarism, can take the view of other people like colleagues or supervisors who can read the draft of the work (Walliman, 2011, p.50).

I.14. IMPORTANCE OF KNOWING HOW RESEARCH IS DONE

Studying about research and research methodology may have a positive effect on the learners’ capacities in research. According to Kothari (2004), research methodology helps the students through a variety of ways:

- Provides practical training to students and aids them to develop their capacities through practice especially about the data collection with specific problems. Therefore, research methodology provides the necessary knowledge and the practice needed.
- Studying research methodology enhances the students’ ability to understand results and to base their decision on logic in real life. That is to say, it helps the students develop reason-based thinking.

- Enhancing the students' judgments through teaching the students to be objective observers.

CONCLUSION

All that is discussed through this chapter proves the complexity but the importance of scientific research. Teaching about research is, thus, indispensable regarding the benefits it brings to humanity and the human being himself. Students are required to be very attentive, analytical, and good decision-makers to conduct good and reliable research.

It is not only important to have good knowledge about research methods, tools, and techniques, but also to have a righteous and logical mind. Researchers, in order to conduct scientific research, need advanced research-related knowledge. When practicing research works, the researcher should be able to make a difference between what is right and wrong and should have ethical qualities. More importantly, a researcher needs to have a certain level of logical thinking when conducting scientific research.

To summarize, this chapter had reviewed the main definitions of the concepts in the field of scientific research, introduction to different research tools, design and methods of research, main considerations, and errors that the researchers should be aware of and should avoid throughout the research.

CHAPTER II: STATISTICS EDUCATION

INTRODUCTION

The importance of quantification in research has emerged increasingly during the recent decade; and numerical data and statistics are demanded during every human activity and throughout a variety of domains including business, health, economics, education, management, and others. The researchers collect, analyze, treat, interpret the numerical data for the sake of being able to provide logical and empirical arguments and evidence to their inquiries, ideas, and the activities they perform in their everyday life.

In the English Language Teaching/ Learning context (ELT/L), learners, as well as teachers, are engaged in different types of research where they significantly need to use appropriate methods when collecting, analyzing, and drawing conclusions. This method should provide reasonable and evidential data to support the interpretation; for this reason, the use of statistics in this field is indispensable.

Therefore, throughout this chapter, we shed light on the different and the important areas of statistics education, including definitions of the most principal concepts and notions, goals of teaching and learning statistics, the role of technology and SPSS in EFL research, challenges of teaching and learning statistics, strategies for facing these challenges, guidelines for teaching introductory statistics, description of the teaching of statistics at the Algerian pre-university levels, sampling and related terms, and finally, introduction to quantitative data analysis and main concepts and statistics tests.

II.1. DEFINING STATISTICS AND STATISTICS EDUCATION

II.1.1. Statistics

A large amount of the data in the world revealed a huge need for a science of data that enables researchers to organize, classify and display them in a meaningful way. For this reason, the existence of statistics is indispensable and the emergence of this field in recent years is widely remarkable (cited in Varalakshmi, Suseela, Sundaram, Ezhilarasi & Indrani, 2004, p. 1).

Statistics come from the Latin word “Status” which stands for “Political State” (Varalakshmi, Suseela, Sundaram, Ezhilarasi & Indrani, 2004). According to the same source, statistics refers to a group of systematic methods for collecting and interpreting numerical data. That is to say, statistics are not only interested in showing the numbers but, most importantly, interested in what these numbers mean and refer to in the field of the study.

Opinions about what statistics differ from a person to another; although a lot of people belonging to non-scientific specialties think that it is an application of a range of rules to reach results and conclusions where a variety of numbers and graphs figure out to display the attained results. This view was the dominating view in the past. Bowley (n.d.) defined statistics as a “numerical statement of facts in any department of inquiry placed in relation to each other” (cited in Varalakshmi, Suseela, Sundaram, Ezhilarasi & Indrani, 2004). Bowley focuses on explaining statistics as a science of “counting” or the “scheme of averages” where the researcher is supposed only to gather the data without analyzing or interpreting them. However, the modern views of statistics are different. Definitions like Horace Secrist’s and Croxton and Cowden (as cited in Varalakshmi, Suseela, Sundaram, Ezhilarasi & Indrani, 2004) maintained that statistics is a systematic and purposive process that starts with gathering numeral data to reach a given purpose or a given conclusion and interpretation.

Moreover, Agresti and Finlay (1997) supported the modern views; they claimed that statistics is more than numbers or tables: “Statistics consists of a body of methods for collecting and analyzing data” (p.3). It is a whole methodology and design to the whole study; it does not only include ways of collecting, analyzing, interpreting, and presenting the conclusions but makes the study appears as logical as possible; it balances between the theory and its application. In other words, Shafer and Zhang (2012, p.9) defined it as “a collection of methods for collecting, displaying, analyzing, and drawing conclusions from data”. From this point of view, the role of statistics’ tools and methods is not limited to displaying the data in graphs and tables, but it trespasses into making inferences and drawing conclusions from the existing data. Accordingly, Kothari (2004) claimed that statistics guide the researcher in designing the study, analyzing the data, and drawing conclusions. Moreover, Statistics help the student get control over a large number of raw data to be analyzed through classifications and tabulations. Statistics provide bases for the generalization of the data (mainly through inferential statistics)

According to Hebl (2003), statistics is related to mathematics, calculations, and numbers, yet; what is more important in statistics is how these numbers are chosen and what they stand for. The meaning and the interpretation of numerical data is the utmost goal of statistics as the numbers in isolation are senseless until they give insight about something and unless they infer something. Hebl (2003) added: “statistics refers to a range of techniques and procedures for analyzing, interpreting, displaying, and making decisions based on data” (p.12). In this sense, the role of statistics is not only organizing and displaying the data but also helping the researcher to make righteous decisions based on facts conveyed by these data.

Furthermore, Rumsey (2010) mentioned that statistics is not only a method for analyzing the data but it is the whole process that is followed to answer the research questions and make the decisions using the data obtained. According to the author, statistics follow scientific procedures to reach these conclusions. These procedures involve chiefly:

- ***Designing the studies***, the researchers should make their research aim and question(s) clear to decide whether the study is observational or experimental. In observational studies, the researchers opt for surveys so as they do not affect or manipulate the sample/population conditions and environment (they tend to explain only the relationship between the variables). The Experimental studies are based on the manipulation of some conditions; and as termed by Rumsey (2010), experiments impose treatment on the participants in order to make a comparison clear. Designing the study in the right way is very important in reaching valid and reliable answers to the research question (s).
- ***Collecting the data***: After designing the appropriate study, the next step is gathering the needed information. To collect the data, the researchers need to specify the population and the sample respectively following the appropriate sampling procedures to avoid any sampling bias. Another important point in this step is that the researchers should avoid any kind of bias in their data, this happens through following the suitable and proper statistical methods and procedures (Rumsey, 2010).
- ***Describing the data***: After having the data in their hands, the researchers display the data summarized and in a meaningful way. The data is presented either in form of tables and numbers or in form of graphs and pictures (or both) (Rumsey, 2010). In statistics, this is called Descriptive Statistics (this concept is explained in Part I, Chapter II, page 75).
- ***Analyzing the data***: after having the data clear and meaningful, the researchers start navigating in these data to look for insight to answer the research question (s). There are different statistical data analysis methods: we can find the t-test, ANOVA, ANCOVA, MANOVA …etc. Each is related to a set of assumptions, conditions, and aims (Rumsey, 2010).

- ***Making conclusions***: the data analyzed should be given a meaning in accordance to the current study, what would be the interpretation of all the data in relation to the research aim and the research question(s). The researcher should, at this stage, decide whether the results obtained will be generalized or not (Rumsey, 2010).

In short, Rumsey (2010) explained that statistics is not limited to collecting and treating the numbers and the tables, but it is a uniform that underlies and guides the whole study. It is more than mere procedures to calculate results; it is the whole procedure that guides the study into valid interpretations and avoids being biased and wronged by any condition of the study.

The above steps are shared with Hall (1978) who summarized the procedures followed by statisticians in six (6) steps which are: a) Setting the purpose of the inquiry; b) Choosing the sample and the population; c) Setting the method of the inquiry; d) Collecting the data: here this step includes two sub-steps: *processing the data and then *displaying the data; e) Interpreting the results; f) and finally making the decision for the future action.

In our study, we focus on Rumsey's definition of statistics as it shows the different steps of research where the learners need to make decisions. Utts (2013) reported: "Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability". The learners, through statistics educations, learn how to deal with the variability in data and learn how to base their decision throughout the study. This is why, during our study, we trace the development of our sample's decision making skill throughout all these steps so as we can see whether the implementation of what they learned in statistics lessons help them to make right decisions during their own research or not.

II.1.2. Statistics Education

The teaching and the learning of statistics are required and are very demanded throughout all the domains. It is taught formally and informally in all settings. Garfield (1995) stated: "…regardless of the setting, a major concern of those who teach statistics is how to ensure that the students understand statistical ideas and can apply what they learn to real-world situations"; therefore, statistics education aims not only at clarifying the content of statistics field but also at teaching the students how to apply these concepts in the target setting or the target field. In the EFL research, students choose problems from their context to investigate them; therefore, the goal of teaching statistics to EFL students is to teach them how to apply the different statistical methods to solve the problems under study.

Da Ponte (2011) claimed that teaching statistics is a hard task, teachers are not only required to have background knowledge in the statistics field but also need to have professional knowledge (planning, conducting, and reflecting). The teachers in statistics education then should have:

1. ***The Statistical Background Knowledge:*** this refers to the needed knowledge concerning statistics concepts, procedures, tools, and methods. In short, they should be accustomed to the content of statistics. Da Ponte (2011) explained that when the teaching is concerned with the knowledge about statistics, the teachers should be able to:
    - Understand and differentiate between the different concepts, notions, methods ...etc in statistics that will be needed in the classrooms. He claims that teachers should: "mastering the needed concepts and procedures, computing statistics measures and representing data in routine exercises" (p. 2).
    - The teachers should be able to manage the data provided either by the teacher, internet, textbooks …etc and they should know how to collect, represent and interpret these data.
    - Finally, the teachers should be able to do the "statistical investigations" starting from the steps of asking questions, then "collecting, analyzing, interpreting, and critiquing data and arguments" (p. 2).
2. ***The Statistical Professional Knowledge***: this is more related to the teaching practice. This knowledge bases more on teaching skills and abilities. Da Ponte (2011) explained this knowledge in terms of three phases:
    - First, the Planning phase which is related to the preparation of the lesson. It includes preparing for curriculum objectives, classroom objectives (introduction, exploration, and finally discussion), materials, organizing students' works, management of time, and finally assessment.
    - The second phase is Conducting which is related to the practice of the planned part; it mainly happens inside the classroom. It involves the introduction and the negotiation of the tasks, classroom and communication management, negotiation of statistical meanings and finally making decisions according to the lesson situations.

- The third phase is Reflection which is related to the evaluation of the teaching process and the attainments of the lesson. At this phase, the teacher is supposed to make sure that the objectives are attained, whether the students have acquired the needed skills, to know whether the plan is appropriate or not, and whether the classroom environment is well managed or not.

Consequently, the teaching and the learning of statistics trespass the fact of teaching and learning the statistics' basics, knowledge, ideas, notions, etc. it is related to a lot of education principles and practices where both teachers and learners are required to put more efforts into the statistics education classrooms.

II.2. GOALS OF STATISTICS EDUCATION

According to Gal, Ginsburg, and Schau (1997), the aim of statistics education is not to teach or to learn procedural and computational skills, but it aims at developing "flexible statistical problem-solving, statistical literacy and related communication skills, and data analyzing skills". Gal and Ginsburg (1994) summarized the aims of statistics education (especially to the teaching of Introductory Statistics) into two main goals (cited in Gal, Ginsburg and Schau, 1997):

- preparing the students to be smart citizens in modern society through teaching them to deal with statistical situations that exist outside the classroom
- preparing the student to be able to manage, use and interpret the statistical data of their own academic research (of the domain of interest)

In short, statistics aims at preparing the students not only to solve problems inside of the classroom but also to solve real-life problems. This is why the classroom practices should take into consideration these two goals and put a focus on the understanding of everything by the students.

Furthermore, statistics education aims also at developing the learners' statistical literacy, statistical thinking, and statistical reasoning. Garfield and Ben Zvi (2004a) made a distinction between these three concepts that make statistics differ from mathematics (cited in Garfield & Ben Zvi, 2008):

1. ***Statistical Literacy***: this concept refers to the ability to understand both statistics language (including statistical terms and symbols) and statistics tools (the ways of

interpreting the representations of the data as termed by the authors). Watson and Callingham (2003) maintained that statistical literacy includes three levels: "the knowledge of terms, the understanding of terms in context and critiquing claims in the media" (cited in Garfield and Ben Zvi, 2008, p.34). This literacy is not only targeted at the students but also all the citizens. On this concern, Hulsizer and Woolf (2009) stated that: "One key component of statistical literacy is the ability to apply statistical thinking correctly to different situations" (p.16).

2. ***The Statistical Reasoning***: this is related to the ability to explain the statistical situations and/or being able to understand and interpret the statistical data. For Garfield and Ben Zvi (2008), this concept represents: "the mental representations and connections that students have regarding statistical concepts" (p. 34).
3. ***Statistical Thinking***: this refers to the way that statisticians think (Wild & Pfannkuch, 1999, cited in Garfield & Ben Zvi, 2008). It includes the "how and why to use a particular method, measure, design or statistical model; deep understanding of the theories underlying statistical processes and methods; as well as understanding the constraints and limitations of statistics and statistical inference" (p. 34).

Garfield and Ben Zvi (2008, p.35) claimed that despite the difference between these three characteristics, statistical literacy acts as a basis for both thinking and reasoning. These three characteristics of statistics are crucial and the statistics education lectures should aim at developing them through the different classroom practices, activities, tasks, and so on.

II.3. STATISTICS IN SOCIAL SCIENCES AND EDUCATION CONTEXT

Van Elst (2012) asserted that the quantitative methods in social sciences are used to collect data from a large number of individuals from a social system in a scientific manner for the sake of describing larger systems (p.9). Therefore, the researchers use statistics in social sciences in order to give scientific and empirical descriptions of the social phenomena. The statistical data gathered present conclusive and evidential data for the interpretations and the conclusions being summarized at the end of the research.

More specifically, statistics in education is used to test past knowledge in the field of education and develop new knowledge based on the previous one (Varalakshmi, Suseela, Sundaram, Ezhilarasi & Indrani, 2004, p. 6-7). McCall (1922) spoke about the importance of quantification (and quantitative methods) in education and educational research (cited in

Smeyers & Depaepe, 2010); he emphasizes the three assumptions of the fact that everything can be measured. McCall (1922) cited these three assumptions (as cited in Smeyers & Depaepe, 2010):

- "Whatever exists at all, exists in some amount" that is to say, a part can represent the whole, as in research a well-chosen sample can represent the population
- "Anything that exists in amount can be measured" quantifying in the educational field in specific and all human and social sciences is possible because the variables exist in amounts that can be measured.
- And finally, "measurement in education is, in general, the same as a measurement in the physical sciences": since education applied the two above quotations, there should be the same ways of measurements as in the physical field or other scientific fields.

Basing on the above assumptions, the use of statistics in all human and social sciences and educational fields in specific is possible because there are variables that can be assessed and quantified in amounts.

Perry (2005) explained the importance of statistics in the field of Applied Linguistics. The author claims that two things make the students alienate from studying statistics: either the mathematical calculations (formulas) or the technical jargon. However, the understanding of statistical and mathematical formulas is not indispensable for students. The most important thing in the use of statistics in the field of applied linguistics is to know whether the applied statistical test will lead to answering the research questions and whether the researcher has well interpreted the research results (Perry, 2005, p.163).

To summarize the use of quantitative methods in social and human sciences and educations is possible as the different phenomena in these fields can be measured and in terms of McCall (1922 as cited in Smeyers & Depaepe, 2010), they exist in amounts. Statistics is used in these fields to draw evidential and decisive conclusions and to make reliable decisions about the phenomena under study following empirical procedures. Moreover, statistics facilitate concluding a large number of individuals from data which are collected from a small number of participants.

II.4. IMPORTANCE OF STATISTICS EDUCATION

Statistics, in general, helps in evaluating the data that we read or hear in everyday life; the evaluation helps in making decisions appropriately. For example, people come to hear that kind of things they consume (like tobacco) can cause cancer. It would be hard to know whether to believe such information or not because they cannot evaluate to which extent the statement is true or not, but when they read “Almost 85% of lung cancers in men and 45% in women are tobacco-related” (cited in Hebl, 2003, p.13). People would believe that it is the information based on a systematic study that provides statistical evidence and that supports the decision they make. In short, Hebl (2003, p.14) claimed that: “learning about statistics is a long step towards taking control of your life”, that is to say, statistics provides systematic and reasonable reasons to people to make reliable and credible decisions; it helps people to get rid of the misleading and biasing data that affect their life. The same point of view is adopted by Gelman and Nolan (2002, p.2.) who asserted that the use of statistics helps people in deciding their lives and help them to understand the world because as mentioned in the example of Hebl (2003), most of the decisions taken around the world have statistical justifications, this, in turn, helps us to understand the reasons behind making these decisions. In short, statistics help in understanding the causes as well as the effects of our decisions.

For Agresti and Finlay (1997), learning about statistics elaborates to the researchers the research design they should follow, shows descriptions about the data (how to categorize, analyze and treat them), and finally provides a way to make inferences (including assessing and evaluate then generalize the achieved conclusions) (cited in, 2014).

Moreover, Blai (1971) summarized the above benefits into two main reasons for why should students study statistics; Blai (1971) claimed that: statistics should be studied:

- ***To describe the large and unwieldy mass of numbers***: where the data is shown in a meaningful and reduced in a manageable way through graphs and tables. This is what researchers mainly call: descriptive statistics.
- ***To make inferences from these data***: as research works aim at reaching conclusions and making decisions, the researchers are supposed to use the statistical data they described in order to explain the meaning of these numbers displayed in the graphs and tables.

- To be statistically educated is one of the major aims of statistics education. The students, through statistics education, may develop statistics literacy and statistical reasoning (Garfield & Ben Zvi, 2008).

Varalakshmi, Suseela, Sundaram, Ezhilarasi & Indrani (2004) summarized the functions of statistics in the followings:

- ***Condensation***: this function helps the understanding of a huge and complex amount of data. Statistics play an important role in reducing and lessening the data by providing some observations that stand for the whole (for example observations of the sample that stand for the whole population, or presenting the average instead of presenting the whole scores …etc). That is to say that statistics present a lot of and complicated data in a meaningful and easy way to be understood by everyone through the use of tabulations and classifications (Varalakshmi et al., 2004).
- ***Comparison:*** the tables, the graphs, figures, the summarized numbers …etc that are condensed in the first function enable the researcher to compare the data with other data sets in an easy way (Varalakshmi et al., 2004).
- ***Forecasting***: the statistical data gathered by the researcher in the previous year can help them to predict and forecast some near-future conclusions through the analysis of time series and regression analysis (Varalakshmi et al., 2004).
- ***Estimation***: the aim of statistics here is to draw inferences about the population from the data gathered from the sample (Varalakshmi et al., 2004).
- ***Tests of Hypothesis***: the researcher tries to know whether a given treatment works over a given problem. On this concern, Varalakshmi et al. (2004) stated: "A statistical hypothesis is some statement about the probability distribution, characterizing a population based on the information available from the sample observations" (p. 5).

Consequently, Statistics has different functions that can cover different fields and disciplines. For EFL learners, who are mostly non-scientific students, these functions can be helpful to facilitate their understanding of the different statistical procedures and can help them in understanding well their problems under study and how to make use of the data they gathered.

The field of statistics is more an intellectual field where the learners learn powerful ways of thinking as termed in Garfield and Ben-Zvi (2008). Moore (1998) stated: "Statistics is a general intellectual method that applies wherever data, variation, and chance appear. It is a fundamental method because data, variation, and chance are omnipresent in modern life" (p. 134, cited in Garfield and Ben-Zvi, 2008). That is to say, statistics is more than a science to learn how to count down and use rules and numbers, but it is a life-support domain where people learn how to think and how to use the variety of data in order to live in the appropriate life and to take the appropriate decisions. Wishart (1939, p.549) talked about the importance of the teaching of statistics and said that: "it protects individuals from the misleading practices of "the propagandists" (cited in Hulsizer & Woolf, 2009, p. 5). Taking decisions about what to believe and what not to believe would be easier with the mastering of statistical knowledge. According to a study undertaken by Gattuso and Pannone (2000), most teachers of statistics have a positive attitude towards statistics, they claimed through a survey that statistics has more to do with practice than what is learned inside the classroom; it enables students to use the everyday information they get from newspapers, news, TV ... etc reasonably and they can understand them. According to the study, teachers think that statistics helps students to make decisions and make forecasts.

Consequently, the importance of statistics education is not limited to developing the learners' statistical literacy including both ways of displaying/ organizing the data and making inferences, conclusions, and decisions based on statistical information. It also develops statistical thinking and reasoning. The statistics lectures have also future importance because it helps to form conscious, attentive and smart citizens who can analyze the everyday information and make reliable decisions.

II.5. TECHNOLOGY AND THE ROLE OF SPSS IN EFL RESEARCH AND STATISTICS EDUCATION

From the general point of view, the role of technology in research is indispensable. It not only provides easy ways to reach different information but also enables researchers to go through complex research studies due to its developed software that helps researchers examine complex mathematical calculations to complete the analysis of results.

The EFL students need to learn statistics but do not intend to be statisticians. Their need to use statistics is related to solving problems in their field of interest. For this reason, the use of technology and mainly the SPSS software can be of great help to the students in learning how to use statistics to reach their goals. Moreover, computers help researchers to detect errors and fix them easily and rapidly to get correct and reliable results. Besides, computers enable the researchers to draw appropriate graphs and tables in a precise way and make it easy to type the research report (Kothari, 2004).

Garfield and Ben Zvi (2008, p. 29) explained the importance of using technology in developing the students' statistical skills and reasoning. They reported the experiments of DelMas, Garfield, and Chance (1999) which revealed an important role of technologies like simulation programs, computers, the internet, graph calculators that helped the students to understand the statistical concepts and activities (as cited in Garfield and Ben Zvi, 2008, p. 29; Chance, Ben-Zvi, Garfield & Medina, 2007). On this topic, Hammerman & Rubin (2004, p. 18) clarified the importance of the new technologies in enhancing the learners' understanding of statistics, and they mentioned the challenges of using these technologies for teachers, they claim:

> Interactive software data visualization tools which allow for the creation of novel representations of data open up new possibilities for students (and teachers) to make sense of data, but also place new demands on teachers to assess the validity of the arguments that students are making with these representations, and to facilitate conversations in productive ways.

(Cited in Garfield and Ben Zvi, 2008, p. 91)

Therefore, the new technologies provide the students with the opportunity to visualize the data and create their representations in order to better understand them. The student will be able, through the use of technologies, to create arguments that will be assessed later by the teachers and test their validity. The teachers, thus; need to have the needed technical skills in order to ensure better performance of technology-based lectures of statistics.

However, the use of technology to teach statistics is limited by some challenges. Garfield and ben Zvi (2008, p100 & 111) listed some of these challenges which are summarized in the followings:

- The integration of new technologies would bring a change in the learning goals set at the beginning. The teaching goals and evaluation principles and the learning content would change to incorporate these technologies and ensure a smoother way to learn statistics. The changes can be also in the teaching methods and plans, and learning styles …etc.
- Incorporating the new technologies into statistics lectures would create uncomfortable situations for both learners and teachers due to the lack of skills in using these technologies.

- The lack of administrative support concerning the funding of computer labs, the technical support for teachers, and the lack of teacher training (train them to use the technologies).
- Time constraints: the time limited to using these technologies is limited. The students need more time to explore their different uses and benefits (also cited by Gattuso & Pannone, 2000).
- Technology may fail: the students, as well as teachers, may face problems concerning these technologies themselves. For example, the internet (the network problems), the websites can be unavailable, electricity cuts, computers may crash. All these problems may cause postponing the lectures and losing time.

These technologies may bring a lot of benefits as they facilitate the learning and the understanding of the statistical ideas as claimed by Garfield (1995, p.29) stated that using software that helps the students to visualize and interact with data facilitate the learners understanding of the phenomena and the learning of the data analysis methods. Nevertheless, the computer may have some limitations that should be avoided. Computers demand a high level of understanding in the technological field especially when coding data and computing and analyzing the results; besides this, they are consuming much time, cost, and effort (Kothari, 2004). Therefore, teachers, as well as learners, may face difficulties that prevent them from reaching the goals set. To avoid these challenges, the choice of these technologies should be careful. The choice should take into consideration the teachers' skills, the learners' needs and levels, the content being taught, and so on(Garfield,1995).

II.6. CHALLENGES IN TEACHING STATISTICS

Tishkovskaya and Lancaster (2012) summarized the other researchers' findings concerning the challenges met when teaching statistics. They divided the challenges into three main domains:

- The problems of teaching and learning statistics as a discipline,
- Statistical literacy and communicating statistics
- Statistics as a profession in the UK and other countries.

In this study, we are more concerned with the two first categories. We have classified these challenges into two main categories: challenges met by learners and challenges met by teacher:

II.6.1.Challenges met by Teachers:

Most of the researchers in the field of statistics argue that teaching this discipline is hard not from the content side but from the pedagogical implications. We have summarized most of the challenges in the following points:

1. Acquiring the above-mentioned types of knowledge (statistical background knowledge and statistical professional knowledge) is extremely difficult as it is much time and effort-consuming. However, any teacher of statistics should master the two. Therefore, one of the challenges that meet the teachers of statistics is their inability to handle the classroom unless they master both types of knowledge. Moreover, trying to learn both theoretical knowledge and practical knowledge at the same time would be one of the greatest challenges that can meet the teachers (Da Ponte, 2011).
2. Another challenge met by teachers of statistics is explained by Smith (2001), who claims that the teachers' education models (means when preparing teachers to be teachers of statistics) are very "Academic" (cited in Da Ponte, 2011). The academic model usually follows given curricula that need to be finished in a short time, this may cause the problem of the lack of practice and "the practical implementations" as termed by Da Ponte (2011).
3. Teaching statistics to students who are not interested in learning this discipline or those who hate it is a hard task (cited in Francis & Lipson, 2010). The attitude towards statistics may play an important role in raising learners' willingness to learn statistics; yet, when the students lose interest in learning the content, the lessons will be hard to be taught.
4. The lack of training of teachers for specific needs and the lack of specific programs to prepare statistics' teacher (Zieffler et al., 2008, as cited in Tishkovskaya and Lancaster, 2012). Furthermore, Verhoeven (2006), Smith and Staetsky (2007), and Meng (2009) mention that the service teaching of teachers is taught without making any link with the subject area (cited in Tishkovskaya and Lancaster, 2012). For example, when preparing teachers to teach statistics in the EFL field, service teaching should be based on the EFL context.
5. There is no valid and reliable approach to assessing the statistical reasoning of the students; therefore, the teachers may face problems when they come to evaluate the

students' outcome (Garfield, 1994; Gal & Garfield, 1997; Garfield & Gal, 1999; cited in Tishkovskaya and Lancaster, 2012)

6. Gelman and Nolan (2002) report that teachers find difficulties in motivating students and engaging them to solve statistical problems because statistics, which bases on problem-solving activities and tasks, could not be taught traditionally, where the teachers solve the statistical problems on the board and the students follow attentively. The same idea is explained by Garfield and Zvi (2008). They argued that it is hard to motivate students to learn statistics because many statistical ideas and rules are complex and hard.
7. For teachers, the challenge of teaching statistics lies in the appropriate method and innovative strategies to use. Hulsizer and Woolf (2009) stated: "… statistics teachers might consider structuring their courses in ways that facilitate new and more adaptive learning strategies" (p. 4), the teachers need to choose the appropriate ways to teach in order to avoid the fact that learners' performance and self-efficacy drop.

Consequently, the above-mentioned challenges are more related to the professional knowledge of the teachers. It is related to the best way to teach statistics and not the content being taught. Most of the challenges, as we have seen above, concern dealing with the learners' attitudes, or the lack of the teachers' preparation, or the teachers are undecided about the best method to teach …etc. Therefore, solving these challenges is in between the hands of the teachers themselves who need to be flexible to the classroom situations and be adaptive. They need to prepare themselves for every situation they could meet.

II.6.2. Challenges met by Learners

On the other side, teaching statistics is not a hard task for only the teachers; the students also face difficulties when learning this subject. Most of the students who study statistics face the following challenges and problems:

The students are unable to solve statistical problems from specific contexts because the teaching of statistics bases on teaching the mathematical aspects of the knowledge. This means that in the classroom, the students are engaged in learning the mathematical aspects of the statistics lectures and they are not engaged in specific statistical problems in the context (Garfield, 1995; Allen, Folkhard, Lancaster, Sherlock & Abram, 2012; cited in Tishkovskaya and Lancaster, 2012).

According to Gal and Ginsburg (1994), Garfield (1995), and Verhoeven (2006), most of the students have negative attitudes towards learning statistics. Some of them have "Math-phobia" or "Statistics Anxiety", others have pre-dispositions against statistics and others have no interest in this field. Moreover, Garfield (1995) and Garfield & Ben-Zvi (2007) maintained that students from other disciplines find the statistics content hard to be read (cited in Tishkovskaya and Lancaster, 2012). Garfield and Ben-Zvi (2008) claimed that the students find statistics unpleasant to be studied and a difficult subject with hard topics. Gal, Ginsburg, and Schau (1997) also commented on the importance of positive attitudes of the learners toward statistics in creating a good learning atmosphere, however, most of the students have these negative attitudes that prevent them from learning.

Garfield and Ben Zvi (2008) mentioned among the challenges of statistics education the fact that students equate statistics with mathematics, this is why their negative attitudes towards the latter associates always with the first.

Porter, Cartwright, and Sneglar (2006) reported a survey study's results for the attitudes of the learners of statistics. Their study reveals that the students who had better grades have worse attitudes towards the lectures. The approach of the lectures, according to them, is "less deep and more surface in their approach to the curriculum" (Porter, Cartwright and Sneglar, 2006, p.3). This shows that the learners' needs when choosing the approach and the content when teaching is very important in refining the learners' attitudes towards the subject matter and their studies. Moreover, the authors reported other studies where they found that most of the students have statistics anxiety which is related to particular tests (test anxiety).

Wood (1990) claimed that one of the challenges that the students from Non-English speaking backgrounds (NESB students) mainly meet exist at the linguistic level; more specifically at the level of vocabulary (mainly to problems in understanding the terms and the words that are specific to statistics like inference, confidence interval), syntax (the problem mainly is when using the comparative like at least, more than/ not more than …etc and logical connectors like: therefore, because, if, only if…etc. these should be well taught to the students), sequencing and logic (refer to how students follow a logical and sequential way to derive conclusions from the proofs), culture and context (some students from the different cultural background maybe not accustomed culturally to some ways that are used in statistics like dice, card, roulette …etc). Therefore, the teachers should focus especially in the first lessons on these levels and clarifying these points to students.

As we may see, most of the students' challenges when learning statistics are related to their attitudes towards this subject. Statistics education, thus, should aim first at refining these attitudes before going further in the lectures. Moreover, the lectures and content should be based on the learners' needs in order to attract the learners' interest and attention to this subject.

II.7. STRATEGIES FOR SUCCESSFUL STATISTICS LESSONS

Successful statistical lesson relies on a different aspect, most importantly, on the teachers and the learners. The teachers should have sufficient content and professional knowledge and learners should know the importance of these lectures for their studies as well as their future as employees or as citizens in general. Garfield and Ben Zvi (2008) reported George Cobb's et al. work concerning the strategies of teaching introductory statistics. They recommended the following three strategies:

1. **Focusing on Statistical Thinking**: the statistical lectures should show the students how to think statistically. This happens through different procedures like (as cited by Garfield and Ben Zvi, 2008):
   - Showing them the need for the data in taking decisions, because the data present evidence and argument to life decisions. Moreover, it is very important to show the student the danger of basing their decisions on assumptions that are not proven by the data or supported by arguments.
   - Showing them the importance of producing the data and the difficulty of making and formulating problems for the lectures (by the teachers).
   - Showing them that variability exists everywhere. Students should be taught that variability is the essence of statistics, and it is something to be learned by experience.
   - Showing them the importance of quantification and variability in data.
2. **Focusing on more data and concepts and fewer theories**: The introductory statistics lectures should be first based on the clarification of the main concept and initial calculations (as cited by Garfield and Ben Zvi, 2008).
3. **Foster active learning**: the learners should be engaged in the different stages of the lectures: calculations, problem-solving, discussions, activities, and so on. Whereas the teacher should have fewer roles in lecturing and demonstrating (as cited by Garfield and Ben Zvi, 2008).

Gal, Ginsburg, and Schau (1997) suggested that teaching and learning statistics should happen in an environment where learners feel: safe, comfortable, motivated, and where they believe in their abilities to learn (self-efficacy). Therefore, the strategies developed to enhance statistics education should be based on improving first the learners' attitudes towards the course and the content, then towards the methods of teaching and learning. According to Gal, Ginsburg, and Schau (1997), the learners' attitudes are very important in order to construct problem-solving abilities and to reach the desired goals of statistics education.

For better results when teaching statistics, the teachers should work collaboratively to produce positive results and train themselves to better performance. Da Ponte (2011) proposed some pedagogical implications to statistics education and teacher training. The author provides an example of a program to train teachers to teach statistics where the teachers should discuss together different content topics like the curriculum, the strategies, the tasks, the data, the content of the curriculum …etc. The training or the teachers' education should aim at developing the teachers' professional practices. Since the training is done with small groups of teachers, discussion and reflection should be done in order to develop their performance.

Therefore, for successful statistics lessons, both teachers' and learners' efforts are needed. Working collaboratively can help in sharing experiences and developing different strategies for better learning and teaching. Moreover, learners' attitudes could one of the challenges that should be faced during statistics lectures.

II.8. GUIDELINES FOR TEACHING INTRODUCTORY STATISTICS

The best introductory statistics lecture should focus on introducing the learners to the different basic concepts, ideas, and knowledge. A lot of studies have been undertaken in order to identify what to teach exactly in the course of statistics to the introductory level. HulSizer and Woolf (2009, p. 14) summarized some researchers' findings concerning this point. The research then revealed the following titles:

- ✓ summarizing data and graphs (e.g., frequency histograms, regression lines);
- ✓ summarizing data using descriptive data (e.g., measures of central tendency and variability);
- ✓ probability and probability distributions (e.g., normal distribution, central limit theorem);

- ✓ estimation (e.g., sampling distributions, least squares estimation);
- ✓ hypothesis testing (e.g., t-tests, Type I and Type II errors);
- ✓ categorical data analysis (e.g., chi-squared test for independence);
- ✓ correlation and regression;
- ✓ ANOVA;
- ✓ Nonparametric tests.

According to Garfield and Ben Zvi (2008), the statistics lectures should base on some statistical ideas that teachers should clarify. Here is a small introduction to the basic concepts (more details come in the following sections). The authors (2008) then reported:

1. *Data*: the statistical lectures should include the methods of collecting data (like questionnaires, scales, and all kinds of surveys) and the method for producing data (the experiments). Moreover, the lessons should include ways to make learners understand the different data and ways to evaluate them. The learners should know the different types of information, their characteristics, their roles, their importance, and the different conclusions that can be drawn from these types of data. Furthermore, the students should be aware of the importance of random sampling and random assignment in the collection and the production of data (Garfield and Ben Zvi, 2008).
2. *Distribution:* this is one of the most important steps of the data analysis phase. The learners should understand that the data can be explored as an entity (distribution) and not as a set of separate cases (Garfield and Ben Zvi, 2008, p.49).
3. *Variability*: learners should understand that data vary, and it is different because of the random sampling, measurement error, or the nature of the tested variable (like the weight or the affect …etc). Different statistical measures determine variability. These measures can describe well the distribution and the spread of the data (like the range, the standard deviation …etc). This notion is well explained in the following section (Garfield and Ben Zvi, 2008).
4. *Center*: some statistical measures like the mean and the median can show the center of any distribution (Garfield and Ben Zvi, 2008).
5. *Statistical Models*: the data are usually compared to a statistical model to see whether the data fit the model or deviates from the model (Garfield and Ben Zvi, 2008).
6. *Randomness*: the results of randomization are unpredictable except for long term patterns (Garfield and Ben Zvi, 2008).

7. *Sampling*: in statistics, the work is done by choosing a sample to make estimates, decisions, and conclusions about the whole population. The analysis of the statistical data is done within the sample and/or between the samples to make inferences (Garfield and Ben Zvi, 2008).
8. *Statistical inference*: or as called the P-value; it is used to measure the strength of the evidence against a conjecture but it does not suggest the importance of the statistical results. The P-value helps to answer the question: "is this result due to chance or due to an effect of interest (such as a condition in an experiment"(Garfield and Ben Zvi, 2008, p.50).
9. *Statistic and Parameter*: Perry (2005, p.163) defines statistics as the quantities that are collected from a sample and that could give information about the population. If the quantities have been directly collected from the population (not from the sample), they are called parameters; this later describes the population as it is.

In addition to the above ideas, Garfield (1995) states that the central goals to learning statistics for students include some basic concepts, notions, and ideas that are summarized in the following:

1. Variability of data and summary statistics
2. Normal distributions
3. The usefulness of sample characteristics (and inference principles regarding the sampling methods)
4. A correlation between two variables (but not cause and effect relationship)
5. The statistical conclusion should be "blindly" accepted because statistical proofs are conclusive.

According to Garfield and Ben Zvi (2008), whatever the syllabus the teachers of statistics follow or whatever the domain where statistics is used, these ideas are central and significant to the better understanding of statistics. For the EFL students, starting by clarifying these ideas might help in constructing a strong base for developing their needed statistical skills.

However, whatever the content being taught, teachers should use appropriate methods and suitable strategies to motivate and attract the attention of the learners to this content. Garfield (1995) proposes the principles to learning statistics which are based on constructive approach principles (p.30). These principles base on practical teaching activities and active learning where learners are the center of the learning process and understanding is the core of the teaching. The principles are summarized in the following points:

1. ***Students learn by constructing knowledge***: According to Garfield (1995), students should not be passive recipients of the knowledge but they should construct their own meaning after receiving the statistical knowledge. Basing on this, teachers of statistics should not ignore, dismiss or disprove the students' constructed meaning. Grafield and Ben Zvi (2008) added: "Students tend to accept new ideas only when their old ideas do not work, or are shown to be inefficient for purposes they think are important" (p. 40). The teachers, therefore, should use appropriate strategies to draw the attention of the students to the new information and guide them to correct their meaning
2. ***Students learn by active involvement in learning activities***: engaging students to learn statistics on their own helps them to better understand the lectures. Being active and taking part in the activities and tasks raise the learners' motivation to learn. Group activities, interactive as well collaborative learning help in involving the student in the tasks and the activities and the in the lecture in general (Garfield, 1995; Garfield & Ben Zvi, 2008). On another side, the teachers' role shifts to listeners, guides, probers, and assessors (Garfield & Ben Zvi, 2008).
3. ***Students learn well by practice***: that is to say, students understand better when they apply the ideas and the data they learn. What is important to them is how to use the information they get and not what the information is. Through practice, learners learn to be critical, learn how to analyze the information, construct arguments and communicate the ideas (Garfield, 1995; Garfield & Ben Zvi, 2008).
4. ***The teachers should understand the students' deficiencies when learning the introductory concepts in statistics***: the statistics concept can be hard to be learned by the students or can be conflicted with other concepts or ideas. This is why the teachers should not underestimate the difficulties the students face when learning (Garfield, 1995; Garfield & Ben Zvi, 2008).
5. ***The teachers should not overestimate the learners' understanding of basic statistical ideas and concepts***: the researchers focus on the importance of dealing carefully with the well understanding of the basic concepts because even the students can perform well the calculations or answer correctly the test items, they may misunderstand the main ideas,

interpretations or may fail to remember the main ideas of statistics (Garfield, 1995; Garfield & Ben Zvi, 2008).

6. ***Learners improve their learning of statistics by confronting their errors in reasoning***: some students have a kind of dogmatic thinking; they rely on their own reasoning even if they are confronted with arguments and evidence. Therefore, in order to better understand statistics, learners should learn how to evaluate data logically and make a difference between the own belief and the evidential truth proved by empirical studies. The students thus should know how to evaluate and analyze these differences to know their errors when reasoning and improve them (Garfield, 1995; Garfield & Ben Zvi, 2008).
7. ***The use of technology when teaching statistics is fundamental***: these technologies enable the students to visualize and treat the data by themselves in a practical way. In addition, they help the students to manipulate different statistical situations (like choosing different samples from different populations, observing distributions …etc.) (Garfield & Ben Zvi, 2008). Garfield (1995) talked about the importance of calculators and computer-based instruction in facilitating the students learning of basic statistical concepts; however, the development of technology provided more help and more technological sources that help in teaching statistics, we can find Youtube, different websites, graph designers …etc.
8. ***Feedback is important to motivate the student to better learn statistics***: teachers should provide the learners with supporting feedback on the different activities they perform. According to the authors, the feedback should be supportive especially when the students are interested in getting this feedback, in addition; it should be analytical in a way that makes the learners discover the right and the wrong in a critical way. It is important too, according to the authors, to provide the learners with sufficient time to reflect upon their performance especially before being assessed or given grades. Finally, the assessment of statistics performance should trespass the ability to perform the calculations well into the: "students' ability to reason, communicate, and apply their statistical knowledge" (Garfield & Ben Zvi, 2008, p. 42). Davies and Marriott (2010) claimed that good assessment helps in resulting a good learning and good teaching. The authors argue that since assessment is learning, the teachers should be concise in choosing the assessment method of statistics knowledge. The assessment according to them should include not only the statistical knowledge (content) but also the process of doing statistics, the global skills, critical abilities (especially needed when collecting data via surveys), and finally the skills of communicating the results and conclusions (p. 4-5).

To summarize, teaching and learning statistics is not a fact of lecturing the students about the different rules and concepts, but it includes understanding, reasoning, thinking, reflecting, practicing, sharing, discussing, making errors, correcting them…etc. Statistics education considers the learners as human and not machines. Therefore, it should be active and motivating to ensure the learners' interest and positive attitudes first towards the learning environment, then towards the subject itself. Teachers should support the learners' learning because even the easiest concepts and ideas may be hard for a student; this is why they should neither underestimate nor overestimate these challenges to students. Finally, the evaluation should be based on a different aspect of the lesson, as mentioned earlier; the students' statistical thinking and statistical reasoning, the way students communicate and apply the statistical knowledge should be included in the test and the evaluation.

II.9. STATISTICS IN THE ALGERIAN PRE-UNIVERSITY SYLLABI

The teaching of statistics in Algerian schools starts from the third year at the Intermediate level (or Middle School (MS)) and continues till the third year at the secondary level. It is not an independent subject but it is embedded as a chapter in the subject of Mathematics where it is taught in Arabic language and maintains great and Latin symbols that connote to the technical vocabulary of this domain. The content being taught differs from one level to another but the main competencies that are targeted are in general terms the same (see mathematics' syllabi of 3rd year MS, 2013; the 1st year Secondary level Science and technology branch, 2004; 1st year literature branch, 2005; 2nd year Literature & Philosophy, foreign Languages & Management and Economics Branches, 2006; 2nd year experimental science, Mathematics and Technical Mathematics (2006), 3rd year Experimental Science, Mathematics and Technical mathematics, 2011; 3rd year Literature & Philosophy and Foreign languages (2006); 3rd year Management & Economics, 2011

& see also the attached document to the 4th year MS' Syllabus, 2013).

In general, through the third year Middle Schools (MS) statistics, learners will be able to organize the data into a data set, present the data set in tables and graphical presentations and charts, calculating frequencies and relative frequencies (3rd year syllabus, 2013, p.92-93). The learners, then, are introduced into the calculation of the data set's mean which will help them to understand the importance of summarizing the data. Another point on which the third-year syllabus focuses is instructing the learners how to use the appropriate statistical expressions to state statistical events through the use of the appropriate vocabulary in the field of statistics (3rd-year syllabus, 2013, p.85). Finally, the syllabus focuses on the importance of introducing the Information Communication Technologies (ICTs) into statistics, where it recommends to instructs the learners about how to use Excel (3rd-year syllabus, 2013, p.93). The national committee of Syllabi design, the Mathematics Specialized Group (2016) claims that teaching statistics for third-year learners at the Middle Schools (MS) aims at two main goals:

- **a.** Training learners to read and use data;
- **b.** Discover some notions and concepts in Descriptive Statistics.

In the fourth year, Statistics Chapter is an extension of the chapter of the third year at the Middle School where it maintains the same targeted competencies. The syllabus mainly focuses on the use of ICTs (mainly Excel) and reminding the learners about the calculation of the mean. Later, the syllabus introduces the learners to the Median (M or) of a data set and carries on with the other measures of central tendency. Afterward, the syllabus brings in the notion of variability to provide a base to the first year at the secondary level (Syllabus of the fourth year, 2013 p.31).

The statistics lectures of the first year at the secondary level of both branches: Science & Technology (S&T) and Literature Common Core (LCC) also maintain the same above-mentioned competencies (of third and fourth year MS). According to the aims mentioned in the syllabus of S&T, the learners will be able to recognize the data sets and find out both measures of central tendency and measures of variability. Moreover, they will be capable of using the data in modeling statistical studies. The syllabus sheds the light on the importance of teaching the learners about the appropriate statistical expressions to signify the data, the measures, and the results. In general, the syllabus targets the basic statistical competences (cited in the S&T 1st year Syllabus, 2004, p.8, 10, 21&22):

- **a.** Ability to read the data, to describe them in tables and graphs;
- **b.** Summarizing the data set through presenting its central tendency measures;
- **c.** Differentiating and discriminating between the different measures of central tendency.

The chapter of Statistics in the S&T Branch stresses the “Range” which is one of the measures of variability and focuses also on the sample oscillation and stability as an introduction to the probability chapter.

For the second Branch (LCC), the statistics chapter in the syllabus (2005) aims in general at developing logical thinking and problem-solving competencies in the learners. More specifically, the targeted statistical competencies are the same as those mentioned in the syllabus of 1st year S&T (see the LCC syllabus, 2005, p.5) and those generally mentioned in the 3rd and 4th Intermediate levels. In general, learners need to be accustomed to the basic notions like data sets, and being able to extract the central tendency and variability measures; then, the learners will be able to model statistical studies according to the available data. As the above syllabi, planting the statistical expressions to describe the data, the measures, and the results and using the ICTs (mainly scientific calculator and data calculator like Excel) are indispensable (the LCC Syllabus, 2005, p.5-6). Contrary to the Syllabus of the S&T branch, the literary syllabus excludes the measures of variability and the probability from the program (p.9).

In the second year of Literature & Philosophy (L&P), Foreign Languages (FL), and Management & Economics (M&E) branches, statistics aims at recognizing the data set, measures of central tendency and variability, modeling statistical data to prepare statistical studies, the use of the appropriate statistical expressions that are appropriate to the description of the data, measures, and results (L&P and FL Syllabus, 2006, p.3; M&E, 2006. At the end of the programs, the learners will be able to link statistics with the probability field. The programs of the second year bases on developing the learners’ knowledge and competencies that they have already acquired through the previous years in the intermediate and the secondary levels (L&P and FL Syllabus, 2006, p.7). It recommends the learners to have an already acquired knowledge and competencies like knowing how to read the tables, graphs, and charts. Moreover, pupils need to know what are the measures of central tendency and measures of variability. Finally, the programs of these branches introduce the learners to the probability and the simulated random experimentations. Like the other levels and branches, the focus on the ICTs mainly Excel, at this level, also is very important (p.7).

At the Baccalaureate level, Statistics in the branches of L&P and FL extends its aims to enable the learners to acquire the material that helps them understand and recognize the simple simulated random experimentations through the observation of the relative frequencies.

The Syllabus (2006), finally, recommends using the experiments that are used in the first and second year like the use of “Dice” and “Coin”. In the branch of Management & Economics, Statistics aims at introducing the learners to a data set with two numerical variables and how to present it graphically through the “Point Cloud” than learning how to identify the coordinates of the middle point, the linear adjustment, and how to create a linear adjustment direct (Syllabus of Management & Economics, 2011).

Finally, the third year syllabi of Mathematics, Technical Mathematics, and Experimental Sciences branches (2011) do not replicate the lecture of statistics, rather; they introduce directly the learners to the probability.

To summarize, Statistics at the Algerian pre-university levels aims at establishing the basic knowledge in the domain through teaching the main concepts and vocabulary that is needed to express appropriately the basic statistical events and situations. The Language with which it is taught is the Arabic language but they maintain the Latin and Greek symbols and notations.

II.10. SAMPLING AND RELATED TERMS

When the researchers are interested in investigating a phenomenon, or answering research questions, or testing a hypothesis, they need a source or some sources from which to obtain data. The sources include cases of human beings called subjects or participants, or inanimate objects (like corpora of verbal discourse). These two types of sources are called a sample (Perry, 2005, p.55-56). Walliman (2011) defined sampling as the process of selecting a small number of cases out of a larger group (p.93). The larger group is called a population. The word "population" refers to all the people of a given place or country, but in the context of the research, the population represents the total number of the participants to whom the researcher targets to generalize the research results (Perry, 2005, p.59). From Walliman’s (2011) point of view, population refers to a large number of objects, organizations, people, or even events. When there is a difference between the mean of the population and the mean of the sample, researchers call this a “sampling error” that leads to a bias in the research results (Walliman, 2011, p.93). What Kothari (2004) called a “sample design” is the explicit plan that includes the technique with which researchers select the appropriate sample items from the chosen population. The author, also, explains the “Sample size” as the number of sample items that are selected from the population. For better results of the study, the sample size should not be small either large. Moreover, the number should fulfill "the requirements of the efficiency, representativeness, reliability, and flexibility" (Kothari, 2004, p.56).

During the process of selecting samples, researchers should take into consideration different conditions and the nature of the study. Therefore, researchers established some paradigms (Perry, 2005) that help the researcher select his/her sample. These paradigms are:

II.10.1. Information Rich Paradigm:

This paradigm guides the researcher to get a sample that is rich with the information the researcher is aiming at. This sampling is also called a "non-probability sample" according to Walliman (2011) and Kothari (2004). The Information Rich Sample (IRS) is characterized by its small size that enables the in-depth analysis and the extraction of the maximum relevant information from the sample. Therefore, the results of the studies employing this type of sampling cannot be generalized regarding the small number of participants. It is suitable in qualitative studies (Perry, 2005, pp.56-57). According to Kothari (2004), in the non-probability sampling, the researcher targets the sample items to get in-depth information. This paradigm includes different sampling strategies; among these we can find:

1. *Deliberate sampling*: it is also called purposive or convenience sampling. The researcher selects items purposefully especially those that are easy to be accessed. This sampling procedure is limited especially if the population is not homogeneous (Kothari, 2004).
2. *Judgment Sampling*: this technique is used most frequently in qualitative research where the researcher aims at generating a hypothesis and not generalizing it to the whole population. The selection of the items is based on the researchers' judgment on a sample (i.e. whether it is representative or not) (Kothari, 2004).
3. *Quota Sampling*: is a form of non-probability sampling. It is like a stratified sampling with the difference in that the selection of items from each stratum is based on the researchers' judgment (the random selection is costly for the researcher) (Kothari, 2004).

Kothari (2004) explained that non-probability sampling is a limited sampling procedure because the results can be subject to the researchers' impartiality. Moreover, another limitation is that the researcher cannot estimate the sampling error as the sampling procedure is not based on chance (each item has not the same or equal chances to be selected).

II.10.2. Representative Sample Paradigm (Probability Sampling):

This paradigm leads the researcher to choose the sample that can be representative of the targeted population. It is also called a "Probability Sampling" (Walliman, 2011 & Kothari, 2004); it results in choosing reliably a sample that is representative of the population as it assumes that each element of the population has an equal chance to be selected (Walliman, 2011 & Kothari, 2004). However, when choosing the sample, the researcher should verify whether the population is homogeneous or includes different characteristics or classes as claimed by Walliman (2011, p.96). The aim of the researcher when using this type of sampling is to generalize the obtained results from the sample to a larger group (Perry, 2005, p. 56). According to the author, this paradigm involves different strategies to sample selection:

1. *Simple random sampling*: it is also called "chance sampling" (Kothari, 2004). This strategy bases on the fact that every single subject of the target population has the same opportunity to be selected for the sample. This technique can get rid of the effect that may be caused by the extraneous variable (Perry, 2005, p. 62).
2. *Systematic sampling*: the research put into a list all the population items then the researcher decides on a random number (an) to be selected (for example the researcher selects each 10th student from the list of all the students in his or her population). An important point here is that the "i" number is randomly chosen by the researcher (Kothari, 2004).
3. *Stratified random sampling*: it is used when the population is not homogeneous this is which means that is pre-divided into subgroups or "strata" (Kothari, 2004 & Perry, 2005); for example, a population is divided into males and females, or in case of students' level: poor, intermediate and high levels (Perry, 2005, p. 63). The researcher chooses subjects from each stratum randomly to ensure the sample has the same characteristics as the population.
4. *Cluster Sampling*: Jupp (2006) defined cluster sampling as: "A method of survey sampling which selects clusters such as groups defined by the area of residence, organizational membership or other group-defining characteristics" (p.29). Similarly, Kothari (2004) asserts it is used in a heterogeneous (mixed) population that includes heterogeneous groups (called clusters). The researcher does not select individual items

but selects a whole group or cluster. To avoid any bias in the results, it is recommended to use a large sample size (Kothari, 2004).

5. *Area Sampling*: is used when there is a large geographical area and it is related to cluster sampling. The researcher divides the geographical area into separate smaller cluster areas. Then a random number of these clusters are selected (Kothari, 2004). Jupp (2006) added that area sampling relies on selecting clusters, not from lists of individuals, groups, or institutions, but they are selected through maps.
6. *Volunteers*: with this strategy, the participants are volunteers and they are not under obligation to participate in the study (contrary to the convenience strategy). However, researchers have claimed that this types of sampling do not have the qualities of being random sampling techniques since most of the volunteers have some specific characteristics like being highly educated, more outgoing …etc (Perry, 2005, p. 65)

Kothari (2004) explained other types of sampling including multiple stage sampling and sequencing sampling which are related to cluster sampling. The author claimed that the researcher can make use of more than one sampling technique in compound studies, and this will be called a “mixed sampling”.

II.11. QUANTITATIVE DATA ANALYSIS

Historically, the quantitative approach in the social sciences was inspired by natural sciences in the 19th century and was referred to as a scientific method. The scientific method, as it is known even among philosophers in the mid-sixteenth century, has three main steps: the first involves identification of the problem (or observing the phenomenon); the second, generating a hypothesis; and finally testing the hypothesis through empirical procedures. If the research has been replicated it will be validated and accepted as being a theory or a law (Dörnyei, 2007). Later on, Rutherford (who won the Nobel Prize) stated that described the knowledge that cannot be measured numerically as being poor knowledge (cited in Dörnyei, 2007, p.31) has to lead to the fact that a scientific method cannot stand without statistics and the numerical measurement. For this reason, statistics had been increasingly growing in the field of social research and became an indispensable part of it. At the turn of the twentieth century, Francis Galton initiated the quantitative data collection and the quantitative method of data analysis into psychology.

Analysis refers to the process of computing certain values through employing some statistical patterns to prove a kind of relationship between the data patterns (Kothari, 2004). Quantitative data analysis refers to the process of employing mathematical operations to deal with the data in form of numbers and investigate their characteristics and features. The quantitative data analysis takes into consideration the type of the data scale (level of measurements: nominal, ordinal, ratio, and interval) because of their importance in selecting the data analysis method. The quantitative analysis primarily aims at different goals in which the researcher may use different aims; these objectives are: measuring, making comparisons, examining relationships, make forecasts, test hypotheses, construct theories and concepts, explore, control and explain (Walliman, 2011, p.113).

According to Kothari (2004), before starting the analysis of the data, researchers should first “Process” them. The processing phase includes four main steps including:

- *Editing*: here the researcher examines the raw data to spot any errors or omissions in order to correct them if possible.
- *Coding*: this refers to the process of representing the data collected via numbers or symbols. This process is important in order to summarize the large sets of data and categorize them.
- *Classification*: the large set of data should be reduced to homogeneous groups (that have common features) of data in order to establish meaningful relationships.
- *Tabulation*: this refers to the process of displaying the data in form of tables. These tables enable the researchers to view clearly the data for instant comparisons, and they help them decide upon the appropriate statistical computations to be used.

Different problems may arise during the data processing phase. One of the most recurrent problems is when the respondents respond with a “do not know” answer which may refer to either the respondent did not understand the question or s/he does not know the information. The best ways to use in order to avoid is to design questions is to create the categorical questions which will guide the respondent (of course when it is legitimate) (Kotahri, 2004).

The quantitative analysis depends on the number of variables:

1. ***Univariate Analysis:*** where the researchers focus on the description of ONE variable. They make use of descriptive tests. Usually, researchers use either Frequency

distributions (the data are presented in tables that show frequency and percentage) or measures of central tendency or measures of dispersion (Walliman 2011, p.117)

2. ***Bivariate Analysis:*** the researcher deals with determining the relationship of the properties and the characteristics of TWO variables (Walliman, 2011, p.118). The relationship can be either a correlation or a cause and effect. The choice of the bivariate statistical test depends on the type of the data or the level of the measurement. The most used bivariate tests include Pearson's correlation coefficient r (for interval and ratio data), and Spearman rho (p) which is used for ordinal data or when the variable is ordinal and the other is an interval (Walliman, 2011, p. 122).
3. ***Multivariate analysis:*** this looks for the relationship between MORE than TWO variables (Walliman, 2011).

Basing on the above information, researchers should have a clear idea about their variables and their aims in order to proceed appropriately in the data analysis. The data analysis data two main ways: present the data in summative ways and then analyze it to infer the meaning that the data convey.

II.11.1.Data measurement Scales

The data that are collected through different types of tools can be categorized into four main types that are very important in the data analysis:

1. ***Data on Nominal Scale***: are the data that are represented in the form of frequencies and percentages. The nominal data can be classified into categories and then compared with each other (if needed). They can be represented by words or numbers where the number should not have any other meaning (Perry, 2005, p.207). This type of data can be analyzed with a simple graphical presentation (like a bar graph) or simple statistical properties like percentages (Walliman, 2011, p.75).
2. ***Ordinal scales of data***: the data have a certain type of ranking. When coded, the data could be given numerical data, but contrary to the nominal, the numbers of the ordinal scales have a meaning (ranked from high to low for example) (Perry, 2005, p.208). This type of data does not require a specific or precise measurement of the property, they show whether the variables/or the measured thing is higher or lesser than others; it is determined when one value is different from another (Walliman, 2011, p.75 & p.76). An example is the different types of Likert Scales. This scale has two characteristics: first, it has unequal distance (for example if we use a five-point Likert scale there is not the same distance

between the first proposition and the second and between the second and the third). Second, there is no true zero; which means if we assigned a zero to a given category it just means that category but not the fact that this category is not existing (Perry, 2005, p.208). According to Walliman (2011, p.75), the analysis of this data includes different statistical procedures. Cohen, Manion, and Morrison (2007) explained that the data here can be classified and put in order; they can be classified from the "weakest to strongest, smallest to biggest, lowest to highest, least to most and so on" (p.502).

3. ***Interval Scales of data***: these scales have an equal distance between the numbers and have no true zero. The author gave the example of temperature, between 21 and 22 degrees, and between 25 and 26 degrees, there is an equal distance. Moreover, a 0 degree Celsius does not mean the total absence of heat, but the degree to which the water freezes. Another example where the author claims that when a student gets a mark of 0 does not mean the absence of the answers, but means the answers provided were not correct (Perry, 2005, p.208). According to Walliman (2011, p.76), this type of data is analyzed with more developed statistical procedures. According to Cohen, Manion, and Morrison (2007), interval statistics present a metric (which is "a regular and equal interval between each data point" p.502) and the data are classified and ordered. For example, the age intervals present interval data: (a person whose age 15 and another whose age is 30, we can know that the first person is younger than the second and we can know also that the second is older than the first by 15 years). This kind of data has the three properties: Identity (have a unique sense), magnitude (can be ordered according to a defined order), and the equal interval (the difference unit between the data are equal for example: between 3 years and 4, between 9 and 10, between 19 and20 …etc) that is to say that the interval unit is the same all along the data set.
4. ***Ratio Scales of data***: this is hardly ever used in the field of applied linguistics' studies. This is characterized by an equal distance and a true zero (Perry, 2005, p.209). This type of data can be analyzed by a lot of statistical procedures (Walliman, 2011, p.76).

Before proceeding in the analysis of the data, the researchers should be aware of the types the data they obtained (or the level of the measurement of their data). When reporting the data descriptively, it is very important to know which type of data the researcher is going to report. Rumsey summarizes the most important measures that should be reported for each type of data:

- ***Reporting Categorical Data***: Since the categorical data classify the individuals (like male and female; good health, bad health; poor, good, excellent …etc), the data are usually presented in the forms of a number of individuals (n) falling in each category, percentages). The data are displayed in tables or in two-raw tables (crosstabs that have rows and columns) to summarize all the information provided by the categorical data. Through the total number, you can calculate the percentage, but if we have the only percentage, we can never know the number of the individuals in the category (cited in Rumsey, 2010)
- ***Reporting Numerical Data***: When the researchers come to summarize and display the results of numerical data, they usually present the centers of the data (measures of central tendency: mean, median, and mode). The method used influences in a great way the conclusion derived from the data (for example we cannot use the mode value to compare between two groups' scores, we use the mean instead) (cited in Rumsey, 2010).

II.11.2. Types of Quantitative Analysis

After knowing the types of data the researchers start processing their data and reporting them. There are two types of data analysis methods in which the researcher should take into consideration:

II.11.2.1. Descriptive Statistics:

According to Perry (2005, p.164), Descriptive statistics analysis is used to describe a set of data and they are the starting point of the inferential statistics. Descriptive statistics is mainly concerned with three main areas: first the shape of the distribution, measures of average, and measures of variations (p.164). Besides, according to Rumsey (2010), descriptive statistics involve numerical data that summarize some features of a set of data of a given phenomenon. Descriptive statistics provide direct and concise information about the study so the researcher can read them easily and know what is happening in the study. According to the author, the kind of data you have determines the information that will be displayed in the results of the descriptive statistics.

According to Tavacoli (2012), descriptive statistics is used to organize and display the data drawn from the sample of the investigation. It includes data that describes the central tendency, the variation, and the graphical presentation. It refers to:

> "A set of statistical procedures that are used to describe, organize and summarize characteristics of sample data in a clear and understandable way, both numerically and graphically. some of the descriptive statistics procedures include measures of central tendency (such as the mean, mode, or median), and variability (typically the variance or standard deviation) and in graphical presentations frequency distribution, bar graph, histogram, frequency polygon, pie chart, normal distribution, and skewed distribution." (Tavakoli, 2012, p. 161)

When performing a descriptive analysis, Blai (1971), Kothari (2004), Perry (2005), and Singpurwalla (2013) discussed the task of descriptive statistics in presenting the data and providing a clear and meaningful image of the data being described.

- *First: the shape of the distribution*: the descriptive statistics present the shape of the data which means that it shows how the values are distributed (Walliman,2011, p.116). Determining the shape of the data is essential for the choice of the test and the other measures; Perry (2005) claimed the shape explain whether the data are normally distributed (symmetry); the author explains: "when the distribution is severely skewed (lopsided) or rectangular (no curve at all) or multi modals (more than one cluster of data), certain statistics should not be used" (Perry, 2005, p.165). Even though it is important, few research studies and articles report the shape of the distribution.
- *Second: the measure of average* refers to the statistics (measure) that are used to describe the average (central tendency) of a set of data. These include generally: the mean, median, and mode (Perry, 2005). Moreover, these measurements provide information about the "typical performance of the members of the sample". The most used measurements are the mean, median, and mode (Blai, 1971). These central values give a representative figure of the entire set of data (Kothari, 2004)
- *Third: the measures of variance*that describe the variance in the data set. We have chiefly three main measures: the standard deviation which represents the average deviation of the data items (scores). Besides, we have the measure that "estimates where the middle 50% of the scores are located in the data distribution" (Perry, 2005, p.165). Finally, the last measure of variance mentioned by the author "describes the distance from the lowest to the highest scores in the distribution" (Perry, 2005, p.165). In addition, these measurements explain how the individual scores are dispersed about the mean. They show whether the scores are close or far (spread away) from the mean. The basic measures of variability are the range, the standard deviation … etc (Blai, 1971). These measures

contrary to the central ones focus on describing the individual values rather than a representative value (Kothari, 2004)

In addition to these three, Descriptive statistics also presents the data in form of graphs. Singpurwalla (2013) stated that graphic presentation can take different shapes; we can find pie charts (that are circular charts divided into different classes that represent the elements being described). Another type is “frequency histograms” which constitute bars representing the frequency of each of the described elements. Moreover, the researcher can also use the dot plot, bar graphs, typical histograms …etc.

1. *Main Measures of Central Tendency*:

- The mean: or also called the average. When we have a numeral data set, we can calculate the mean (average) by adding up all the numbers in the data set, then divide the sum by the number of the numbers of the data set (n) (Rumsey, 2010). For example, we have a score of 10 students (S represent the student) (S1 got 12, S2 got 5, S3got 10, S4 got 18, S5 got 11, S6 got 6, S7 got 15, S8 got 13, S9 got 10, S10 got 10). The mean of this data set is calculated: (12+5+10+18+11+6+15+13+10+10)/10 which mean that the mean score is 11. In statistics, it is denoted ($\bar{x}$ =11). According to Rumsey (2010), the mean score cannot tell everything about the data set, because there is in the data set details that can influence the conclusion like the outliers (that are the numbers (or the score in our example) that describe the highest and the lowest numbers (scores), in our case: 18 and 5). In the example in our example, according to the mean, the group scores are above the average (10); however, we cannot conclude that all the students got scores above the average because as we can see, we have scores that are under the average (10).
- The Median: in the place where the data set is divided into two parts after being ordered from the smallest to the largest. It is denoted (M or $\tilde{x}$) (Rumsey, 2010). The median is calculated through * ordering the numbers from smallest to the largest, then * if n is an odd number, the median is exactly the number in the middle of the set for example we have this data set: n = 9 scores: 12 5 10 18 11 6 15 13 10, after re-ordering them: 5 6 10 10 11 12 13 15 18. Therefore, the median is the number which is situated in the middle of the data set: M is 11. * If n is an even number, we take the two numbers that are situated in the middle of the set and find their average.

For example: if we have a data set where n is an even number, (here n =10): 12 5 10 18 11 6 15 13 10 10, after reordering them we get: 5 6 10 10 10 11 12 13 15 18, we divide our set into two parts of five scores (5 6 10 10 10) and (11 12 13 15 18), we choose the two number that are at the middle if the set which are 10 and 11, then we find their average (10+11)/2 which means M =10.5.

- Mode: According to Cohen, Manion and Morrison (2007), the mode represents the "score obtained by the greatest number of people" (p. 503).

It is important to report these measures when summarizing the numerical data (and more frequently to ordinal data) because each one gives information about the data set. Knowing these details helps in making the right conclusion and the right decision. When comparing two data sets, we may find that they have the same mean and the same median; in such cases like these, we cannot say that the two sets of the data are the same. It is very important to report also the measures of variability that demonstrate the variation between the two sets (Rumsey, 2010).

2.*Main Measures of Variability*:

Rumsey (2010) said that statistics aims to describe the variation of the data between individuals, groups, time (from a moment to another, a year to another …etc). He adds: "Variation always exists in a data set, regardless of which character you're measuring, because not every individual will have the same exact value for every characteristic you measure" (p. 17). The measures of variability cannot mean any things if they are reported alone; however, they are very important when used to compare between two data sets because they give more details about them (Walliman, 2011). The most used variability measurements we find:

- The Standard deviation: according to Rumsey (2010) the standard deviation represents: "represents the typical distance from any point in the data set to the center" (p. 17). It is denoted –according to the author- by "s". The standard deviation is calculated following these procedures: 1) calculate the mean ($\bar{x}$) of the data set, 2) for each number subtract the average from it. 3) square each of the differences, 4) add up all the results from step 3, 5) divide the sum of the squares of step 4 by n (number of the scores) minus 1, 6) finally take the square root of the variance, and the value we get is the standard deviation. The steps are summarized in the following rule: s =

$\frac{\sum(x-\bar{x})^2}{n-1}$. Rumsey (2010) claimed that standard deviation cannot be a negative number, and the smallest value is 0 when the data are all the same (all the scores for example are the same score), standard deviation is affected by the outliers because both are related to distance from the mean.

- Percentiles: According to Rumsey (2010), it “is the percentage of individuals in the data set who are below where your particular number is located” (p. 19). To calculate it: 1) Order all the numbers in the data set from smallest to largest. 2) Multiply k percent times the total number of numbers, n. 3a) If your result from Step 2 is a whole number, go to Step 4. If the result from Step 2 is not a whole number, round it up to the nearest whole number and go to Step 3b. 3b) Count the numbers in your data set from left to right (from the smallest to the largest number) until you reach the value from Step 3a. This corresponding number in your data set is the percentile. 4) Count the numbers in your data set from left to right until you reach that whole number. The percentile is the average of that corresponding number in your data set and the next number in your data set (Rumsey, 2010). For example: if we have a data set of 20 scores ordered from the lowest to the highest: 1 3 4 4 5 8 9 9 10 11 11 12 13 14 17 18 18 19 20 20. For example, to find the 80th percentile of this data set, we start by multiplying the percentile times n (the number of the scores): 80% x 20= 16. Since this is a whole number we proceed to the fourth step where we count the numbers from left to right until we reach the 16th, in our case, the 16th number is 18. Then finally to find the 80th percentile we calculate the average of the 16th number with the number that comes after, it means (18+18)/2= 18. In the case where the number that we do not get a whole number in step 2 for example in this set: 5 8 9 9 10 11 11 12 13 14 17 18, we want to find the 60th percentile: 60%*12 = 7.2. The number is not a whole number; this is why we round it to the closest which is the 60th percentile of this data set then is 11. A percentile is a number that describes the difference between different percentiles and the spread of the numbers of the data set between the percentiles. For example, when comparing the percentiles of the group, for example (the 25th, the 50th, the 75th, and 100th) we can know how many students are under the 50th percentile and how much are above.
- Maximum and Minimum: the minimum is the smallest number in the data set and the maximum is the largest number in it. These values are used to describe the data (descriptive statistics). Usually when reporting the maximum and the minimum we

also report the 25th (which is called the first quartile), the 50th and the 75th (which is called the third quartile) percentile. The 50th percentile is what we called the median and these 5 numbers are called in statistics the five-number summary (including the minimum, the 25th percentile, the median, the 75th percentile and the maximum). When we want to use these five number summary to describe the variability of our data set, we can calculate the IQR (Interquartile Range) that is calculated through calculating the difference between the third quartile (Q3) and the first quartile (Q1): IQR = Q3-Q1. The value we get explains the distance taken up by the innermost 50% of the data. If the IQR is small, you know that there are much data close to the median; and if it is large, you know that the data are spread out from the median (Rumsey, 2010, p. 22).

To summarize, the descriptive data are used to display the results and in order to facilitate to the readers and the researchers to have a general view of the data set and to understand them well. Each of the above components is reported for a reason, this is why the statistics education lectures for EFL learners need to clarify these concepts and the reasons behind using them.

II.11.2.2. Inferential Statistics:

It is also called "sampling statistics", "inductive statistics" or "analytical statistics" (Tavacoli, 2012, p. 274 & p.565). Inferential statistics refers, according to him, to:

> "a branch of statistics that is concerned with the development and applications of methods and techniques for drawing generalizations about a population on the basis of data obtained from a random sample, usually with a certain degree of uncertainty associated with it" (p.274).

Inferential statistics makes use of the data drawn from a single group of the whole population to make inferences, estimates, and decisions about the other groups of the same population. Inferential statistics makes use of two kinds of tests: Parametric and Non-parametric which deal with the parameters of the population from which the samples have been chosen (Tavacoli, 2012). Cohen, Manion, and Morrison (2007) explained that "parametric data assume knowledge of the characteristics of the population, for inferences to be able to be made securely" (p.503); whereas, the non-parametric data are, according to them, "make no assumptions about the population, usually because the characteristics of the population are unknown" (p.503). Non-parametric data includes the ordinal and nominal data that are usually gathered through questionnaires and surveys. The parametric data, thus, include interval and ratio data that are collected from experiments and tests. For the authors, it is very important to know the type of data before deciding upon the statistical test to use because it is incorrect to apply a parametric test to non-parametric data and it is incorrect to conduct non-parametric tests to parametric data.

According to Blai (1971), inferential statistics deals with how to make conclusions and predictions based on the data collected and most importantly how to ascertain the reliability of these predictions. Inferential statistics deals with data collected from samples to make predictions about the population. According to him, the population can be defined as: "the total number of individuals or objects having a defined characteristic" (p.4), a sample, he adds, is: "A lesser number from among the population" (p.4). The sample is taken to represent the whole population as this latter is large in number.

According to Singpurwalla (2013), the researcher, when using inferential statistics, follows these main steps:

1. Decide upon the population
2. Decide about the variables that are going to be studied
3. Decide and choose the sample
4. Run the statistical test that will serve your research
5. Generalize the result of the sample to the whole population and draw the conclusions.

In order to understand inferential statistics, it is highly required to understand some basic concepts are associated with it. The main concepts are:

a. *The Null Hypothesis:*

It is one of the most important concepts in inferential statistics is mostly found in hypothesis-testing research. When testing a hypothesis, researchers usually try to answer two kinds of questions: "whether there is a relationship?" or "whether there is a difference" between groups or variables. The null hypothesis, thus, suggests that "there is no relationship" or "there is no difference" between the groups/ variables (Perry, 2005, p.166-167).

b. *Statistical Significance*:

When conducting research where a sample is used instead of the population, the researcher needs to provide evidence that the results of the study represent the population and that the results did not happen because of chance. When the results are statistically significant, they are representative of the population (Walliman, 2011, p.122). This gives an idea about the "probability of a mistake being made when inferring that the results found in a sample reflect some truth about the target population" (Perry, 2005, p. 167). When talking about the errors in statistics, we should understand first that:

- Either the null hypothesis is true (that means there is no relationship or difference between the groups or the variables of the population).
- Or the null hypothesis is false (which means there is a difference between the variables (or the groups) of the population).

If the results obtained to claim that there is no relation or difference (which means they failed to reject the null hypothesis (because there is no statistical significance). Here we say there is no error made. However, if the null hypothesis is false in the population, and the results found in the sample claim that there is no relationship or difference (there is not a significant relation or difference) between variables; therefore, we claim that there is "an error" which is called "***type II error***". On another side, if the results from the sample claim that there is a significant relationship or difference (they reject the null hypothesis) where, in reality, the null hypothesis is true in the population; then, there is an error called "***type I error***" (Perry, 2005, p.168).

Accordingly, statistical significance can be explained as the chance of committing a type I error at a given level. That is to say, there a given degree at which there is a chance to make a mistake when inferring that the null hypothesis is not true in the population. This level maybe 5% or 1%, which means that there is a chance of 5% or 1% (respectively) to commit a type I error. On another side, type II error may happen when the sample size is small (Perry, 2005, pp.168-169).

c. Parametric and non-parametric tests:

Walliman (2011) claimed that a "parameter of a population … is a constant feature that it shares with other populations" (p.115). Therefore, it assures that the different populations which contain different cases have the same feature, and any case among any population can be representative of the other population or other cases.

- Parametric tests: used to analyze "the data that do not stray far from a normal distribution and typically involve the use of means and standard deviations, scores on tests and surveys usually fit these criteria" (Perry, 2005, 171). That is to say, the parametric tests take the different cases of the population as the same based on this shared feature (parameter). Kothari (2004) claimed that in order to use parametric tests, researchers should make an assumption about the population parameters (a normal distribution should be assumed, large sample size, and researchers should think about the population means and variances ...etc). That is to say, researchers should think about the population and how the sample represents the population parameters, and then what is the appropriate test. Cohen, Manion, and Morrison (2007) explained parametric tests as tests that are designed to present the whole population (for example the country or age group). These kinds of tests are usually published and commercially available. They are standardized on a representative sample of the population. These tests have "complete backup data on sampling, reliability and validity statistics which have been computed in the devising of the test" (p. 415). These tests make use of interval and ratio types of data. The spelling test, the mathematics test, the end-of-year examination … etc. are examples of parametric tests.
- Non-Parametric tests: Cohen, Manion, and Morrison (2013) argued that these types of tests do not make any assumption about the whole population or its features. The researcher in these tests makes use of nominal and ordinal data. They are tests that are used "to analyze data in form of frequencies, ranked data, and data that do not approximate a normal distribution" (Perry, 2005, 171). According to Walliman (2011), the non-parametric tests take into consideration the individual differences between the cases; they are weaker and provide less reliable results than the parametric tests because they work with small-sized samples. According to Walliman (2011, p.126), the non-parametric test used when:
    - The sample size is very small;
    - Few assumptions are made about the data (estimations about the population and shape of the data distribution);
    - The data are rank-ordered or nominal;
    - Samples are taken from different populations.

d. Confidence Level / Significance Level:

This refers to the percentage of times that the calculated value will fall within the cited limits. If the researcher chooses, for example, a 95% confidence level this means that there are 95 chances of 100 chances that the results obtained from the sample represent the population and there are only 5 chances out of 100 that the sample results do not represent the population (Kothari, 2004). Kirk (1999, p. 337) indicated that “a statistically significant result is one for which chance is an unlikely explanation” (cited in Cohen, Manion & Morrison, 2007, p.515). This notion mainly exists in hypothesis testing research where the researcher deals with two types of hypothesis: the null (no change or no difference or no relationship between variables or groups… etc) and the alternative hypotheses (there is a change or difference or relationship between variables or groups…etc). The researcher may face a situation where there is no sufficient ground for accepting the alternative hypothesis, therefore; the statistical significance presents proof and evidence to reject the null hypothesis and accept the alternative one.

e. One tailed Vs Two tailed tests:

These two terms are central in hypothesis-testing research. A two-tailed test rejects the null hypothesis when the sample mean is higher or lower than the hypothesized value of the population means. From another side, a one-tailed test is used when the researcher wants to know whether the population mean is higher or lower than a given hypothesized value (Kothari, 2004).

II.12. INFERENTIAL STATISTICS TESTS

Inferential statistics usually try to make interpretations about either relationships or testing differences between groups and variables. For this reason, different statistical tests have been created. In this section, we shall introduce briefly the different statistical tests for both differences and relationships (both parametric and non-parametric):

II.12.1. Tests of Relationships

The measurement of relationships mainly deals with the identification and the assessment of the direction and the degree of an association between variables through the use of the correlation coefficients. When the researcher detects the relationship, it does not mean that s/he proved a cause and effect relationship (Walliman, 2011, p.118).

***a) Non parametric Tests of Relationships*:**

- *Chi-square Test*: pronounced [ky-square] (Perry, 2005) or [ki-square] (Kothari, 2004) and symbolized by χ^2. It is the test that mostly used when dealing with data in form of frequencies. It is related to the null hypothesis as it "compares the observed frequency of the different levels of a variable with what would be expected if no relationship existed (Perry, 2005, p.172). According to Walliman (2011), this test "measures the degree of association or linkage between two variables by comparing the differences between the observed values and expected values if no association were present" (p.122). Perry (2005) explained the expected value of the null hypothesis by the following example: a comparison between 40 males and 40 males' success, if there is no relation, 20 males & 20 females fail and 20 males &20 females succeed. Therefore, the expected value is 20 (for more details about the example see Perry, 2005, p.172).
- *Spearman Rank Order Test*: the spearman correlation coefficient or as it is known "Spearman rho correlation coefficient" and symbolized as r_{rank} or the Greek symbol: ρ which is pronounced rho. This test analyzes the data that is ranked (ordinal data) (Perry, 2005). The ρ values range from -1 to +1, a value of -1 connotes a perfect negative relationship (which means when the first variable increases, the other variable decreases for example). When the value is +1, this refers to a positive relationship (if variable A increases, the variable B also increases, if A decreases, B decreases as well). Finally, a 0 correlation values mean that there is no relationship between the two variables (Perry, 2005, p.173 & Walliman, 2011, p.121).
- *Kendall's Coefficient of Concordance*: It is symbolized by W and it acts like the Spearman coefficient, but the difference is that it deals with several (k) data sets (not two sets like Spearman) (Kothari, 2004).

Perry (2005, 174) claimed that other testing methods are used to test correlations between variables. These methods include: Cohen's Kappa, Phi-coefficients, Cramer's V, Somer's …etc.

b) Parametric tests of Correlation

- *Pearson Product Moment Correlation Coefficient*: This test tries to investigate a linear relationship between two variables (Kothari, 2004). It is called Pearson's *r* or r_{xy}. It is the equivalent of the Spearman Rho test, and it tries to measures the correlation between two variables' measures for each participant (it means for example to test the relationship between anxiety and failure within the same group) (Perry, 2005, p. 174). Like Spearman Rho, Pearson Correlation Coefficient values range between -1 and +1, -1 refers to a negative relationship, +1 a positive relationship and 0 refers that there is no relationship (Perry, 2005, p. 174 & Kothari, 2004, p139).

- *Regression Analysis:* it is related to Pearson correlations and aims at identifying the independent variables that predict or explain the dependent variables (we do not suggest any cause and effect relationship). There are two forms of regressions: "Simple Regression" that studies ONE independent (predictor) variable and ONE dependent (predicted/ explained) variable (Perry, 2005 & Kothari, 2004). Perry (2005, p.176) provided the example of researchers who tried to predict the SUCCESS (dependent) of a group of students based on their grades in the TOEFL exam (predictor variable). Another example provided by the author elaborates the "explanation aim" of simple regressions. This example claims "how much students' scores on an essay exam can be explained by their Grammar ability" (p.176). The other form of regression analysis is "Multiple Regression". This latter focuses on a combination of independent variables and how they predict/explain the variation in ONE variable (Perry, 2005).
- *Multiple Regression*: this is used when the study consists of multiple independent variables (IVs) and one dependent variable (DV). A researcher aims to explain or predict the dependent variables. This is mainly dealing with continuous data (Orme & Combs-Orme, 2009). For example, a researcher may be interested in studying the effect of women's behavior during pregnancy (alcohol use, age, psychological health, and smoking) on newborn babies' birth-weights (Orme & Combs-Orme, 2009).

According to the author, other parametric procedures test correlations; these include Factor Analysis, Discrimination Analysis, Latent Trait Analysis, Structural Equation Modeling …etc. these methods aim at finding the correlation between variables to know which variables have common variance. Moreover, some of these tests are sometimes used to identify cause and effect (Perry, 2005, p.177). Moreover, Kothari (2004) explained some other tests for multiple analyses including Multiple Discriminant Analysis,Canonical Correlation Analysis, Factor Analysis, and Path Analysis.

II.12.2. Tests of Differences between Groups of Data

These procedures aim at finding out a difference between two or more groups of data. These procedures can be parametric and non-parametric.

A. *Non-Parametric tests*

- *Chi-Square test*: it is used to identify differences any difference between groups of frequency-based data (Perry, 2005, p.178).
- *Mann Whitney U test*: this test works with two independent groups of participants and one dependent variable. It is used when the data shape does is not near the normal distribution and the data are not in the form of frequencies. The analysis of the databases on transforming the data into ranks but not means and standard deviations. When the test's value is calculated, it is symbolized U and if $U<.05$, that means that the difference is statistically significant (Perry, 2005, p.179).
- *Wilcoxon Matched-Pairs Signed Rank Test*: and also called Wilcoxon t-test. This test is used in case of paired data (Kothari, 2004). This procedure is said to compare 1) two sets of data that are gathered from the same group of participants or 2) from two different groups which are compared on one variable (Perry, 2005, p.176, Kothari, 2004). That is to say, the Wilcoxon test is used to compare data that are not independent of each other (they can be either from the same participants or they measure the same variable with different groups).
- *Kruskal-Walis test*: this test is used when the data are not normally distributed (Perry, 2005 & Kothari, 2004). It is an extension of Mann Whitney U test with the difference that these tests (Kruska-Walis) "compares more than two independent groups of participants using the same procedure of ranking data prior to analysis" (Perry, 2005, p.181). According to Walliman (2011), this test requires data to be ordinal.
- *The Friedman test*: this is quite similar to the Wilcoxon tests in that it is used to tests the difference between three or more sets of dependent data (with the repeated measures) (Perry, 2005, p.181).

Other non-parametric tests are cited in Kothari (2004), like mainly: Fisher Irwin Test, McNemar Test, One Sample Runs Tests etc.

B. *Parametric tests*

The tests that are going to be discussed below are considered as mirrors of the ones we have seen in the section of the non-parametric (Perry, 2005, p.182). However, there are two differences between the parametric and non-parametric tests of differences in addition to the fact that parametric tests take into consideration the normality of the distribution. The two differences are (Perry, 2005, p.182):

- The types of the data analyzed (they based on different types of data)
- The use of means and standard deviation (they are not used in the non-parametric but used in the parametric tests)

The Parametric tests that are discussed by Perry (2005) include:

1. *The t-tests*: this test is the equivalent of both Mann-Whitney and Wilcoxon tests. It is used to compare the difference between two sets of statistics (measures) on one dependent variable (Perry, 2005, p.182). The t-test is used in the case of small-sized samples and when the population variance is not known (Kothari, 2004). There are three types: independent t-test, dependent t-test or One-Sample t-test.

   a. *Independent t-test*: deals with the difference between two means on one dependent variable obtained from two independent groups of participants (correspondent test of Mann Whitney) (Perry, 2005 & Kothari, 2004). In Gaur and Gaur's (2009) terms, it is run to compare between two populations through the use of a random sample from each population. This test aims at finding the difference between two different (independent) groups like comparing between the scores of males and females (here the participants of the groups are different and are dependent).

   b. *Dependent t-test* (also called paired t-test): it investigates the difference between the averages (means) of two sets of scores for the same group (related groups) of participants (Perry, 2005, pp. 183-184 & Kothari, 2004, Gaur& gaur, 2009). This applies only for small samples (Kothari, 2004).

   c. One Sample t-test: it is used to compare the mean of a single sample with the sample of the population. For example, a teacher wants to compare his first year group's scores with the scores of the whole population (first year in our case) (Gaur and Gaur, 2009)

2. *ANOVA*: refers to the Analysis of Variance which compares more than two sets of data (Perry, 2005, p.185). According to Jupp (2006), ANOVA refers to "A set of procedures that estimate and attribute variance in a data set to different sources and determine the probability, under the null hypothesis, of obtaining the differences between the variance estimates by chance" (p.3). This is widely used in different research fields like Economics, Business, Psychology, Sociology, and Education …etc (Kothari, 2004). It is the analysis of variance method that tests the difference between many means with different independent variables. According to Gaur and Gaur (2009), ANOVA compares more than two populations. Walliman (2011) claimed that analysis of variance tests assesses the difference between a number of sets of data obtained under two or more different conditions. The ANOVA tests enable us to run simultaneous analyses of different data sets and making inferences (Kothari, 2004). ANOVA is divided into different types:

A. One Way ANOVA: According to Perry (2005), this procedure works with ONE independent (which may have three or more levels) variable and ONE dependent variable. The research, via this test, tries to find out whether there is a difference between the means of the independent variables measured on the dependent variable. In terms of Kothari (2004), one-way ANOVA can be used to test the significant difference between different samples measured on one factor (variables). Perry (2005) provided an example: a researcher may want to test the difference at the level of reading proficiency between different groups of nationalities (say: French, English, Russian …etc). Here, the researcher calculates a value referred to by the "F ratio" in which it is statistically significant if the $p \leq .05$ or less (Perry, 2005, p. 185). If the researcher tries to use a t-test in such a case (to test the difference between each level with the dependent variable), this would lead to committing a type I error (Perry, 2005, p. 185).
B. Two ways ANOVA: According to Perry (2005), this procedure is used when testing the effect of TWO independent Variables (where each of the independent variables may have two or more levels) on ONE dependent variable at the same time. For example, the researcher may want to test whether there is a difference

between a number of participants whose nationalities and gender are different at the level of their reading proficiency. The first independent variable is the nationalities (can be French, Egyptian, Chinese, Russian …), the second independent variable gender (male and female) and finally, the dependent variable is the reading proficiency. Here the researcher is going to analyze the data through three steps: first: the main effect of the first independent viable; the second, the main effect of the second variable; finally, the interaction between the two independent variables. By the "main effect," the researcher means whether there is any difference between the levels of each of the individual variables. That is to say, performing a one-way ANOVA for each independent variable. The interaction means whether the dependent variable is varying differently at the different meeting points of the independent variables (Perry, 2005, pp. 186-187).

The author claims that there are other types of the ANOVA like three ways, four ways ANOVA, ANCOVA, MANOVA, MANVOVA that can be used in the Applied Linguistics field.

3. *Z-tests*: they are used to judge the significance of a variety of statistical measures (mainly the mean, but it is also used to compare medians, modes, coefficients of correlations, and other statistical measures). These means are compared with a hypothesized mean when the sample is large or when the population variance is known. This test is also used to test the significant difference between two independent groups' means when the sample is large or the population variance is known (Kothari, 2004, p. 196).
4. *Elaboration analysis*:it is a form of multivariate analysis that deals with more than two variables. The researcher here tests the effect of a third variable on the relationship between two variables. To do this, the researcher uses simple tables to compare the effects (Walliman, 2011).
5. *Multiple regressions*: it is also a type of multivariate analysis. It is used to measure the effects of two or more independent variables on ONE dependent variable. This type of analysis requires the dependent variable to be measure on the interval of the ratio scales. The technological aids (especially the SPSS) facilitate the mathematical calculations (Walliman, 2011).

6. *Logistic Regression*: this is a developed version of the multiple regression. It is used to assess the influence of dependent variables on dependent variables that are measured on nominal scales (dependent variables are nominal) (Walliman, 2011).

III.13. TESTING THE QUALITY OF THE DATA COLLECTED

The researcher should ensure that the collected data is having high characteristics. To do so, they should test the validity and the reliability of their data.

II.13.1. Validity

It refers to the ability of an instrument to test what it aims to test and to answer the research questions (Perry, 2005, P. 138). In addition, Kothari (2004) claimed that the validity of a research instrument relies on its ability to measure what it is meant to measure. There are different types of validity, but they are classified mainly into two categories:

- ***Internal Validity:*** This has to do with how much the extraneous variables are controlled. That is to say, it explains whether the change in the dependent variable is readily caused by the independent variable. In qualitative research, researchers use the term “credibility” instead of internal validity (Perry, 2005, p.91). From Walliman’s (2011, 104) point of view, internal validity has to do with the extent to which the study reflects the cause and effect relationship between the variables. This validity, according to the author, can be weakened by the use of inappropriate research tools that had not taken into consideration the effects that other factors may have on the main dependent variable.
- ***External Validity:***represents the degree to which the research results can be generalized to the population (Perry, 2005, p.91). This validity can be diluted or damaged by the use of a sample which not representative of the population, or through a poor description of the study that may make replication of the study impossible(Walliman, 2011, 104).

Consequently, in order to test the validity, Kothari (2004) explained the tests that can be used. Among these tests:

- ***Content Validity Test***: it refers to the extent to which the instrument covers the topic being studied. Content validity is good when the sample is representative of the population. In order to test content validity, the research gives the instrument to a panel of judgments to judge whether the instrument is adequate with the aim (Kothari, 2004).

- ***Criterion Related Validity***: this kind of validity is related to the extent to which a measure can expect or predict the outcome of another measure or "to estimate the existence of some current conditions" (Kothari, 2004, p.74). It has two types: predictive validity which refers to the ability of a given measurement to predict future performance; and concurrent validity which is the ability of a test (or instrument) to be related to another which is proved as being valid. To test predictive validity, the researchers correlate between the test scores (or the data of the instrument) with the scores of future performance (obtained from another instrument). For concurrent validity, a correlation coefficient is calculated for the scores of the instrument and other scores on the other instrument whose validity has been already proved (Kothari, 2004).
- ***Construct Validity***: In psychology, since there is no one definition of psychological constructs, researchers wish to make sure that their instruments test the meant construct; therefore, construct validity refers to whether the instrument measures the targeted construct or not (Westen &Rosenthal, 2003). Kothari (2004) claimed that construct validity is "the degree to which scores on a test can be accounted for by the explanatory constructs of sound theory" (p.74). In order to find construct validity, the "researchers generally establish the construct validity of a measure by correlating it with several other measures and arguing from the pattern of correlations that the measure is associated with these variables in theoretically predictable ways" (Westen &Rosenthal, 2003, p.608). That is to say, testing construct validity bases on correlating the instrument with another instrument which test the same construct, and if there is a correlation between these instruments, that means there is some construct validity.

II.13.2. Reliability

The researchers tend to use different methods and with different participants. The researchers aim at reaching results that are consistent and reliable. Therefore, any researcher needs to check the reliability of their study and results. For this reason, researchers have created different methods to checking reliability (Perry, 2005, p.130). Therefore, reliability refers to the accuracy and the precision of the results being collected through a given research procedure (Kothari, 2004). Among these, we can find the correlation Coefficient which is the most common for testing the reliability of the data collected via observational and instrumental procedures. A correlation coefficient measures the degree to which two variables are related. Once it is used to check reliability, it is called the reliability coefficient. The value of the reliability coefficient ranges from 0 to +1 a coefficient. If the coefficient is 0, then there is NO reliability and the more it comes closer to +1, the reliability becomes stronger. Therefore, a coefficient of +1 represents a perfect correlation (Perry, 2005, p.130). There are different ways to check reliability, Perry (2005, p.131) explained these ways that we can summarize in the followings:

- The Inter-rater/observer Reliability measures the consistency over different raters or observers. The measurement procedures used are the observation of the performance (either oral or written). The statistical procedures that are used are the correlation or the percentage of agreement.
- Intra-raters/observers Reliability: the measurement investigates the consistency over the different times of the same rater. The measurement procedure includes also the above method: observation of oral or written performance. The statistical procedure to test the reliability also used the correlation or the percentage of the agreement.
- Test-Retest Reliability that checks reliability when there are different times of testing. The measurement procedures that are used are standardized tests and inventories. The statistical procedure that is used to check this reliability is the correlation.
- Alternate form Reliability: this focuses on checking the consistency over the different test items through different times of testing. This makes use of one instrument with different forms and then the researchers check the reliability through the use of a correlation procedure.
- Split half/ Kuder Richardson 20 & 21 and Cronbach Alpha Reliability deals with checking the internal consistency of items within a test. This deals with the data obtained from instruments using discrete items and Likert-type items (numerical discrete and ordinal data). The statistical procedures used to check the reliability are correlation, Spearman-Brown, Alpha, KR20, and KR21.

Moreover, Perry (2005) listed some factors that affect reliability. These factors include:

- The extent to which the research instrument is affected to subjectivity;

- The length of the test especially when it is short (an instrument with few items) that produces automatically low reliability.
- The ambiguity in the items of the procedure that are written in poor language may affect the reliability that leads to inconsistent responses and thus low or no reliability.

II.14. FURTHER READING IN STATISTICS

The understanding of the different statistical terms, concepts, and test relies on the understanding of some peculiar information. We suggest here some of the important concepts that play a crucial role in the understanding and the employment of statistics:

II.14.1. Shape of the Data Distributions

The elaboration of the shape of the distribution is important in enabling the researcher to choose the right estimates and the appropriate inferential procedures. The distribution of data is a “graphical display of how many (frequency) participants/ objects obtained certain measures beginning from the lowest measure to the highest” (Perry, 2005, p.210). Some things always discussed when talking about distributions. Each one has to do with how they are compliant to the normal distribution:

1. **Symmetricality**: the normal distribution is considered as a reference to comparing shapes of data. The normal distribution happens when the three main measures of tendency (namely: the mean, the mode, and median) have the same value and that produces a symmetrical curve (Walliman, 2011, p.117). According to Dörnyei (2007), normal distribution happens mainly when the sample is large and the sample characteristics approach the population parameters. The author explained that distribution is said to be normal when few individuals of the sample score higher and few other scores lower and the wide number of individuals are dispersed around the middle or average. This results (graphically) in what is called a bell-shaped curve.
2. **Skewness:** happens when the mean is located in one of the two sides of the median (either left or right); as termed by Walliman (2011, p.118): “Skewness occurs when the mean is pushed to one side of the median ... If there are two modes to each side of the mean and median points, then it is a bimodal distribution. The curve will have two peaks and a valley between”.

II.14.2. Graphical Presentations

***1.1. Graphical representations of measure of variability*:**

- *Bar graphs*: they are used to present nominal and ordinal data. There two axes: horizontal and vertical. On the horizontal axis (X-axis), we put the variables and on the vertical (Y-axis) we present the values. One feature of this type of graphs is that the bars do not touch each other (Walliman, 2011, p.118).
- *The Pie Chart:* this presents the variables in sections and provides information about them using –usually- percentages (Walliman, 2011, p.118).
- *Standard Deviation Error Bar*: this is represented by a point and two bars. The point represents the mean and the two bars (one above the mean and one below) indicate the extent of one standard deviation (Walliman, 2011, p.118).

1.2. Graphical presentations of relationships:

1. *Scattergrams*: it is used to show the relationship between two variables. It employs a two-dimensional matrix where the data from the variables are plotted. If the plotted points (representing the data) appear in a random dispersion, this means that there is NO relationship between the two variables. If the plot points are presented in a linear line (arrangement), it means that there is a relationship between the variables. When the points are combined closely around a perfect line refers to a strong relationship and when they are dispersed far from the line, it means a weak relationship (Walliman, 2011, 122).
2. *Cross tabulation*: or it is also called a contingency table. This graphical presentation is used with variables that have few categories and thus used to determine a relationship between these categories. This tabulation report both frequency and the percentages of responses and the total numbers. Then the data can be converted into a bar chart (Walliman, 2011, p.122). According to Kothari (2004), this is used to classify nominal data into two or more sub-classes and then cross-classify them and then observe the kind of interactions between each class with the others. Types of interactions according to the author can be: symmetrical in which two variables vary together but not because of cause and effect relation (one is due to another). The second is reciprocal in which the two variables reciprocally reinforce or influence each other. Finally, asymmetrical interactions in which the independent variable is responsible for the other.

CONCLUSION

This chapter reviewed the different concepts related to statistics and statistics educations. The role of statistics in research is indispensable as it bases on providing scientific explanations and concrete evidences to the choices made in research. Therefore, it is highly required to be introduced to the field of education because educational research bases immensely on quantitative data.

This chapter highlighted the importance of developing students' statistical literacy, thinking, and reasoning which are major concerns in statistics education, regarding the different benefits that these students might earn, not only during class time but also in real life. In order to achieve the three levels above, the chapter went through the different types of statistics that should be targeted, the variety of techniques and strategies that might be employed to ensure the good reception of statistical knowledge, and the success of statistics education. Besides, the chapter emphasized the roles that both teachers and learners might play to reduce the challenges of teaching and learning statistics. Finally, this chapter showed the relationship between statistics educations and the new technologies.

CHAPTER III: DECISION MAKING SKILL

INTRODUCTION

Decision-making is one of the pillar skills of human life. People meet a variety of intersections in their lives where they need to decide which road to take. The nature of the coming step of people's life is defined by the choice they make at the intersection point. Consequently, decision-making is one of the most important but the most stressful and complex human behaviors, because it needs higher thinking qualities to reach reliable and desired results. In this chapter, we try to provide a conceptual overview of decision-making in all human life aspects and mainly in psychology and cognitive sciences. Different theories that explain the decision-making process and the strategies, as well as the different styles employed when making research are going to be presented in this chapter.

III.1. BASIC DEFINITIONS OF DECISION MAKING

Franklin D Roosevelt once said: "There is a time when we must firmly choose the course we will follow, or the relentless drift of events will make the decision" (cited in Adair, 2010, p.17). Life is experienced as a "series of choices" which involves different choices and various options that human being need to decide which option to take and which one to let go (Hargreaves et al., 1992: cited in Greenbank, 2010). The word decision originates from Latin and it means "to cut-off" (Adair, 2010 p.28). Decision-making is, then, the process of choosing among these alternatives the appropriate option. According to Raiff (1968), Von Winterfeldt & Edwards (1986) decision making is the process of choosing "among competing courses of actions" (cited in Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989). The same idea is expressed by Chandrasekhar Pammi & Srinivasan (2013) who claim that Decision making is "the process of choosing an action or a prospect out of several alternatives" (p. xi). The choices according to the authors can be for individual purposes or to solve social situations. Moreover, Byrnes (1998) defined decision-making competence as "this ability to discriminate among poor, acceptable, and very good choices" (cited in Byrnes, 2005, p.11-12). Todd and Wilke (2012) defined decision making as a process of "using information to guide behavior among multiple possible courses of action" (p. 3)

Venkatraman (2013, p.268) explained that the development of the research in the field of decision making had passed by four main phases. They are:

- The first phase started in the early 1950s. The interest in decision-making was from the mathematical point of view. Researchers made use of mathematical modeling to explain "the human judgment and decision preferences" (Hammond, 1955, cited in Venkatraman, 2013, p.268).
- The second phase dates back to Simon (1955) and started accelerating in the mid of 1970s. This phase bases on cognitive science and employs the Information Processing Approach to explain the decision and the decision-making process (cited in Venkatraman, 2013, p.268).
- The third phase starts from the 1990s and emphasized the effect of emotions and affect in the decision-making process and behavior (cited in Venkatraman, 2013, p.268).
- Finally, the last phase is the more recent. It deals with the employment of neuroscience tools to understand and explain the "individual and variability in decision making". The produced field is called neuroeconomics or decision neuroscience (cited in Venkatraman, 2013, p.268)

Therefore, attempts to define human decision-making have been made by different theories from different fields. The main theories of decision making have been taken from the fields of Economics and Psychology. These two fields support contradictory principles of decision-making skills. In Economics, decision-making is a rational process and the decision-maker is a "utility maximizer" wherein in Psychology the process is irrational and humans are not utility maximizers (Gonzalez, 2013, p.74). Later on, due to the conflicts between the economic theories and psychological ones, Neuroeconomics or Decision Neuroscience has shown interest in explaining the decision-making process basing on empirical research. This field is "an emerging interdisciplinary topic that employs neuroscience techniques to explain the parameters associated with decision-making behavior" (Miyapuram & Chandrasekhar Pammi, 2013, p. 240). According to Vartanian and Mandel (2012), the neuroscientific domain tries to explain how the different brain structures help in the occurrence of psychological behaviors; conversely, researchers in cognitive and social neuroscience are more interested in the different processes and mechanism that participate in the behavior under study than in the brain structures involved in its occurrence.

The cognitive theories claim that "decision" can be defined as "the cognitive process that precedes the choice" and "decision making" which is an integral part of the human behavior represents the phenomenon of making the choice (Miyapuram & Chandrasekhar Pammi, 2013, p. 241).

Furthermore, the Psychological perspective of decision making bases on the Behaviorists' notions of "reward and punishment". They claim that human being's decision-making as any other behavior can be reinforced by rewards. The rewards in the decision-making process are called goals. Therefore, the decision-making process in this context is defined by the authors as the process "consists in choosing the appropriate series of actions leading to the desired goal", thus; it is a "goal-oriented-behavior" (Miyapuram & Chandrasekhar Pammi, 2013, p.242).

In addition, the notion of decision-making in psychology is usually associated with the concept of "problem-solving" (Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989). Nonetheless, both concepts are different from each other. Adair (2010) distinguished between the three types of "practical thinking" or the "applied thinking" that include: decision making, problem-solving, and creative thinking. The Author defines problem-solving as the process that aims at finding a solution to an existing problem or finding out an answer or a conclusion where decision making involves the process of choosing "what action to take; it usually involves choice between options" (p.1). Besides this, Newell and Simon (1972) explained the difference by stating that the concept of "problem" is a task whose solution is not clear to people, therefore; the notion of "problem-solving" is the process of searching and investigating the solution that makes the desired change in the situations. Consequently, at the end of the process, the researcher will be able to say whether the solution is effective or not. Similarly, the decision-making process also deals with finding out the effective solution, yet; since the decision-makers face many goals and objectives, they tend to choose among a set of alternative solutions, the one that leads to best performances and reach the objective(s) set at the beginning (cited in Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989). Yates (2003) endorsed the above distinctions and claims that decision is: "a commitment to a course of action that is intended to serve the interests and values of particular people" (p.24, cited in Yates & Angott, 2012 p. 263). Conversely, the problem, according to Glass & Holyoak (1986, p. 385), is: "a circumstance in which a person wants something that is not immediately attainable" (cited in Yates & Angott, 2012, p. 263). Therefore, Yates & Angott (2012) stressed the fact that decision making is the process in which the decision-maker is in front of a problem whose solution requires taking actions to reach a conclusion or results that are specifically good or satisfying certain people rather than others. On the other hand, problem-solving is a process that leads to finding out a solution to a problem where the solution will be universally considered correct (p.263). Another concept that is usually confounded with "decision" is the word "judgment". This later is defined by Yates and Chen (2009, p. 645) as "an opinion as to what was, is, or will be some decision-significant state of the world" (as cited in Yates & Angott, 2012, p. 263); that is to say decisions rely on the past, present and future judgments about the decision situation, options … etc.

In some situations, decision-makers may face situations where they cannot predict what consequences may follow the alternatives, therefore; they tend to make decisions under the condition of uncertainty (cited in Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989). Priest & Dixon (p.28) use the words "judgment" and "decision making" interchangeably. The authors define judgment as a "series of procedures undertaken by the human brain in an effort to fill in for information that is uncertain, nonetheless important to the problem-solving process" (cited in Guthrie, 1996). Miles (1987) defined judgment as "the making of a decision when face with a potentially hazardous or risky situation (p. 503, cited in Guthrie, 1996). According to the author, sound decision-making and judgment bases on good knowledge, experience, and practice. These three conditions help the decision-maker to foster good habits of thinking and a good ability to foresee, estimate and recognize the limitations and errors in judgments.

Contrary to the psychological and neuroeconomics which base on the outcome and the goal values; economical models are based on how a decision-maker can choose the best outcome value. But since the outcome of any decision is only known after the decision is implemented, researchers in the economical domain investigate the importance of "prediction" in the decision-making process. Nonetheless, the outcome in decision-making can not be always predicted or estimated because the environment is not stable and the conditions always change. Therefore, the decision-making outcomes may be classified under uncertainty and the choice will be under risky conditions (Miyapuram & Chandrasekhar Pammi, 2013, p.247-248). In short, from the economical point of view, decision-making is not only about the goal and the outcome, but it deals with the process and the behavior of making this choice in order to achieve the desired goal. The economists focused on clarifying making decisions under risk and uncertainty (Miyapuram & Chandrasekhar Pammi, 2013, p.249).

In this concern, Miyapuram and Chandrasekhar Pammi (2013) made a distinction between risky decisions and ambiguous decisions. The former is made when the outcome is known whereas the latter is made when the outcome is unknown (p.248).

When Placek and Pearson (1998) explained the strategies to develop decision making, they explained that the word “DECIDE” itself defines the process of making decisions. They claimed that each letter stands for a decision-making step: D: define the problem, E: explore the alternative, C: consider the consequences, I: identify your values, D: decide and act and finally, E: evaluate the result. The values according to Clemen and Gregory (1995) represent the goals that are targeted. Thus, the importance of decision making according to the authors relies on constructing experience for future situations. The decision-making process relies on listening to different alternatives and each alternative may produce different outcomes. Therefore, the decision-maker forms a list of good and bad outcomes that could be used in the future.

To summarize, whatever the domain, the decision making enables people to advance in their lives through choosing one or a series of things that leads them to reach their goals or at least to approach them. Decisions that rely on logical processing of the knowledge and the employment of previous practical experiences are usually the decisions that are considered as being sound and that lead to satisfying goals.

III.2. IMPORTANCE OF DECISION MAKING SKILL

According to Clemen and Gregory (1995), decision-making is very important because, in life, we tend to be in front of a lot of alternatives that may cause either positive or negative effects. The positive or negative (or as termed by the author, the good consequences and bad consequences) are governed by the values which represent “the many objectives that the decision-maker wants to accomplish” (p.02). That is to say, the existence of many alternatives may block up the way towards reaching these values, this is why decision making and the choice of the appropriate alternative is very important.

III.3. TYPES OF DECISIONS

Clemen and Gregory (1995, pp13-14) classified decisions into different types; these types include the following:

1. *Riskless versus risky Decisions*: this type of decision bases on two types of alternatives. Either the alternatives are risky in which the outcome of applying it is not safe or not risky which means that the result is safe.

2. *Information-gathering decisions*: the decision-makers make decisions based on the available information. They first identify the sources of the information, then they judge its usefulness, and finally, they decide whether they take the information or not.
3. *Tradeoffs:* the situation that needs a decision is defined by different but conflicting goals. In this case, the decision-maker should weigh these objectives and narrow them down to the most important and then analyze the available alternatives to decide which alternative can lead to the important objective(s).
4. *One-time versus repeated decisions*: these two types of decisions are based on their repetition through time. Some decisions in life are faced only once, whereas some others are repeatedly faced.
5. *Sequential decisions:* some situations require making decisions in a sequence where each decision affects the one coming after.
6. *Individual versus group decisions*: some situations require the individual to decide whereas others require the group to make the decision.

This classification made by Clemen and Gregory (1995) is based mainly on the special characteristics of each decision. Moreover, these types are interrelated wherein one situation, we can meet different types.

III.4. FACTORS AFFECTING DECISION MAKING

Placek and Pearson (1998) claimed that decision-making is very important and any inappropriate decision can affect the present and future of the students. Therefore, it is extremely important to think of the different aspects that may impact these decisions. Accordingly, Greenbank (2010) claimed that many factors affect the decision making. These factors include:

- ***The Individual's Personality***: this involves some personality features like sociability, confidence, maturity, and attitudes to risks. These factors, according to the author, may affect the way people make decisions.
- ***Reflection***: Margaret Asher (2007, cited in Greenbank, 2010) distinguishes between four types of reflections (including internal conversations which are the conversations made with themselves). The four models of reflection include: First, the communicative reflexives: here people's internal conversations need approval from others before taking action. Second, the autonomous reflexives where the person is self-contained. Third, meta-reflexives: here the person criticizes his own internal

conversations and the effectiveness of the actions. Last, fractured reflexives where the internal conversations increase the distress of the person which disorient him or from the goal that is set.

- ***Age, gender and social class***: these factors as stated by Greenbank (2010) correlated with the four types of reflexes stated above. Concerning age, Peters & Bruine de Bruin (2012) claim that old adults make better decisions because of three reasons: first, the adults tend to make use of deliberate and conscious processes which are analytical and logical (see chapter 3: dual processing model, p. 127). Second, they gathered much of experience; and finally, there is an increase in the effective focus among old adult and a decline in the cognitive counteracting (Peters & Bruine de Bruin, 2012. p.132)
- ***The social context of the decision makers***: the people's decisions are highly influenced by the others with whom they interact.
- ***The person's cognitive style***: as Scott and Bruce (1995) claimed, the "data sensitivity" and "logic" in people may be very influential in decision making because these two features push the person to use detailed information and to analyze reasonably the options contrary to "data filterers" who tend to make intuitive decisions (Greenbank, 2010). In addition to the above-mentioned factors, Helms (1983) classified additional factors that affect the decision-making skill under the acceptable risk. These factors are collected from different studies in different life sectors, including psychology, cognitive, economic, and social situations…etc. They include: Age, self-confidence, experience, ignorance and inexperience, invulnerability, low self-concept, risk-taking as a cultural value, group behavior, hazard folklore, fashion, time and exposure to risk, better equipment and safety (secure techniques), societal pressure, and advertisement, the need for challenge and success and finally, personality traits (cited in Guthrie, 1997).

Furthermore, Meeks and Heit (1987) provided more factors that mainly affect teenagers and adolescents (cited in Placek & Pearson, 1998). Among these factors, they mentioned:

- The lack of sufficient knowledge lead to their wellness
- External influence of peers and society because social life is very important to young people.
- Self-esteem (Pruitt, Crumpler & Prothrow-Stith, 1994 p. 34 cited in Placek & Pearson, 1998),

- The content that is being transmitted via media tools (like magazines, movies, music …etc).
- The leisure activities (as the authors claim, the empty time may affect negatively their thinking as well as their decisions).
- The lack of maturity and experience

Moreover, Placek and Pearson (1998) talked about the importance of thinking skills in the decision-making process. According to the authors, poor thinkers tend to consider few alternatives when they tend to make decisions and this leads them to commit decision errors. Therefore, they claim that students should be taught to develop their thinking skills. More specifically, Woodman (1997) -in his study- claimed that weak critical thinking skills affect the problem solving and decision making of elementary school students. The author emphasizes teaching decision-making to the students to prepare them for better future life, careers, and other future responsibilities.

Bandyopadhyay, Chandrasekhar Pammi, and Srinivasan (2013) investigated the effect of the affective side on problem-solving and decision-making skills. The Authors (2013, p. 39) classified the emotions into two categories:

- ***The influence of relevant emotions***: they are also called “predicted emotion”. They are the emotions that raise from the decision-making task itself. The person constructs these feeling during the time of making the decision or when facing its consequences (like regret and disappointment).
- ***The influence of irrelevant emotions:*** they are also called “incidental emotions”. These feelings come from other sources rather than the decision-making tasks. They can come from the surrounding and the environment (like the good smell when someone decides to buy a perfume, it can be the person’s mood …etc).

The neuroscientific empirical findings have revealed the impact that some factors on the decision-making process. The most important factors are emotions, the decision makers’ view of the outcome: be it losses or gain prospect or the gains only prospect (that is to say the decision makers’ belief of the outcome of the decision). Moreover, other factors include the type of the task (be it a decision or anticipation), the application (see that any error in the application may cause systematic bias in the decision), and finally proved the impact of the belief bias on decisions (cited in Vartanian & Mandel, 2012, pp. 46-47).

In addition, Miyapuram and Chandrasekhar Pammi (2013) talked about the influence of the top-down factors and more specifically what Tversky and Kahneman (1981, cited in Miyapuram & Chandrasekhar Pammi (2013) called "framing effect" on the decision making. That is to say, a decision-maker should frame well the problematic situation in terms of losses and gains in order to avoid decision bias. Predicting the same gains and losses to similar problems may lead to regret. In short, the decision should be based on "counterfactual comparison" to determine whether the chosen alternative will "have greater/lesser value depending on whether the alternative outcome would have been smaller/larger" as termed in (Mellers et al., 1997, cited in Miyapuram & Chandrasekhar Pammi (2013, p.249).

Additionally, the person's everyday decision making is also affected by the surrounding and more specifically, the people around him/ her like parents, children, friends, colleagues at work and supervisors …etc; through time, this person forms a habit that lead always to the same choice although there might be a choice that can lead to better results in the list of alternatives (Clemen & Gregory, 1995).

III.5. DECISION MAKING STRATEGIES

According to Milkerman, Chugh, and Bazerman (2009), the understanding of the decision-making process requires the comprehension of two basic cognitive systems that explain how and on which basis does a person makes a decision. The two systems are described first by Stanovich and West (2000 as cited in Milkerman, Chugh and Bazerman, 2008):

- *System 1*: This system is also called the intuition system. It is characterized by being "fast, automatic, effortless, implicit and emotional" (Milkerman, Chugh and Bazerman, 2008, p.4).
- *System 2*: This system bases on reasoning. It is characterized by being "Slower, conscious, effortful, explicit and logical" (Milkerman, Chugh and Bazerman, 2008, p.4).

Basing decisions on the first system leads the person to make "costly errors", therefore; a person needs some strategies to reduce these errors. Some applicable strategies recommend the person to move from system one to system two way of thinking. However, the choice of the strategy demands analyzing some basic factors, as mentioned by Massialas (1996), like the time needed to the decision, the complexity of the decision and the level of the uncertainty and ambiguity involved in the decision. The strategies, according to Milkerman, Chugh and Bazerman (2008), are:

- *Replacing intuition with formal analytical processes*: Instead of basing on emotions and intuitions, the decision-maker collects quantitative data from the previous decision making processes in order to forecast and estimate the outcome of a given decision.
- *Taking an outsiders' perspective:* the outsiders' standpoints help the decision-makers, and it has three main advantages: 1) to think objectively towards their decision process. 2) Besides, the others' opinions help to reduce the decision makers' "overconfidence of the own knowledge" as termed by Gizerenzer, Hoffrage, and Kleinbölting (1991, cited in Milkerman, Chugh and Bazerman, 2009). Finally, 3) the others' outlooks help in de-biasing the decisions because it is proved that group decision making is more accurate than the individuals' decisions.
- *Consider the opposite of the decision:* this will help also in reducing the biases of the decision-makers at the level of overconfidence, anchoring, and the hindsight (Larrick, 2004; Musweiler, Strack & Pfeiffer, 2000; cited in Milkerman, Chugh and Bazerman, 2009).
- *Making use of analogical reasoning:*the authors claim that this strategy deals with the "understanding of common principles underlying a set of seemingly unrelated tasks subsequently demonstrated an improved ability to discover solutions in a different task that relied on the same underlying principle" (Thompson et al., 2000; cited in Milkerman, Chugh and Bazerman, 2009). That is to say this strategy bases on comparing disparate tasks which base on the same rationales in order to help to create new solutions to the basic problem through studying deep details of each task and extract new alternatives and study the best choice.
- *Work in joint versus separate decision making:*this strategy is used when the decision-maker is in from of different choices or various options. Instead of analyzing each choice separately, this person can work and analyze all the options simultaneously. This, according to the authors, helps emotional decision making because as they claim "the first impulse tend to be more emotional than logical" (Moore & Loewenstein, 2004 as cited in Milkerman, Chugh and Bazerman, 2009).
- *Leverage of the person's automatics cognitive processes:* at the level of the strategy, the authors focus on the importance of empowering the person's system one of

decision making instead of replacing system 1 by system 2. The change, therefore, should be in the environment through the person's hard-working. (Milkerman, Chugh and Bazerman, 2009).

Moreover, Bandyopadhyay, Chandrasekhar Pammi, and Srinivasan (2013, p.40) mentioned two other types of decision-making that are widely affected by affective factors. These strategies are:

- ***Compensatory strategies:*** the decision-maker tends to incorporate different information from various aspects in order to make decisions. That means that some elements from one aspect can help to get over the shortcoming of another aspect (Bandyopadhyay, Chandrasekhar Pammi, and Srinivasan, 2013, p.40). According to Peters and Bruine de Bruin (2012, p.153), these strategies are called compensatory because one information cue to pay damages of other cues.
- ***Non-compensatory strategies:*** the decision-maker gets rid of compensations and sticks to classifying and ordering the options. Peters and Bruine de Bruin (2012, p.153) named these strategies as "information frugal non-compensatory strategies" where the decision-maker bases on one information cue (which s/he sees as the most important) and ignores the other pieces of information.

The decision-maker alternates between these two types of strategies when facing difficult decisions that are highly affected by emotions (Luce et al., 1997; cited in Bandyopadhyay, Chandrasekhar Pammi, and Srinivasan (2013, p.40).

III.6. APPROACHES TO STRATEGY SELECTION

Given the importance of the strategies in the decision-making process, it is highly required to know how does decision-maker retrieves the decision-making strategies in different situations. On this concern, Peters and Bruine de Bruin (2012) mentioned two main approaches:

III.6.1. The Cost-Benefit Approach (CBA):

This approach bases on calculating the probability of the consequences of the different strategies and to which extent does each strategy help the decision-maker achieve a correct solution or beneficial outcome in addition to the costs that will be caused by the use of a given strategy (Mata & Rieskamp, 2012). According to the authors, this approach claims that strategy selection is affected by two factors: first, the decision situations impose conditions that lead the decision-maker to automatically choose another strategy instead of the needed one; for example: when there is no time to employ an “information-intensive strategy” where the decision-maker should look to a lot of information and lot of evidence, s/he selects “simple strategy” that limits time as it is dictated by the current situation (cited in Mata & Rieskamp, 2012). The second factor that affects the strategy selection is the person’s cognitive abilities. The authors claim that a person with low cognitive capacity tends to choose strategies that are not complex or that do not require high cognitive abilities.

However, this strategy is criticized by Busemeyer (1993) for not being clear in explaining the process of the selection of the strategies especially at the computational level (cited in Mata & Rieskamp, 2012).

III.6.2. The strategy Selection Learning (SSL):

This approach bases on the cognitive strategy and individual differences of the decision-makers instead of the choice option. Most importantly, it focuses on the role that experience plays in updating the decision makers’ strategy selection. The advocates of this theory claim that the decision outcome is considered as a reinforcement that changes the strategy evaluation; that is to say, when the decision-maker employs a given strategy that leads to a good outcome, this outcome will be considered as reinforcement to re-select it again in the future. Moreover, when learning how to select the strategies, feedback is very important in refining and updating the expectancy and the initial preferences of a given strategy (Mata and Rieskamp, 2012).

III.7. APPROACHES TO DECISION MAKING

Decisions are made through some approaches. Massialas (1996) provided some models that a person follows in order to make a given decision:

III.7.1. The single feature model

This is the simplest approach where the decision-maker focuses on one characteristic and ignores the other features. This approach is mainly used for the simplest decisions and it is certainly not efficient for complex decisions (Massialas, 1996).

III.7.2. Additive feature model:

This approach suggests the decision-makers collect all the options and the characteristics; then they study and analyze them thoroughly. In the end, they make their decision based on the conclusion of their analysis. However, this kind of approaches is time-consuming and is not efficient for the decisions that need to be made in a short time or haste (Massialas, 1996).

III.7.3. Eliminating by aspects model:

According to Tversky (1972) -who is the first to introduce this model-, the decision is made through choosing the criteria and the options (items) at a time. After that, when one option does not meet the criteria set at the beginning, the decision-makers should cross it off. In the end, there will be a list of the items that are crossed off and arrive at the item that fits the feature you set at the beginning of the process.

III.8. COGNITION AND DECISION MAKING

III.8.1. Values and consequences and decision making heuristics

Mettas (20011) provided six steps to decision making including: Defining the problem, identifying the criteria, weighing the criteria, generating alternatives, rating each alternative and each criterion, and finally computing the optimal decision. The researcher suggests that the above decision-making process is well performed through the optimization strategies. The latter includes for example:

1. Making a distinction between "Values" and "Facts": Clemen and Gregory (1995) claimed that: "values (what we want, what we are trying to accomplish, what gives us satisfaction) and facts (what we know about what might happen)" (p.8). Therefore, the decision-maker should be aware of the kind of information s/he has and be sure about the goal s/he wants to achieve.
2. Organizing the elements into the decision tree may facilitate categorization and visualizing the decision elements. The decision tree is important to give insights and understanding of the situation but does not give an answer

Goals are very important in any decision-making process. Wilke and Todd (2012) distinguished between two types of adaptive goals:

1. *The single ultimate goal*: this goal is related to keeping the offspring of human beings. In this case surviving is considered as a way to keep reproducing the human being.
2. *The proximal goals*: are specifically related to keeping the person surviving. This category includes many goals including the search for food and avoiding being the prey of others …etc. In order to achieve these proximal goals, there should be what (Gigerenzer, 2000 as cited in Wilke & Todd, 2012) called "the mind's adaptive toolbox" which includes the decision mechanisms. These mechanisms are what are called heuristics.

III.8.2. Decision making and the minds adaptive toolbox

The mind comprises "built-in" mechanisms that lead people to act toward his/her environment. Some other mechanisms are "learned" through life experiences or people in the surrounding. Both the built-in and the learned mechanism construct what Wilke and Todd (2012) called "Heuristics". They define this concept as a group of rules that help in the process of decision-making. Moreover, these heuristics may be as termed by Gigerenzer, Todd, and the ABC Research Group (1999): "decision-making shortcuts to adaptive behavior that rely on little information and little cognitive processing" (cited in Wilke & Todd, 2012, p. 5). That is to say, heuristics are kind of rules formed by the cognitive processing of information that helps in guiding the decision-maker to take the appropriate behavior. The heuristics comprise building blocks that rely on the decision makers' "evolved capacities" that are developed through the interaction with the surrounding and the environment (p.5). In the following sections, we introduce each element of the mind toolbox as it is cited by Wilke and Todd (2012):

1. *Capacities*: when making decisions, the person relies on capacities like perception: tracking moving objects, orienting to sounds), search: such as discovering the different sources, and learning: include the ability to learn from the first trial, to learn from others, and imitate them …etc. Moreover, another capacity is the memory that includes the ability to recall names or recognize people and to forget the information that is not necessary. Furthermore, the capacity mechanism includes social intelligence and interpersonal intelligence like cooperation and interaction …etc (Wilke & Todd, 2012, p.5).

2. *The building blocks*: these are formed by the decision-making capacities and form the decision heuristics. For example, some building blocks evolve from the search capacities like what Wilke and Todd call "the search for recognition knowledge" (p.6). This latter evolves from the search capacity and is forming at the same time the "recognition heuristics". According to the author, the functioning of these toolbox mechanisms depends on the decision situation and more specifically the decision environment. In addition to the search for recognition knowledge, the "stop-search building block" is used to end the information and the alternative search process when it should be stopped. Mainly the search process is ceased when there is no information or they reach recognized information. Sometimes the decision is made when the toolbox mechanism meets the first information cue or the reason to choose given information or option. A third example of the building blocks is the one which is called to make inference or choice basing on the results of the search (p.7).
3. *Heuristics*: the heuristics process of the information that is available from or retrieved from the environment with the help of the building blocks and the evolved capacities and at the end produce a goal-oriented behavior. The authors provide some examples of these heuristics like the recognition heuristics which bases on the recognized information and make use of the search building blocks, the simple quick heuristics ((Wilke & Todd, 2012, p.6). What differentiate the heuristics from the building block or the capacities mechanisms is that heuristics are functioning directly with the environment to produce adaptive behaviors (Wilke & Todd, 2012).

In addition to the above mentioned heuristics, Massialas (1996) suggested two cognitive rules that are mainly used when making decisions under uncertainty:

1. *The Availability Heuristic*: the decision-makers focus on retrieving similar past events and then predict the output according to these events. For example, when a person is in front of two alternatives, s/he may think of the outcome of other people concerning these two options and predict which one is more successful. Through this strategy, the person emphasizes the available information about past events and the success of this strategy is related to how much information does he or she knows about past events (Massialas, 1996).
2. *The Representativeness Heuristic*: it is a shortcut where the decision-makers compare their current situation with their self-image or as the author names it "self-representation" or the "one's prototype" as it is represented in their minds. The author

provided the example of a student who is late and has to go at all speed to arrive at the time of the quiz. There were two options: either to go by car using high speed and be at the risk of receiving the speedy ticket by the police or running late to the test. The student can choose to use speed at the risk of receiving the ticket because he knows that he is not like a teenager who is conducting a "sports car" therefore, he could save himself from getting the ticket through careful driving. Thus, the success of this strategy is related to how well a person knows him/herself (Massialas, 1996).

In addition to the above one, other heuristics are projected in Wilke and Todd (2012). They claim that decision-making is widely influenced by the amount of information and cues that the decision-maker has about a given situation, option, or other elements of the decision. The two heuristics include:

3. *The recognition heuristics:* According to Goldstein and Gigerenzer (1999; 2002), when meeting recognized and unrecognized options, the decision-makers tend to pick up the recognized one *(*cited in Wilke and Todd, 2012, p.4).
4. *The social learning heuristic:* The decision-makers tend to choose a given option because people around them usually choose that one. It is explained by Boyd and Richerson (1985) that they tend to imitate people (cited in Wilke and Todd, 2012, p.4).

Therefore, the human mind is equipped with some abilities that play a crucial role in the decision-making process. With a well understanding of these heuristics, it is possible to understand how and why a person chooses one option over the other and what goals they aim at.

III.9. IMPORTANCE OF KNOWLEDGE AND INFORMATION IN DECISION MAKING PROCESS

According to Clemen and Gregory (1995), uncertainty in decision making is the situation that requires a decision yet the outcome is not known (p.21). The authors claim that: "Uncertainty is best viewed as a state of knowledge" (p.21); therefore, decision-makers are uncertain when they do not know for sure. From this definition, we can notice the importance of knowledge in reducing the risk of uncertainty in the decision-making process. In this concern, the authors argue that the process of learning aims at reducing the level of certainty among the students, they say: "learning can be taught of as acquiring information to reduce uncertainty" (p. 21). Therefore, raising the people's knowledge reduces the possibility of facing uncertain situations.

People get annoyed when deciding under uncertainty. However, uncertain situations have some advantages. Among these, Clemen and Gregory (1995) mentioned:

- Push people to think twice about the alternatives and the consequences and weigh each carefully before making the decisions.
- Moreover, uncertainty is important because it helps to collect information needed to make the decision.
- In addition, when usually facing a certain situation, the person tends to use "heuristics" which are the rules used to judge situations. Among these rules, the authors have mentioned "availability" which helps the person to recall easily what is available in the memory. However, this rule leads to biased decisions. Therefore, uncertain situations eliminate this effect and help in avoiding this bias.

These advantages stimulate the decision-maker to search for more information in order to produce accurate and sound decisions. According to Wilke and Todd (2012), the information sources are varied, they can be biological, physical, social, and cultural. Most importantly, information comes from others such as friends, social contacts, and so on. Environmental knowledge can highly influence the decision-maker especially when it is cultural (like the age of marriage in certain societies).

III.10. DECISION MAKING LEARNING AND TRAINING PROCESSES

In psychology, training people who have decision-making skill weaknesses aims at instructing them the "debiasing techniques". This means to help them detect the errors in their decisions through the use of these techniques Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989). In education and instructional psychology, the stress is on the cognitive competence where the accent is on how children think rather than what they know. This is mainly because there is a need to detect the "deficiencies that might be corrected through instruction" (cited in Beyth-Marom et al., 1989).

Decision-making and mental competence had been thought to be non-teachable, rather, they are developing through the "biological maturation, social interaction and conventional learning" (Beyth-Marom et al., 1989). Later on, the research and evaluative studies in this field have proved that these competencies can be developed through instruction. The counselors (those who guide the decision-making training) base on teaching their clients how to make better decisions. The stress is, then, put on the developing maturity and sense of personal responsibility when making decisions (cited in Beyth-Marom et al., 1989).

Cassidy and Kurfman (1977) emphasized the importance of teaching decision-making skills especially in "social studies". They stated:

> …decision making as an educational goal derives its justification from two values which underlie our social political system. One of these is belief in popular role, and the other is respect for the individual. From the democratic value of popular rule comes support for developing skill in making decisions about public issues. From the value of individual dignity comes support for making sound decisions about personal problems (p.3, cited in Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989, pp. 23-24)

Therefore, the decision-making training aims at helping the students be active and aware citizens through exposing them to different social and public issues to be solved. Consequently, research targets finding out teaching strategies and techniques that aid the student to ameliorate or to develop their decision-making skills. As a result, Mata and Rieskamp (2012) mentioned two decision making programs that help the students avoid decision biases:

III.10.1.The bounded rationality: this program provides a rational way of learning decision making: first, the students are given a reasoning problem to be solved; the problem should not be ambiguous and the solution can be predicted through probability and statistics rules. Then, the counselors and the students compare the different solutions they presented with the solution that is dictated by the rule to find out the "systematic deviations" or the "biases" that the students have committed. At last, the biases are explained to students that they are the result of the used heuristics (Mata & Rieskamp, 2012, p.144).

III.10.2. Fast and frugal:the second program deals with the role that environment plays in shaping the reasoning strategies employed when making decisions. This is expressed by the authors as "the ecological rationality" (Mata & Rieskamp, 2012,p. 145).

The decision making programs, according to Mata and Rieskamp (2012), should focus on two main points:

a) *On the value of decision options*:

The authors claim that decision options are very significant in the decision-making process. Therefore, when teaching them, the teaching program should emphasize the importance of taking into consideration all the descriptions of options. These descriptions are mainly provided to the decision-maker, otherwise, they are the ones that are learned from experience (Mata & Rieskamp, 2012, p.147).

b) *On the value of decision strategies*:

Once the decision-maker is aware of the different options another problem raises. The best strategy to choose the appropriate option is problematic. The decision options are usually described by a piece of information. The authors define the strategy as practical and logical steps that are used in order to search for pieces of information and to process them. People usually classify the strategies they used through their lifespan; the strategies that led to the best results are those which are considered as the best strategies and which are going to be recurrently used in future situations. Basing on the importance of the strategies, this program focuses on the importance of teaching student about the value of these strategies instead of teaching the value of the options (Mata & Rieskamp, 2012).

Consequently, teaching decision-making is a complex process that requires careful implications. The goal of the training or the teaching process is to help students reduce or ovoid the decision biases through the employment of different strategies. The best way then is to push students to think logically and to make use of all available information to choose the best option. This is implemented through the choice of good teaching strategies that should be used by the teachers.

The decision-making literature emphasizes training students to develop their decision-making. The teachers should encourage students to critically analyze the content being taught and use it to develop their decisions (Placek and Pearson, 1998). Decision-making training aims to push students to be creative. According to Clemen and Gregory (1995), creative decision-making help students to identify which situation needs “careful thought” and which does not. This deep thought enables the student to engender the maximum list of alternatives and thus thinking of the best results of the decisions.

Placek and Pearson (1998) emphasized the importance of sufficient data to make better and sound decisions. For this reason, they proposed different strategies that the teachers should use in order to help their students develop their decision making skill:

1) The use of various teaching strategies that foster the students critical thinking skills,
2) The teaching environment should be stimulating and motivating. The teachers should engage the students in different content through a variety of strategies to stimulate their thinking skills and help them act on the problems.
3) The learning should not only be based on the content but teachers should teach the students to "think, question, wonder, explore, analyze, debate, hypothesize, create and use wisely the vast information they will come across" (Bellanca & Fogarty, 1993; cited in Placek & Pearson, 1998).
4) The authors emphasize the importance of teaching the thinking skills as a whole as they are central in making sound decisions. The thinking skill as they claimed should be taught as a whole and not separately.
5) Another strategy is the use of case study techniques and cooperative –group strategies to help the student develop higher thinking skill learned from others, social skills responsibility as the activities focus on the individual's completion of their own tasks …etc.

III.11. DECISION MAKING EVALUATION

When people tend to evaluate their decisions, they need some criteria to base on their evaluations. Nickerson (1975 as cited in Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989) proposes two different criteria:

1) ***Effectiveness:*** we call a decision effective when it produces the desired outcome. The evaluation of the effectiveness is based on whether the decision works out or not.
2) ***Logical soundness:*** this deals with the conformity of the decision with the values and the information available when making the decision. According to the author, the evaluation of the decision soundness is harder than the effectiveness because the evaluation process goes through different steps where the emphasis is not on the outcome but the process of the decision making. They mainly take into consideration: the available information, the preferences, the estimate probabilities etc.

However, Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby (1989) claimed that the effective evaluation should be based on both outcome and process, that is to say: effectiveness and soundness. They emphasize the importance of training people on decision making and providing them with the principles of good decisions because, as they claim, the "conscious knowledge is necessary for better behavior”. Nonetheless, the curriculum should teach the decision-making principles that are supported by scientific knowledge.

III.12. MODEL OF DECISION MAKING

Basing on the complexity of the decision-making processes as for being related to individual behaviors, different researchers worked on providing several explanations and different definitions. Their research studies resulted in a wide range of theories and models that explain the decisions making process and the strategies that may be helpful either in specific or general situations. In this section, we provide a summary of the most influential decision-making models:

III.12.1.The classical approach to decision making

According to Adair (2010), during the course of life people meet different types of decisions that should be confronted. The author claims that a five-step classical approach can help decision-makers to make prompt decisions and can provide a rational approach to make decisions. This approach mainly includes these strategies according to Adair (2010):

1. *Define the objectives*: in order to avoid ambiguity of the decision, the decision-maker needs to make his objectives clear that represent the outcome(s) he/she wants to achieve. When the decision-maker is uncertain about his/her aims, the author asserts that writing down the goals may help to narrow them down and then define the most appropriate (Adair, 2010, p. 18).
2. *Collecting the relevant information*: this step is very important as no decision can be made accurately without relevant information. The decision-maker should collect the information, and then sharpen them to the most important than the most relevant. The author stresses the importance of making a distinction between the “available” and the “relevant” information (Adair, 2010, p.18). There is a lot of information that exists and that surrounds the decision-maker especially with the development of new technologies and the communication means that may put him/her in an information dilemma (Adair, 2010, p.19-20). Hence, the decision-maker should be careful when selecting the appropriate and relevant information from the available one. Consequently, many investigations of the information lead to biasing information; therefore, the information to collect should be guided by the objective (s).

3. *Generate feasible options*: Adair (2010) asserts the difference between an option and an alternative. According to the author, the literal meaning of an alternative is "one of two courses open" (Adair, 2010, p. 21), that is to say; the decision-maker uses the "either-or" techniques where s/he ignores the other possibilities. Thus, the decision-maker does afford neither time nor mental energy to think of the other alternatives and would claim something like: "if it does not option 'A', it means that it is option B" where option B is considered as the alternative of option A. According to the author, the decision-maker should investigate more options that help in achieving the best outcomes. However, the decision-maker should look for the "feasible" one. The feasibility, according to the author represents the capability of being applicable and workable (Adair, 2010, p. 22) where the decision-maker can practice and realize it. To summarize, in order to proceed in the decision-making process, the decision-maker should not limit him/herself to the alternative but should investigate more effective and feasible options that lead him/her to achieve the desired goals after the analysis and the evaluation of the options, they narrow them down to two alternatives. this process is illustrated by Adair (2010) in the following diagram:

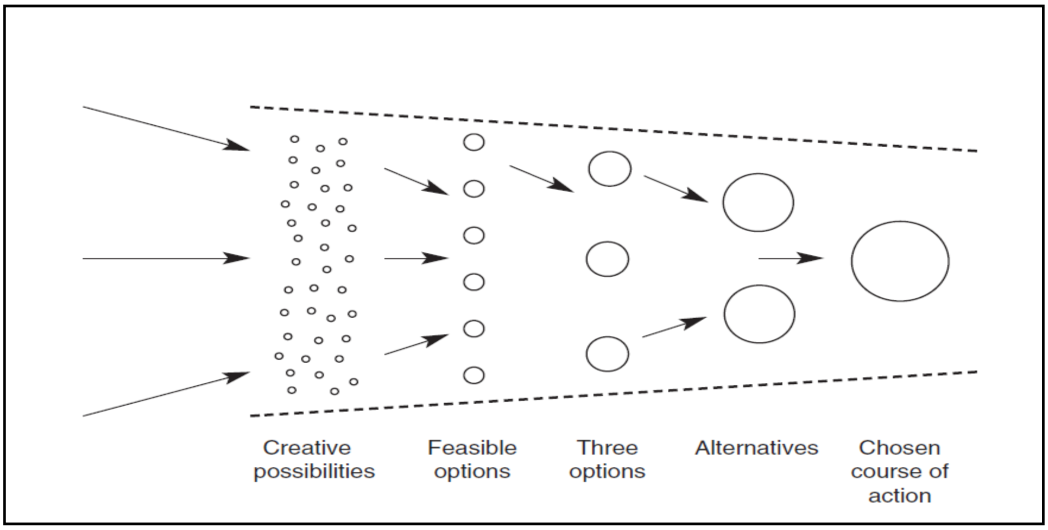


Figure 2: The Lobster Pot Model (cited in Adair, 2010, p. 23)

4. *Make decision:* At this level, the author argues that the first step is to make a list of criteria on which the decision-maker bases his/her selection of options. There should be a list of "SHOULDS" and a list of "MIGHTS". Then the options that do not satisfy the "MUST" necessities should be excluded from the list (Adair, 2010, p.23). In this concern, the decision-maker should take into consideration the risks of choosing

options, according to the author, the risk can be calculated through mathematical and statistical ways in addition to the role that experience plays in determining these risks(Adair, 2010, p.24).

5. *Assessing consequences*: the author claims that reflecting on the risks is a part of the consequences thinking process. The consequences of an option can be clear or not clear or as termed by the author “manifest or latent”. Manifest consequences are clear from the principles of the option and any person- who employs reason- in the same situation would predict the same outcome because they are obvious. Contrary to these, the latent consequences are not probable and the options’ principles do not lead directly to the consequences. In opposite to the manifest, the reasonable person may not see these consequences. In order to aid in generating the latent consequences, the decision-maker can make use of computers to lessen the effect of the unpleasant surprises. The author focuses on the idea that consequences define the bad and good decisions, not the wrong and right ones. The wrong decision is a result of the wrong method and a bad decision happens when “the method or process of decision making was deliberately ignored or irresponsibly put on one side” (Adair, 2010, p.27) and has a severe and/or tragic outcome. The author argues that wrong decisions are unavoidable but bad decisions are avoided by an accurate process where appropriate methods and techniques are used.
6. *Implement and evaluate*: all the above-mentioned strategies are related to the thinking phase. According to the author, this step is related to “taking action” and applying the choice that has been set on. This step is considered as a step of the decision-making process because when implemented, the decision-maker is still evaluating the decision: whether it is right or wrong; or whether the afforded effort is worth it or not. These evaluations lead to construct “experience” that will be basic for future decisions (Adair, 2010, p. 29).

To summarize, these steps are very basic to any decision-making process; however, the decision-maker is not always obliged to respect or to follow them as they are listed above. The decision making steps and strategies are changing from a situation to another and from an objective to another.

III.12.2.Traditional models to judgment and decision making

Many research studies investigated the decision-making processes. In this section, we present two-pillar models that explain well the decision making:

III.12.2.a. The wilderness education model

According to Cain (1991), when decision-makers face a situation that needs a decision, the steps to follow are (cited inGuthrie, 1996):

- Collect all the appropriate information
- When analyzing the information, the decision-maker identifies the alternatives and the options
- Then studies the consequences associated with each option
- After this analysis, the decision-maker settles on the option that is the best (of course the best according to his/her analysis).

However, this model is limited as it did not explain the procedures of choosing the right options and the consequences (Guthrie,1996).

III.12.2.b. The priest model:

According to Priest (1988) and Priest and Dixon (1990), human decision-making is similar to one of the computers as both tend to process information through the same procedures. The process of decision making and judgment bases on retrieving the needed information that is achieved from “experience ad inductive reflection”. Then the decision-maker applies the “logical deductive rules” to generate the decision. Nonetheless, this model bases on pre-made judgments about the information where it did not explain how to make decisions about the information to be chosen (cited in Guthrie,1996).

III.12.3. The behavioral decision making models:

In order to understand the decision-making process, researchers from different domains propose a variety of models. The models include belief and values-based-rules (Beyth-Marom, Fischhoff, Jacobs Quadrel & Furby, 1989) that decision-makers should follow when making decisions. The main behavioral models are:

III.12.3. a. *The normative principles*

One of the most accepted models is the Normative Model which leads to excellent decisions because it is based on reason and its principles are rational (Greenbank, 2010).Furthermore, Bandyopadhyay, Chandrasekhar Pammi and Srinivasan (2013) claimed that the normative model explains the behavior that a person performs when meeting hazardous and risky situations. This model, according to the authors, stands on rational principles of the decision (p.38). It was first developed by philosophers and economists and was later adopted by psychologists (Greenbank, 2010). According to Beyth-Marom, Fischhoff, Jacobs Quadrel, and Furby (1989), the normative model includes the various steps that may differ from a situation to another (uncertain or certain situations). These steps are:

- Make a distinction between the different situations that require decisions. The situations may necessitate decisions under certainty, uncertainty, or risk).
- Defining the situation that needs the decision.
- Listing the different alternative choices.
- Establishing the criteria of the comparison between the alternatives.
- Estimating the different consequences of each option.
- Evaluating the usefulness of possible consequences.
- Evaluating the attractiveness and the probability of each alternative.
- Evaluating the need for additional information.
- Evaluating the decision-making process.

On another side, Greenbank (2010) claimed that “the normative model of decision making usually stress the need to adopt a rational or logical and comprehensive approach to make effective decisions”. The authors provided the steps of normative models to decision making which include: setting objectives, collecting information, generating options, systematic evaluation of the options to make the final choice that meet the goal seat at the very beginning.

Bruine de Bruin (2012) claimed that the normative model supports the idea that the evaluation of the decision should base on the process, not on the outcome this decision gives, and with time, the good process will lead to good outcomes. Therefore, according to the author, good decisions are the ones that reduce the level of regret by stay away from the options that lead to harmful outcomes (p101). Hence, the good decision-making process, according to the normative model, should include the following key steps (as cited in Bruine de Bruin, 2012):

1. Assessing the beliefs that each of the available alternatives has a set of different consequences: the assessment of the beliefs is made upon two bases: first, the correspondence of these beliefs with the external objective criterion; and the second element is the coherence was the beliefs need to be consistent with the other beliefs of the decision-maker (Bruine de Bruin, 2012, p.87).
2. Assessing the value of each consequence in terms of the desired outcome: the assessment is performed also in terms of correspondence and coherence. The correspondence refers to the adherence with the normative principles and the coherence refers to the internal consistency. The normative principles and the correspondence mainly based on what the author names as the "sunk costs rule" which claim (i.e. the rule) that: "good decisions should be made based on the expected future outcome without considering the unrecoverable expenditures" (Bruine de Bruin, 2012, p. 87). The normative principles, then, assert that the decision-making process which is a non-profitable process is useless.
3. Finally, combining the belief and the value to choose the appropriate option (the option that leads to the desired outcome): when the decision-maker makes his/her choice, s/he should be sure that choice leads to the goal(s). When analyzing the different options, the decision-maker chooses to take the risks in order to raise the probability of reaching gaining more benefits (Goldberg and Fischhoff, 2000; Goldberg, Halpern-Felsher and Millstein, 2002, as cited in Bruine de Bruin, 2012).

III.12.3.b. The descriptive model:

Bandyopadhyay, Chandrasekhar Pammi, and Srinivasan (2013, p.38) claimed that the descriptive model takes into consideration not only the consequences of the choices but also the estimate that would be resulted if another choice had been applied under the same situations. This model is used, according to the authors, to avoid regret and disappointment. According to Beyth-Marom, Fischhoff, Jacobs Quadrel, and Furby (1989), the descriptive principles are based on the importance of taking into consideration the decisions made under uncertainty when teaching decision making and should be included as a basic element in the curricula. According to them, the curricula should aim at teaching students how to make multiple choices and alternatives before making a decision and narrow them down. Therefore, the teachers should introduce the different techniques and strategies that are needed to make an effective strategy. On this concern, the descriptive research revealed that adolescents are more likely to hold to the normative principles but they lack the intuitive skills such as when to use heuristics. Therefore, they need to be taught the effective implementation of decision-making before adulthood (Bruine de Bruin, 2012, p.101).

Miyapuram & Chandrasekhar Pammi (2013, p. 242) distinguished between two types of decision-making processes under the descriptive model:

1. *A Simple Perceptual Decision Making*: bases on processing the sensory information the decision-maker has gathered. That is to say, people collect information they may see and observe, touch, taste, sense, and so on; and then use the information in order to make the decision.
2. *Value-Based-Decision Making*: this type involves one further step that differentiates it from the above one. This step is an evaluation step where the decision-maker turns the choices and the options into reward values.

Bruine de Bruin (2012) maintains that: “Descriptive behavioral research examines how people actually make judgments and decisions, typically comparing elements of their decision making performance to specific normative standards” (p.90). That is to say, this model is interested in studying why decision-makers violate normative principles like coherence and correspondence. The findings of the descriptive research revealed the importance of individual differences and the developmental progression in decision-making competence. Furthermore, the results of the descriptive research disclose that decision-makers do not always follow the logic and normative model principles (as they base on logic too) when making decisions (Dawes & Hastie, 2001; Kahneman, Slovic & Tversky, 1982; Yates, 1990, as cited in Bruine de Bruin, 2012, p.91). On this concern, Bruine de Bruin (2012) claimed that when evaluating the adolescents’ decision making, it should not be based on to which extent they followed logic and normative principles, but the evaluation should also include a comparison with the adults’ decision making process.

III.12.3.c. The prescriptive model:

This model’s approaches design programs that help in developing the adolescents’ decision-making. They base on both normative and descriptive principles in teaching adolescents how to overcome decision-making difficulties when they come to implement the normative principles (Bruine de Bruin, 2012, p. 102).

III.12.4. Cognitive models to decision making:

Cognitive studies started to flourish in recent years. Researchers try to explain the mental processes that happen when a person makes a decision. Therefore, as a result of these studies, many models have been illustrated and recommended. The following models (as cited in Jacobs and Klaczynski, 2005, p. 1) resemble each other in some respects but differ in others. The authors claim that: "they differ in the emphases they place on different forms of processing, the importance of different types of information processing, and, especially, in the role that intuitive processing plays in making adaptive decisions" (p.1). The cognitive models to decision making are:

III.12.4.a.*The Self-regulated model*:

This model was first presented by Byrne in mid-1990. Byrne aimed at establishing a theory that combines the normative and the descriptive principles and at the same time should be realistic. According to Byrnes (2005, p.7), human behavior, in general, is shaped by the context (which refers to the situation that is defined by time and place, actors, their roles, and finally the objective). In addition to the context, one of the pillar bases of human behavior is the objectives and intentions of performing these behaviors. Decision-making is also human behavior, and thus bases on the existence of the context and objectives. Byrnes (2005) tried to explain the decision-making process within the Self-Regulated Model (SRM).

Byrnes (2005) explained that the authors who try to explain the decision-making focus on the four main courses of actions that are significant for the decision-making processes. These include:

- *Goal setting:* that refers to setting the objective (s) that are wanted to be achieved,
- *Option Generating:* the decision-maker thinks about one or more ways to accomplish these goals,
- *Option Evaluation:* the decision-maker weighs up the options that are generated according to the objectives set at the beginning,
- *Option Selection:* the decision-maker performs the option which seems the best to accomplish the goal(s).

However, since decision-making relies on the context and objectives, The presence of these four mechanisms does not always lead the human being to strictly obey them, to respect all the elements, or to be conscious and rational when performing them (Byrnes, 2005, p.9). For this reason, theories in decision-making go further in describing the decision-making process by taking into consideration other aspects that are essential in the process. For the SRM, Byrnes (2005) focused on the significance of the “structural aspects” that include: “the declarative, procedural and conceptual knowledge in long term memory, the values represented in the long term memory and the working memory capacity” (pp.9-10).

In the decision-making process, the most confusing step is how to choose the best option; therefore, for the author: “good options are those that are more likely to lead to positive outcomes than not-so-good options” (Byrnes, 2005, pp.10-11). However, if the good option fails to reach the intended outcome, the decision-maker should not judge this option as being a bad choice. Moreover, when the option that had a low possibility of reaching the goal lead to the outcome, the decision-maker should not judge it as being a successful option. That is to say, decisions and options base on the context where the decision is made and as it is mentioned by the author, the quality of the decision “takes a long-term perspective of decision making over time” (Byrnes, 2005, p.11). To summarize the quality of the option is said to be determined by their ability to lead toward the intended goal within a long-term perspective. Therefore, the author claims that when we describe decision-makers as competent, they should know how to generate alternatives and decide about the best one.

Therefore, the Self-Regulated Model of decision making bases on explaining how people make a good decision and what are the characteristics that define a competent decision-maker. Byrnes (2005) explained that the principles of this model are derived from the role that “self-regulation” plays in the social and cognitive processes. Hence, the social and cognitive theories describe self-regulated people through three main features which help them make good decisions. These features are(a cited in Byrnes (2005):

- **a.** The employment of the appropriate strategies to solve problems that are caused by three main problems: lack of knowledge, bothersome personality traits, and emotional influence.
- **b.** The ability to distinguish between the situations where they have the knowledge and where they do not have. Adding to this, the ability to modify their knowledge structure to help themselves arrive at the desired outcome (s).

c. Being capable of giving the appropriate reaction towards failure and success of their decisions.

When talking about the decision-making strategies within the SRM, Byrnes (2005) mentioned some problems that require the use of decision-making strategies. Among these problems we find:

- Misjudging the possibility of occurrence of the options' consequences;
- Overconfidence or under-confidence of the decision-maker;
- Errors of calibration and use of faulty knowledge;
- Limited knowledge resources
- The negative effects of emotions and some personality traits.

These main problems are repeated in Byrnes' (2005) report where the author emphasizes how to use different strategies to reduce the problems that affect their decisions making processes. The author points out some of these strategies that enable the decision-maker to discover the alternatives (options), evaluate them, and finally regulate their personality traits and overcome the decision problems. These mentioned strategies include mainly (as cited in Byrnes (2005):

a. Information gathering strategy which is used to reduce uncertainty;
b. Making a list of the pros and cons of the options in order to have a clear idea of the consequences of each option.
c. Assessing the knowledge, beliefs, and values and then calibrating them. The author explains the calibration as: "by calibrated, I mean that a person's intuitive expectations of the likelihood of an outcome match the actual likelihood of these consequences" (Byrnes, 2005, p.15). That is to say, this person makes use of experienced situations in order to correct the faulty knowledge until the person's intuitive expectations meet the actual possibility of the occurrence of the options' outcomes.
d. Taking feedback from the environment to correct and modify the beliefs and the knowledge in the appropriate ways. The importance of feedback according to the author lies in three main advantages: first; it helps the person to make his/her knowledge and beliefs accurate. Second, it increases the number of strategies that are used for the discovery and the evaluation of the alternatives and strategies that are used to reduce uncertainty when making decisions. Finally, feedback enables people to

make a distinction between an important decision that requires effortful approaches and non-important decisions that do not require that much effort. The difference between important and unimportant situations is that the important ones are those within which choosing the wrong option to lead to serious losses and which make the decision-maker regrets applying that option; whereas the insignificant decisions based on intuition and limited processes to make decisions (Byrnes, 2005, p.14).

After explaining good decision-making and the different problems and the various strategies used in the decision-making process, Byrnes' (2005) SRM focuses on the characteristics of competent decision-makers and how these competent decision-makers make decisions. According to Byrne (2005, p.16), the SRM aims at establishing the correlation between self-regulation characteristics, competent decision-maker, and the frequent attainment of the desired outcome. Furthermore, the SRM lists some features of a competent decision-maker. They include:

a. having accurate knowledge concerning the possibility of outcome occurrence of the different decision making processes and actions;

b. knowing the value of their emotional health, physical health, and financial wellbeing (that is to say that the decision-makers take into consideration what they can and cannot support either from the physical, emotional and financial sides before making his/her decision);

c. having a range of strategies that are retrieved in situations that require reducing the uncertainty, discover good options and evaluate them, and in general, overcoming the different challenges they meet when making decisions.

d. having the ability to know which context need specific knowledge, values, and strategies and the above-mentioned competences.

Therefore, the aim of including self-regulation in the decision-making process is to make people able to make good decisions and acquire decision-making competence by their own selves. According to Byrnes (2005, p.18), children are able to acquire these competencies and strategies if they are given reasonable autonomy by parents.

To summarize, Byrnes' SRM aims at explaining the successful decision-making process and the role of strategic thinking when faced with important decisions. The use of strategies is indispensable especially with important decisions in order to reach what the author called "adaptive goals" which means that "they improve physical health, emotional health, or promote longevity" (p.7). Contrary to the competent decision-maker, unsuccessful decision-makers tend to pursue non-adaptive objectives or do not use the appropriate strategies when discovering and evaluating the options.

III.12.4. b. ***The dual processing model***:

This model focuses on the importance of "information" and the different cognitive mechanisms that participate in the analysis of this information during the decision-making process. On this concern, Klaczynski (2005) emphasized explaining the role that the information processing mechanisms play in the decision-making process within different situations. According to the author, cognitive development is supported by two information processing systems: the experiential and the analytic systems (p.40). These two systems are respectively also called system 1 and system 2 (Peters & Bruine de Bruin, 2012). The two systems are:

III.12.4.c. ***The experiential processing systems:***

The theories base on this system explains cognitive development as the process of acquiring heuristics either implicitly or explicitly (Reber, 1999, cited in Kalczynski, 2005, p.41). This system requires the person to activate preconsciously the "procedural memory" to retrieve the heuristics which have been already acquired (p.41-42).

According to Ullman (2013), the procedural memory system bases on learning and processing new cognitive abilities and habits through repeated exposure to the stimuli or practice. This memory is also called the "implicit memory" where the skills and the knowledge acquired are retrieved unconsciously and they are never exposed to "conscious memory" (Ullman, 2013). Decision-making is like other cognitive processes and it is explained as the process of preconscious retrieving the already acquired judgmental and decision-making heuristics. According to Kalczynski (2005, p.41), the procedural memory is activated automatically to arrive at beneficial outcomes or achieve outcomes that are not considered as big losses to the decision-maker because they are, as termed by the author, "fast and frugal" and intuitive.

Peters and Bruine de Bruin (2012) called this mode an Affective/experiential mode of thinking. It is characterized by being "effortless, spontaneous, automatic, intuitive, associative and fast" (p.114) when functioning. According to the authors, this model is highly affected by the affective side of the decision-maker.

The experiential processing system then assimilates information and stores them in the procedural memory in a related manner. The relation is established by combining the pieces of information with internal or external cues. The combination makes it easy to retrieve easily and automatically the heuristics in specific situations because it bases on the information mapping that enables easy assimilation and incorporation of the information into the existing knowledge and helps to turn the conscious strategies into automatic ones (Kalczynski, 2005, p.41).

III.12.4. d. *Analytic processing system*

This system bases on controlled, logical, and conscious thinking and metacognition. It targets mainly the ability of the decision-makers to reflect and evaluate the decision options and to consciously assess the development of their reasoning during the decision-making process. Contrary to the above system, the analytic system tries to stop the decision-maker from retrieving and activating the memories through the employment of logic and reason. The memories and the heuristics, according to this system, lead to biased decisions. In order to use this system, the decision-maker should develop analytic competencies that will be used consciously during the decision-making process. This is, according to the author, effortful (Kalczynski, 2005, p.42).

Peters and Bruine de Bruin (2012) named this system as “the deliberate mode of thinking” where it is “conscious, analytic, reason-based process, verbal and relatively slow” (Bruine de Bruin, 2012, p. 114). According to the authors, this system’s function relies on controlling and monitoring the quality of the system1 actions and its impact on human behavior (Kahneman, 2003, cited in Bruine de Bruin, 2012, p.114).

Consequently, the importance of this system lies not only on acquiring these abilities but also on using them to prevent the “memory-based-interference” during the decision-making process and to “reflect on the processes of reasoning and decision making, and evaluate the quality of decision options” (Kalczynski, 2005, p.42). However, this system requires some associative competencies mainly the personal disposition and the individual’s motivation because the above aims are reached only if the person is willing or is having the tendency to get into or to enjoy the above-mentioned or steps (Kalczynski, 2005).

Another important point with the analytic system is the ability to evaluate and justify beliefs, assess them, plan for the goals and the sub-goals of the decisions, select the appropriate strategies to achieve these goals, controlling the development of the processes. These preceding levels (abilities) are what make the “metacognitive and the executive functioning” (Kalczynski, 2005, p.43, p.43). These elements, hence, are crucial in the development of reasoning and finally the decision-making skill. Metacognitive functioning involves three main skills: first, the metaprocedural skills: refers to the ability to recognize the type of reasoning used (either inductive or deductive), to assess the memory strategy, the problem-solving procedure, or the decision making strategy used in a particular situation (Kuhn, 2001, 2002; et al. cited in Kalczynski, 2005, p.43). Second, the metacognitive monitoring skills: refers to the ability of an individual to recognize the process that he/she has followed to make a decision, that is to say, as termed by the author “the ability to track the course of one’s reasoning and decision making”. This is demonstrated through the ability to identify and distinguish between the shortcomings or the weaknesses of a decision and its relevance. The importance of both metaprocedural and meta monitoring skills is that they prevent the memories (which are the beliefs) to intervene and bias the evaluation of the decision options and finally they prevent the person from using the automatic heuristics without employing reason and consciousness. Finally, the metaknowledge skills: this skill proves the importance of knowledge in the decision-making process. This knowledge includes not only information of the context and the options but also includes the knowledge of decision-making strategies and most importantly, as it is termed by the author, the knowledge about “the nature of the knowledge and the process of knowing” (Kalczynski, 2005, p.43) including the person’s knowledge of whether they are certain or uncertain. Therefore, according to Kuhn (2001, as cited in Klaczynski, 2005), the decision-maker should differentiate between the different types of knowledge; knowledge types like “accepted facts, beliefs, assertions, and evidence” are different by principle and the decision-maker should know the difference between them as it is very important for a sound decision. Moreover, the decision-maker should know when and how to apply each one of these in real-life situations. According to the author, “metaknowledge skills” represent the ability to make the difference between the different types of knowledge and they refer also to the knowledge of how and when to apply them (cited in Klaczynski, 2005, p.43). To conclude, the information processing systems is found to explain the importance of having the knowledge, understand the different procedure used to process the knowledge and how it is applied in real decision-making situations. It is worth mentioning here, that the decision-maker should be aware and conscious at all the steps mentioned above.

However, for many theorists, decision making relies on both consciousness and pre-consciousness; that is to say, decision making is best done through the experiential and the information processing systems (Klaczynski, 2005, p.48; Peters & Bruine de Bruin, 2012, p.114). On this concern, Sloman (1996) expressed this idea when saying:

> "Experiential thought *feels* like it arises from a different cognitive mechanism than does deliberate, analytical reasoning. Sometimes conclusions simply appear at some level of awareness, as if the mind goes off, does some work, and then comes back with a result..." (p. 3, cited in Klaczynski, 2005, p.50)

That is, automatic processing is not always hindering the decision making and the logical activities; instead, it helps the activation of the reasoning, which is a basic principle in the information processing system, when making decisions. Moreover, the memory representations that are retrieved automatically are often taken from the previous conscious decisions, adding to the fact that the representations are defined the decision maker's willingness and motivation toward producing "correct, precise and justifiable decision" (Klaczynski, 2005, p.52). Furthermore, these representations demonstrate the type of information processing that is used in a given situation. These complementary features of both systems lead theorist to claim that decision is well made through an experimental-analytic processing system(Klaczynski (2005, p. 52).

III.13. THE ROLE OF TECHNOLOGY AND DECISION AIDS IN DECISION MAKING

Regarding the complexity of the decision-making process, researchers try to make use of a variety of tools that facilitate the process and lead to sound and/or objective decisions. With the evolution of technology, researchers emphasize the importance of integrating it in the process of decision making and as a result, the Decision Support Systems (DSS) have been created. This system, according to Butterfield (2010), is the "interactive software designed to help you compile useful information from raw data, documents, and business knowledge", the data then is used to solve problems and make objective decisions (p.98). According to Yates and Angotts (2012), decision aids are any procedure or device that is used to facilitate or help the decision-makers to improve the quality of their decisions (p.283). The decision aids may help in accomplishing some elements of the decision-making process or it may, in some cases, completely replace the decision-maker as is the case of spreadsheets (Yates & Angotts, 2012p.262). Some examples of the technology software may include Microsoft Office Excel, Google Spreadsheets, OpenOffice Calc, Gnumeric, Apple Numbers …etc (Butterfield, 2010, p.114). In addition, other forms of decision aids include computer programs and websites, videos, oral presentations, and counseling (Yates & Angotts, 2012). According to Butterfield (2010), the advantages of using technology or more specifically this software in making decisions are:

- It helps to achieve objective decisions because before using the software, the decision-maker should have a clear idea of the problem and have a clear idea of the information and the data he/she has. Therefore, the decision-maker is engaged in an overall evaluation of all the elements and all the parts included in these decisions before starting using the DSS (as cited in Butterfield, 2010).
- When the decision-maker is in front of complex decisions, the DSS enables them to pack a wide range of data that gives a clear sign of either the problem or the decisions' options. Technology in general and computers in specific provide the decision-makers the opportunity to visualize their data (graphs) and/or make a complex calculation and obtain accurate results through careful data processing and a clear reporting of the data (Butterfield, 2010).
- The DSS enables the decision-makers to adjust their variables whenever they want. It makes the comparisons easier and more obvious through visualization of the differences through the different tables and graphs (Butterfield, 2010).
- The DSS provides an empirical evidence and argument to defend mainly the intuitive decisions. The argument comes from the objective processing of the data (as cited in Butterfield, 2010).

Moreover, one of the most used techniques that facilitate the decision-making process is the use of what Butterfield (2010) called the "Decision tree". The decision tree is one of the supporting system's techniques that enable the decision-maker to model the different aspects and possibilities of the decision in a tree-like shape. It enables him/her to visualize the overall conditions and aspects in a summative way that may affect it and truck the best way to achieve the goal or the desired outcome. This tree may be drawn by hand or by computer software like spreadsheets or presentation graphics programs (Butterfield, 2010, p.107). Other graphics may be employed for data description and data visualizing and presenting. These include drawing or different types of graphs like bar charts, line charts, area charts, pie charts, scatter plots, etc (Butterfield, 2010, p.112).

The effectiveness of the decision aids is related to the quality of the decision that is being taken. Therefore, in order to evaluate the quality of the decision, Yates and Angott (2012) suggest two main evaluation dimensions:

III.12.1. The evaluation of the outcome itself: this evaluation emphasizes the process which has been taken in order to achieve the desired outcome. It includes, according to the authors "the aim fulfillment, rival options, side effects". The first measure refers to whether the decision that has been taken with the help of the decision aid has fulfilled the aim of the decision-maker or not, the second refers to comparing the outcome of the "course of action" that has been taken with the outcome of a competing process if it could be chosen. Finally, the third dimension deals with the other outcomes that have been resulted from the decision-making process rather than the main outcome (Yates and Angott, 2012, p. 267).

III.12.2. The evaluation of the process' costs and benefits*:* it refers to the consequences that will be experienced whatever the decision-making process. It includes material and non-material outcomes. The material outcomes refer to mainly money or any resource that can be turned into money at the end. The non-material outcomes include mainly the psychological outcomes like the "stress and the aggravation of interpersonal discord" (Yates and Angott, 2012, p.267). That is to say the psychological state of the decision-makers during the decision process, whether it causes to increase his/her stress and anxiety or not, or did it worsen the interpersonal disagreements.

To summarize, the evaluation dimensions of to which extent the decision aids helped the decision-maker to achieve a high-quality decision maker bases on the evaluation of the outcome itself and the evaluation of the costs and the benefits of the decision process. However, Yates and Angott (2012) claim that the evaluation may include exchange and "tradeoff" between the two dimensions because the decision-maker sometimes sacrifices one measure from the first dimension to achieve another measure from the second one.

III.13. THE IMPORTANCE OF THE QUANTITATIVE DATA IN DECISION MAKING

According to Butterfield (2010), quantitative data play a crucial role in clarifying the decision and solving a problem. The data representation through numbers facilitates visualizing the decision parts and objectively processing the information to reach logical results (p100). According to the author, the data are encoded into numbers that enable measuring and comparing objectively the data. When the data is subjective (data like strongly agree, disagree…etc), the quantitative modeling helps in achieving high objectivity when describing and when making decisions based on it. When describing the data objectively, the decision-maker makes use of statistical measures like the mean, median, mode, standard deviations (p102); moreover, to compare the decision factors and parts …etc, the decision-maker may employ some mathematical functions and formulas. The Author defines a formula as “a calculation that you perform on one or more variables” (p. 104). They are mainly used to “identify the best choices and solutions” (p.104). As it is a complex process and requires high competencies in mathematics and statistics, the decision-makers tend usually to employ technology and mainly electronic spreadsheets (like SPSS and Excel …etc) to facilitate the process. The electronic spreadsheets enable the decision-maker to test a variety of conditions and possibilities (scenarios) on the situation or the variable under study through what Butterfield (2010) called the “what-if analysis”. For example, the decision-maker may compare his or her current situation with “what if” he or she changes some factors or some variables or the values of the current situation. This way the decision-maker can figure out the best decision to take to make a change in real life (Butterfield, 2010, p.106).

CONCLUSION

Decision-making is a complex process that needs a high level of intention and caution when going through the process. It is very important to the decision-makers to try their best to avoid any kind of regret on the decision made. Despite the importance of decision-making in human life, few research works have been conducted to investigate it. More specifically, the decision-making construct has been explored more in the domains of politics, psychology, and cognition; yet, in the educational field, we have found very few research studies that were conducted in this area.

This chapter was thus dedicated to reviewing of the literature of this variable; it targeted mainly; basic definitions of decision making, factors affecting decision making, decision-making strategies, approaches to strategy selection, the importance of knowledge and information in the decision-making process, decision-making learning, and training processes, decision making evaluation model of decision making, the role of technology and decision aids in decision making, the evaluation of the outcome itself, the evaluation of the process’ costs and benefits, the importance of the quantitative data in decision making and so on.

CONCLUSION

This part plays the role of a guide to our research study and mainly the practical part as it shows the scope and the importance of the research variables. It is spent reviewing the theoretical background of our research variables. It constitutes three chapters namely: scientific research, statistics education, and finally decision making.

Consequently, we have been introduced to the different aspects that chart the research, scientific research, and more specifically academic research. Moreover, we have introduced basic concepts, theories, and models in the decision-making field. Finally, we have been introduced to the general concepts of the field of statistics and statistics education.

Along this part, we have collected different theoretical aspects that proved a kind of logical relationship between decision-making skills, statistics, and research. Through the practical part, we will attempt to find concrete evidence, tough and sound argumentations from the selected sample to prove the relationship between our variables.

PART II: PRACTICE AND EXPERIMENTATION

INTRODUCTION

After defining the study's variables and main concepts in the previous section, and reviewing the different theories and literature in the field of the study, this part is dedicated to present the different research approaches and methodologies employed in order to reach the aims of the study and reach reliable results.

This study at hand investigates the effects of statistics education on fostering EFL learners' decision-making skills during the research process. In order to test the different research hypotheses stated at the beginning of our research and answer the study's research questions, we make use of different research tools and procedures. The data will be analyzed and interpreted in order to produce the needed argumentations.

Consequently, this part involves four main chapters, namely: the research methodology chapter that reviews the research design methods and techniques employed in this research; then, the second chapter presents the findings of the different research tools and their interpretations. The third chapter concerns the discussion of the results and the last chapter concerns the suggested recommendations and implications.

CHAPTER IV: RESEARCH METHODOLOGY AND DESIGN

INTRODUCTION

This study investigates the effect of Statistics Education on EFL Master's students' decision-making skills during the research process. The study also aims at constructing an EFL learners' needs-based syllabus to teaching statistics. To reach the aim of the study, an appropriate methodology, a set of tools and procedures are required to be used.

Therefore, in this chapter, we aim at elaborating and explaining the followed methodology, the research variables, the participants, the data collection tools, and the data collection procedures used in this study.

IV.1.REVIEW OF THE RESEARCH PROBLEM

The problem under study arises from the different challenges and difficulties Master's students face when undertaking a Master's dissertation. These difficulties can be at the level of lack of skills, lack of knowledge lack of experience, lack of writing abilities, lack of motivation and self-confidence, and so on. Nonetheless, the most important challenge that these students meet is their inability to take independent actions and make their own decisions during the research process. Most students wait for decisions made by their supervisors or other teachers, they follow previous research choices without understanding the situations in which these choices have been made. This situation pushed us to think that there is an urgent need to find a way to help students think logically when making their decisions during the research process. Therefore, we suggested statistics education as a way to help these students to develop their decision-making skills based on two main assumptions:

1. Statistics makes use of evidence-based reasoning which justifies any decision and any interpretation of the results. Consequently, helping students to learn statistics enable researchers to develop their cognitive abilities such as understanding and to critically evaluate what is being learnt.
2. Teaching statistics does not only mean learning how to analyze and interpret the results obtained, but it also shows how to choose the accurate design and methodology including the methods and procedures for the whole study. Statistics education is also concerned with hypothesis construction and generalization of results and so on.

Consequently, and based on these two assumptions, we suggested that teaching and learning statistics may help the students to develop their decision-making skills. We targeted the Master's level because they have studied research methodology for three years (during the BA degree) and they are acquainted with the most important notions in the field of research. Besides, these have to prepare a graduation project at their Master two-level. Thus, we targeted Master one as a sample to our experiment, because they are at the level where they need to prepare and make plans for their future research.

The statement of the problem is explained through the following figure:

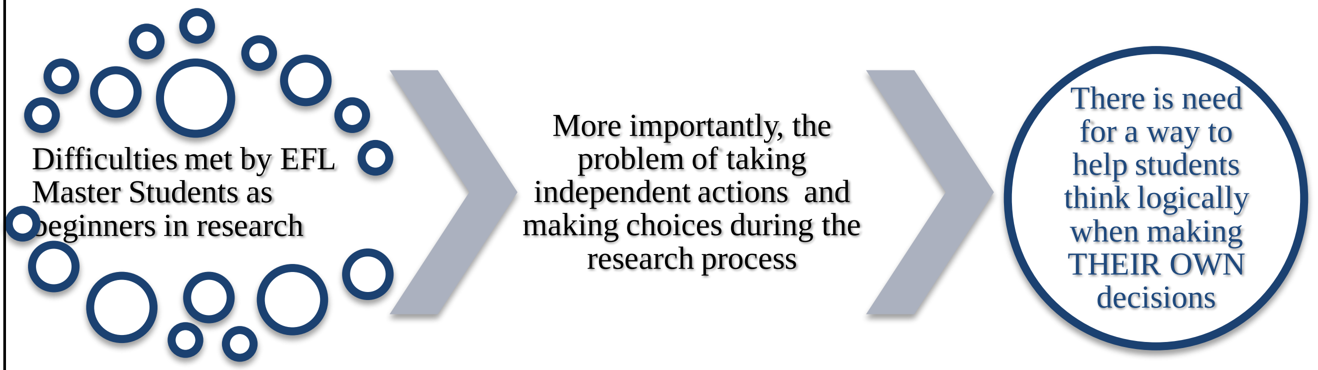


Figure 3: the problem of the study

IV.2. AIMS OF THE STUDY

This study investigates the role that statistics education plays in fostering EFL Master's students' decision-making skills during the research process. In order to reach this primary aim, there should be a syllabus that dictates the different objectives, and the content, the materials that need to be included in statistics education. Therefore, this study targets three main aims:

1. To demonstrate a causal relationship between statistics education and learners' decision making skills among English as Foreign Language (EFL) Master's students. That is to say, to prove that there is a positive impact of statistics education on EFL Master's Students' decision making skills.
2. To clarify the students' attitudes towards studying statistics (in the EFL context). It is known that most students in the EFL field come from human sciences and literature and foreign languages at their secondary school level. Therefore, these students usually have negative attitudes towards scientific subjects, mainly mathematics. Statistics is, then, seen as part of mathematics as they have studied a chapter of statistics in mathematics subject since their middle school. Thus, they have negative attitudes towards statistics. This study, then, tries to change their opinions towards this subject.
3. Finally, to suggest statistics' based syllabus dedicated to EFL Master's students (based on EFL Master's students' needs): statistics is a wide field when students go to study via the internet or want to choose books to study autonomously, they usually feel lost because of the wide range of topics in this field. Therefore, we want to limit the needed content and objectives that EFL Master's students' need to acquire in order to develop their decision-making in the research process.

IV. 3. RESEARCH QUESTIONS

The primary research aim of our study is to prove the cause and effect relationship between statistics education and the EFL learners' decision-making skill during the research process. Other aims- dictated by the nature of the study- including mainly finding out Master's students' decision-making problems and needs and designing the statistics-based syllabus dedicated to Master's students. Therefore, and as we have already explained (in the General Introduction), this research study specifically attempts to answer the following questions:

1. What are the challenges that Master's students of English face when making decisions during their academic research process?
2. What are the factors that hinder Master's EFL students' decision-making skills during the academic research process?

3. How can we develop the learners' decision-making skills during the academic research process?
4. What is the effect of statistics education on EFL learners' decision-making skills?
5. What is the role that teaching and learning statistics play in enhancing EFL Learners' decision-making styles?
6. What would be the most suitable statistics syllabus for EFL Master’s students?

VI. 2.RESEARCH HYPOTHESES

The assumption about statistics and statistics above leads us to think that this science which bases on logical thinking might be very significant in helping the students to foster their decision-making skills. We, then, suggest that if students are introduced to statistics education, they would foster their decision-making skills during the research process. Therefore, as pre-suggestions or pre answers to the above questions, this research work is guided by the following hypotheses:

1. The students' lack of decision-making skills during the scientific research process may be caused by their lack of knowledge about statistics and statistical procedures;
2. Adopting statistics into academic research may affect positively the research results as it can foster the students' decision-making skills.
3. Through following Statistical instructions, students can provide concrete evidence to each decision they make during their research process.
4. The EFL learners' needs can dictate the appropriate Statistics Syllabus as they present different profiles, different attitudes, and different perspectives

IV.2. RESEARCH VARIABLES

We have seen throughout the review of literature that statistics does not only represent the science of counting and the science of numbers but also it is the uniform that underlies and guides the whole study as expressed by Rumsey (2010). It is more than mere procedures to calculate results; it is the whole procedure that guides the study into valid interpretations and avoids being biased and wronged by any condition of the study. From another perspective, decision-making has been defined in a variety of fields; namely, psychology, cognitive psychology, neurology, economics, politics, and so on. However, in whichever domain, the decision-making enables people to advance in their lives through choosing one or a series of things that lead them to reach their goals or at least to approach them. Decisions that rely on logical processing of the knowledge and the employment of previous practical experiences are usually the decisions that are considered as being sound and that lead to satisfying goals.

On another side, academic and scientific research is described in the literature as being a systematic and logical process that constitutes different steps to follow. When the researchers try to define the problems of their studies their hypotheses, aims, research variables relationships, research designs, methods and tools, they will be in need of different practical and cognitive skills, mainly, problem-solving skills and decision-making skills. Therefore, teachers of research methodology and supervisors are required to help their students develop their cognitive skills including decision-making skills. Statistics education, based on the above assumption, seems to be an adequate way to help them foster these abilities.

Therefore, this research is chiefly based on elaborating a causal relationship between the independent variable (which is in our case Statistics Education) and the dependent one (the decision-making skills) during the research process. We hypothesized that the success of our independent variable will lead to the enhancement of the dependent variable. That is to say; the decision-making skills during the research process depending on the success of statistics education lectures.

IV.3. SAMPLE AND POPULATION OF THE STUDY

EFL learners are engaged in the research phase starting from the Master 1 level. Though the students study research methodology modules starting from their first year at the university, they face problems when it comes to take independent decisions for their works. This causes research anxiety and develops the students' negative attitudes towards the research and research methodology. This study targets Master's EFL students who are engaged into academic research at the University of BEJAIA.

IV.3.1. Population

Master 1 students of English: There were 127 students of THREE specialties: Literature & Civilization, Didactics of Foreign Languages, and Applied linguistics at the department of English, University of BEJAIA. There were four Master 1 groups among which one group is studying Applied Linguistics, two groups studying Didactics of Foreign Languages (DLE), and one group studying Literature. The research aims to target only Applied Linguistics and Didactics students which constitute the whole of 94 students.

IV.3. 2. Sample

In order to perform the experiment, 25 students as an experimental group and 25 students for a control group are selected through the cluster sampling technique (probability sampling method). The group had been already pre-divided by the administration and we selected the group of Applied Linguistics because they have the module of statistical data analysis as suggested by their course management system (CANVAS).

To ensure equality of the control and experimental groups at the level of the extraneous variables; namely, age, gender, and research experience. We have included them in the pre-questionnaire. The results have shown the students’ equality at the level of age (Experimental groups’ age ranges from 22 to 25, where the majority (61.9%) were 22 years old. Control groups’ age ranges from 22 to 24, where the Majority (52%) were 23 years old). Concerning the gender, we found that both groups have approximately the same rates of both genders (The majority (95.2%) of the experimental group are female students, only 4.8 % are male The majority (92%) of the control group are female students, and only 8% were male students). Finally, concerning the experience in research, we found that All the students of the Experimental group had 4 Years of studying methodology including their Master 1, and The majority (88%) of the control group reported that they studied methodology for 4 years.

IV.4. THE RESEARCH DESIGN AND METHODOLOGY

The study at hand aims at finding out a causal relationship between statistics education and decision-making skill during the academic research process. Therefore, to reach this goal, we follow the quasi-experimental design’s procedures. We opt for a quasi-experimental design because of the presence of the two major conditions of the experimental design: control and manipulation. Yet, it is worth mentioning that the study could not use a simple random sampling technique which is considered the third required condition of true experimental design. Instead, we opt for cluster sampling (which is dictated by the administration since groups have already been set) technique which is less effective than simple random sampling. Therefore, pre and post-studies are designed to measure the decision-making skills enhancement of our treatment group and the results are compared with the control group’s findings.

Moreover, due to the nature of the study, other sub-aims are appointed. We, thus, intend to design a Syllabus that is based on Master’s students’ needs. In pursuance of this aim, we opt for different procedures including a need evaluation questionnaire which is administered to EFL teachers (supervisors mainly), and diagnostic tests are made for the experimental students before the introduction of each research phase to detect their difficulties when researching posttests. In addition, we analyze 82 works of previous Master 2 students to determine their methodology and statistics problems and mainly decision-making problems. Consequently, based on the finding of these tools, we will design a needs' based syllabus for the module of statistics in the EFL context. This is summarized in the following diagram:

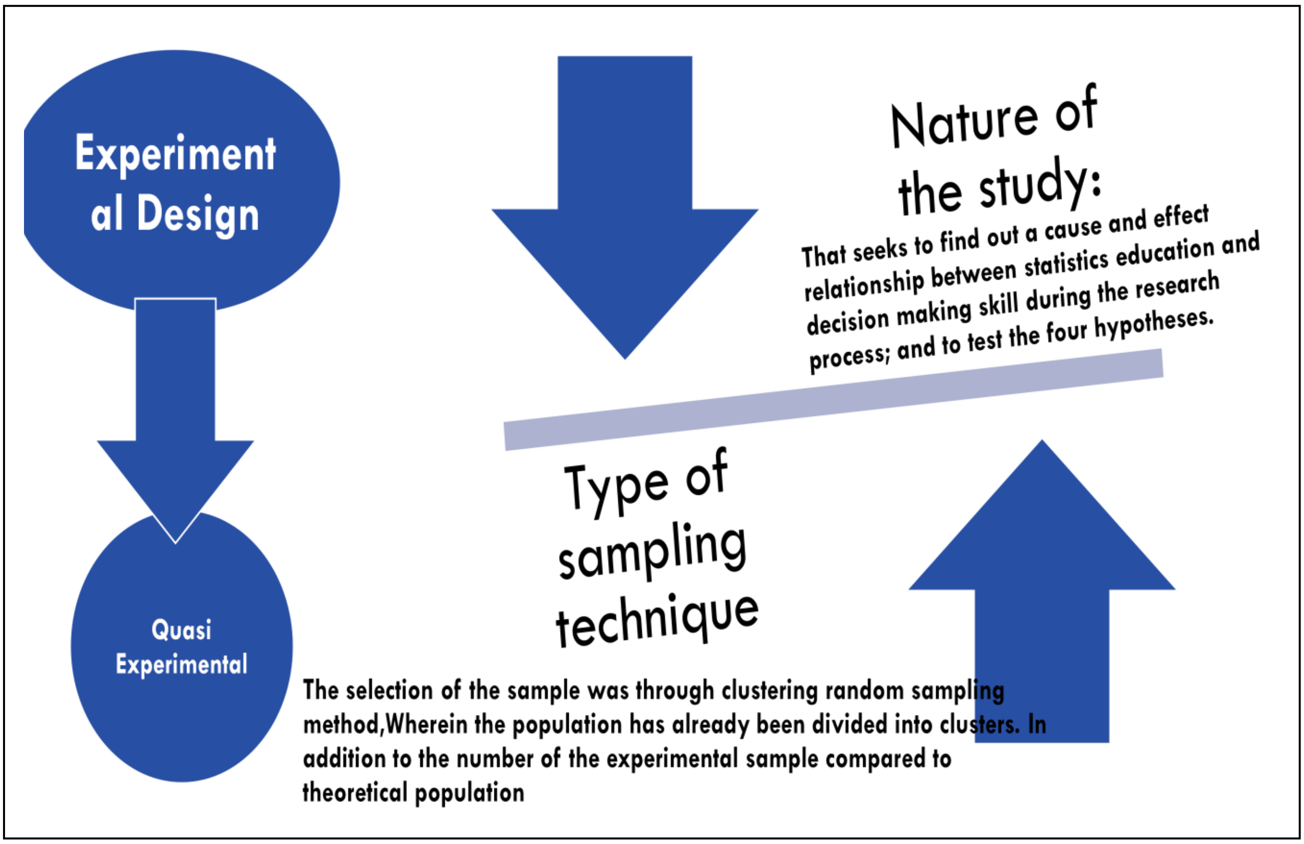


Figure 4: Research Methodology and Design

IV.5. DATA COLLECTION METHODS, TOOLS AND PROCEDURES

As mentioned above, we opt for a quasi-experimental design to prove the cause and effect relationship between our variables. Therefore, a mixed methodology is employed to measure the level of enhancement of the dependent variable. To reach the aim and the other sub-aims, a set of techniques and procedures are employed:

IV.5.1. Analysis of Master 2 dissertations

As a research task to the module of research, we have asked the students to conduct the whole research (in their Master 2 level) without having a supervisor to guide them. Therefore, 82 Master's students' dissertations (performed by 292 Master two students (the academic year of 2016-2017)) have been analyzed in order to investigate the students' lacks, errors ad problems when conduction research in general and when making decisions during the research process.

IV.5.2.A pre questionnaire

This tool is used for two reasons: first to detect the learners' difficulties when making research and second to determine their attitudes and their expectations towards the introduction of statistics into their studies. The questionnaire consists of four sections: the first aims at gathering general information about the participants, the second is about academic research and the different difficulties the students meet during research. The third is entitled decision making in academic research, the fourth is students' attitudes toward the statistics before being introduced to it. Finally, the last section is for further suggestions.

IV.5.3.Post questionnaire

The post questionnaire is designed to know the learners' attitudes towards the statistics after being introduced to it. Moreover, it is used to know the students' attitudes towards whether statistics has helped them to refine their decision-making skills or not.

IV.5.4. Decision Making Questionnaire

It is a scale developed by French DJ, West RJ, Elander J, and Wilding JM in 1993. The scale constitutes 21 items which measure seven (7) sub-behaviors of decision-making skills; these are Thoroughness, Control, Hesitancy, Social resistance, Optimising, Principled, and finally, Instinctiveness.

The scale is administered to the participants before and after the experiment to measure the level of enhancement of each of the control and the experimental groups. French, West, Elander, and Wilding (1993) cited seven (7) types of decision-making styles in the decision-making questionnaire they have developed. These styles are:

a. ***Thoroughness***: this happens when "being open to analyze costs and benefits which are associated to a certain decision" (Stein & Stein, 1998 as cited in Crăciun, 2016), that is to say; the decision-maker becomes active and engages him/herself in the analysis and the evaluation of the decision to be made. In the questionnaire of French, West, Elander, and Wilding (1993), thoroughness is represented by:

- Making decisions with consideration of all of the implications
- Planning well ahead
- Working out all the pros and cons before making a decision
- Decision making a purposeful logical process

Therefore, thorough decision making refers to a thoughtful, purposeful, deliberate process; in which the decision-maker engages him/herself into the analysis of the decision through studying its benefits and disadvantages of it evaluating them. Moreover, this style is related to the rational style in the literature (French, West, Elander and Wilding, 1993).

b. ***Control*:**The second decision-making style is "control" which is "feeling under control" (Stein & Stein, 1998 as cited in Crăciun, 2016). In the questionnaire, Control is referred to by:

- Enjoying making decisions
- Remaining calm when one has to make decisions very quickly?
- Feeling in control of things
- Preferring to avoid making decisions if one can
- Finding it difficult to think clearly when one has to decide something in a hurry.

Consequently, this style has to do with the affective side of the decision-maker and the ability to be in control of things when making decisions. This involves enjoyment during the decision-making process, remaining calm in short time decisions, decision making avoidance, and thinking clearly in short time decisions.

c. ***Social resistance***: this style has to do with making decisions in accordance to the social environment and this includes: "denying external advice" (Stein & Stein, 1998 as cited in Crăciun, 2016); in the questionnaire, this styles involves:

- Liking to consult with others
- Making up one's own mind about things regardless of what others think

- Avoid taking advice over decisions.

d. ***Hesitancy***: Stein & Stein (1998) claim that"showing a tendency of changing courses of actions"(as cited in Crăciun, 2016). This style in the questionnaire is represented by these items:

- Changingone's mind about things
- Taking the safe option if there is one
- Favouring first one option then anotherwhen making decisions

At this style level, the decision makers are cautious when making decisions; they tend to make the safest decision and favoring one over the other as it takes to the safest outcome.

e. ***Instinctiveness***: this style bases on "using intuition or feelings to make decisions" (Stein & Stein, 1998 as cited in Crăciun, 2016). It is represented in the questionnaire by:

- Relying on 'gut feelings' when making decisions
- Sticking by one's decisions come what may

f. ***Principled or Idealism****:*Stein & Stein (1998) defines it as "emphasizing principles instead of practical aspects" (as cited in Crăciun, 2016);

- Whether one's decisions governed by their ideals regardless of practical difficulties
- whether practicalities more important than principlesin one's decision making

The decision making in this style tends to make a decision based on their principles without taking into consideration the difficulties of practicing this decision. According to Golding (1963), the decision is principled if it is guided by some external consideration; these external considerations include reason and the outcome of the decision.

g. ***Optimizing* or *perfectionism***: it includes the following items in the decision making questionnaire:

- When one finds one option that will just about do, does s/he leave it at that.
- Whether one carries on looking for something better even if s/he has found a course of action that is just about OK.

That is to say, this principle has to do with the process of looking for perfect outcomes or a perfect decision even if the decision-maker has a decision that solves the current situation.

That is to say; whether a person is a content with a simple decision or s/he tries to arrive at complete and perfect things.

According to French, West, Elander, and Wilding (1993), this questionnaire is used to demonstrate and/or to measure the relationship between the research variables. They claim that this questionnaire is based on the respondents' ability to report their feelings and attitudes and behaviors in a "fixedresponseformat" (French et al., 1993).

IV.5.5. Research process diagnostic tests

Each test includes three activities for each of the research phases: the data collection phase, the data analysis phase, and the data interpretation test. These tests are made in order to find out the learners' difficulties as well as the learners' needs concerning both statistics content and statistical language and to which extent the learners are able to make decisions at each level. At the end of the experimentation, an overall test is made to check the development of their decision making.

IV.5.6. Needs evaluation questionnaire

This questionnaire is administered to the teachers at the department of English at the University of BEJAIA, mainly the teachers who are supervising Master's students. The questionnaire, thus, aims at supporting the study results that will enable us to design the statistics syllabus which is based on learners' needs.

IV.5.7. Students Interview

This interview is conducted with our participants after accomplishing their Master 2 dissertations and after defending their works. The interview aims at investigating the role that statistics education plays in supporting their decisions in their graduation research.

IV.6. VALIDITY AND RELIABILITY OF THE STUDY

IV.6.1.Internal and External Validity:

This study investigates the effect of statistics education on EFL students' decision-making skills during the research process. Regarding the type of our investigation -which seeks for investigating a cause and effect relationship- we see that it is important of explaining and proving the internal validity of our research that shows the correctness of the cause and effect inferences we come to conclude throughout this study. Our main hypothesis suggests that statistics education fosters the Master 1 EFL students' decision-making skills during the research process. In pursuance of this primary aim, we follow the procedure of quasi-experimental design where we ensure both total manipulation and control of the learning environments. We introduced statistical lectures for two semesters to Master 1 applied linguistics specialty where we have worked with different research steps. In order to assess the decision-making development, we employed pre and post-tests and used decision-making scales; where pre-tests and scales are given before the manipulation phase. However, with the existence of other research methodology-related modules, one would ask whether the development of decision-making skills is due to our manipulation or due to other modules? For this reason, we opt for the methodology of "if x, then y; if not x, then not y". This refers to the employment of a control group that has not been manipulated. Although the differences in the title of the research modules (of control and experimental groups), both groups have two research modules in which students have learned how to conduct research and how to organize the research steps. Moreover, both groups are engaged in writing research proposal tasks, they are approximately at the same age, we got approximately the same percentages of both genders, they come from the same generation at the 3rd-year level. The only difference between the two groups is that the experimental group is engaged in statistics education (presence of x) and the control group is (no x). Based on this, we may say that the results obtained throughout our experimental study are due to the introduction of our independent variable. Furthermore, we supported our results of the experiment with other tools like questionnaires and interview to give as many details as possible about our variables.

Concerning the extent to which our results can be generalized (external validity), we would say, it hard to assert at 100% about the representativeness of the sample of the population. Regarding the sampling method (cluster random sampling) in which the population of Master 1 is already pre-divided by the administration, and that we had been given the group according to the course management system (CANVA) of Master 1 Applied Linguistics (to who statistics is designed to be taught), the generalization of the results is, then, not possible at 100% although our tests indicated that results are statistically significant.

IV.6.2. Reliability of the study

Internal consistency Cronbach Alpha tests ($\alpha1$ for the pre-tests and $\alpha2$ for post-test) of reliability revealed a low-reliability level for both pre and post scales ($\alpha1$ =.42 & $\alpha2$ =.43). However, it is worth mentioning that since the decision making scale assesses seven (7)

DIFFERENT decision-making styles, we see that it is invalid to use the Internal Consistency Test (Cronbach alpha) because this test is used to know whether the used instruments measure the same construct or the SAME idea. However, the Decision Making Questionnaire of French DJ, West RJ, Elander J, and Wilding JM in (1993) is designed to investigate people's decision making styles or behaviors, namely: thoroughness, hesitancy, control, social resistance, intuitiveness, principled, and optimizing.

CONCLUSION

This study aims to find out the cause and effect relationship between statistics education and decision-making skills. Besides this basic aim, other aims are ordained by the nature study. In order to develop the students' decision-making, we need a statistics syllabus that helps them to make logical links between the different steps that constitute the scientific research studies. In order to do that, we investigated the needs of Master's studentss' challenges and problems when conducting research works for the sake of inducing decision-making difficulties among these students. In addition, we want through this study to help the students to change their negative attitudes towards studying and using statistics and quantitative research in general.

Therefore, in this chapter, we reviewed the research methodology that we follow in order to reach the above-cited aims of the study and to answer the research questions. As is mentioned above we opt for a quasi-experimental study with Master 1 students where a mixed methodology is employed. More specifically, we start by analyzing Master two dissertations to investigate the problems and errors they commit. We employ the Decision-Making Questionnaire to measure the students' decision-making skills before and after introducing them to statistics, we use two questionnaires (pre and post) to explore the students' attitudes, we employ diagnostic tests to measure the students' soundness of their decision before and after the treatment, we used a needs evaluation questionnaire addressed to the teachers at the department of English, University of BEJAIA to investigate the needed content to be taught to Master's studentss, and finally, we conduct an interview with a group of the sample students after their graduation from Master two to explain how did the lectures they had in statistics module help them to accomplish their research works and mainly to make their decisions during the research process.

CHAPTER V: RESULTS OF THE STUDY

INTRODUCTION

This research study investigates the effect of statistics education on EFL learners' decision-making skills during the academic research process. The study's experimentation is conducted with 25 Master's studentss and another group of Master (25 students) have been selected as a comparison group.

This chapter presents the results obtained for the whole study. This includes the results of the pre-study: dissertations analysis, pre-questionnaire, the pretests, and pre-scale in addition to the Post Study that includes: the error analysis results, post questionnaire, the post-tests, the post scale, the interview results, and finally Teachers questionnaire.

V.1. ERROR ANALYSIS OF MASTER TWO STUDENTS' RESEARCH PROJECTS

Master two students in the department of English at the University of BEJAIA have the opportunity to choose between training in secondary or middle schools, or to conduct research and write dissertations; however, at their Master level, the students should prepare a research proposal. In the research methodology unit (Master 2 level), we asked the students to carry on the research projects that they started in Master 1 and conduct a real research project with a literature review (summarized) and a complete practical part, discussions, and recommendations. Therefore, we collected the students' research projects to analyze their deficiencies in the research methodology.

V.1.1.Description of the sample

In an attempts to explore the students' research decision lacunas at each research step, we conducted an error analysis on a sample of 82 research projects performed by 292Master 2 (the academic year of 2016-2017) students where each research project is done by six students (a group decision making). The following table illustrates the types of research that have been studied:

Table1: Types of the research projects understudy

The works	*Frequency*	*Percentage (%)*
1. Cause and effect	74	90.24
2. Exploratory	6	7.32
3. Correlation	2	2.44

Total	82	100

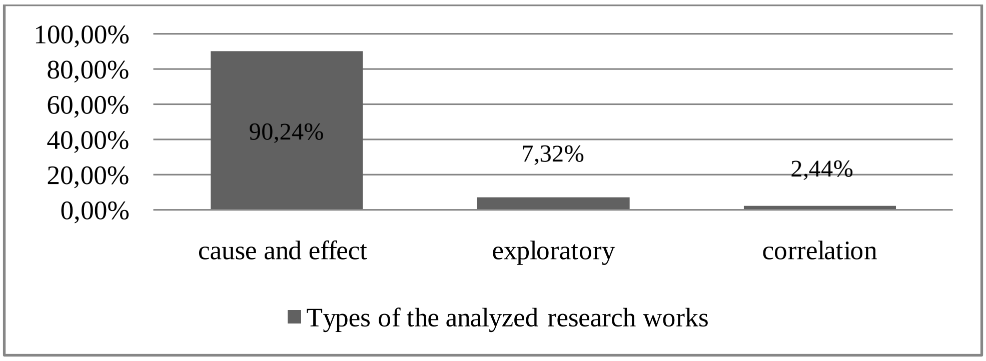


Figure 5: description of the research projects under study

As it is demonstrated by the above table and figure, the majority of works (90.24%) fall under the category of cause and effect research, few (7.32%) of the work are exploratory (descriptive) research, and fewer are correlation-based research works.

Through this section, we aim at analyzing, identifying, and describing the different errors that students make when conducting a research project. We base on the errors that are related to our research aim and that will help in the elaboration of statistics' education-based syllabus.

V.1.2. The findings

Based on the analysis of the errors that Master's studentss committed when making a research project, we find that most students commit errors at the level of 9 steps of the research which are: at the levels of title, variables, aim & research questions, hypothesis, sample and population, research design, methods and tools, data analysis, presentation & reading and finally data interpretation, discussion, and conclusion.

a. *Errors at the level of the research title*:

Table: 2: Types of Errors at the Level of the Title

Errors illustrations	*frequency*	*Percentage (%)*
1. Titles' grammatical structure and choice of words	9	10.59
2. Do not use specific variables in the title	25	29.41
3. Tittles are not complete	51	60
Total number of errors	85	100

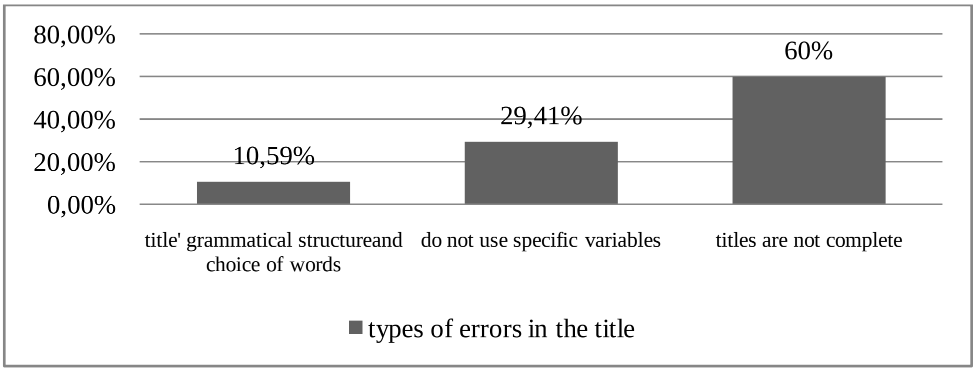


Figure 6: Title’s main errors

The above table and figure demonstrate the errors committed at the level of the titles. We can see that the total number of errors is 85 (100%) where 60% of these errors represent incompleteness of the project titles. The titles mainly miss either the case study or aim word (like reducing, developing fostering, the role, the importance, the effect, impact, the relationship, and so on). Furthermore, 29.41% of the errors represent the inability of the students to utilize specific variables; that means the variables they use are large or general (the effect of ICTs, communication skills …etc). Finally, 10.59 % of the errors are not following grammatical errors or they employ ambiguous words or the words are not appropriate, these errors make the title incomprehensible and ambiguous.

b. *Errors at the level of the research variables*

Table 3: Types of Errors at the level of Variables

Errors illustrations	***F***	***(%)***
1. They do not know what an independent variable and a dependent variable are and when to use them.	7	17.5
2. They use wide range of variables inside the work (they do not stick up to their main variables).	26	65
3. In descriptive studies, they are unable to locate their main variable and whether they are dependent or independent.	2	5
4. They do not make a difference between cause and effect variables and correlation variables (the type of relationship that exists between the variables)	5	12.5
Total number of errors	40	100

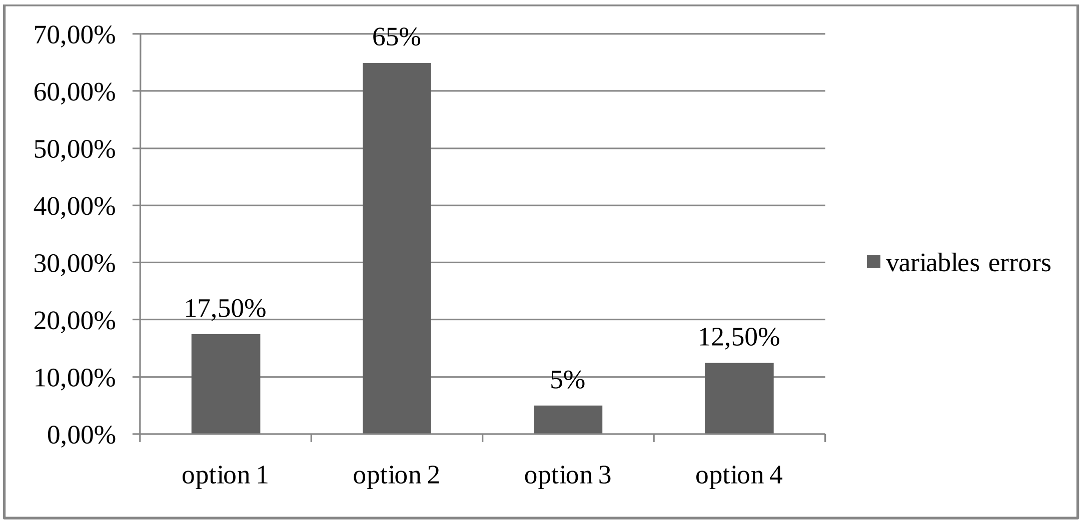


Figure 7: Types of Errors at the level of Variables

The above table and figure demonstrate the types of errors that are made at the level of the variable section. As is exposed in the above table, the total number of variable related errors are 40 (100%) where 65% of the errors represent the use of variables that are different from the main variables because the students think these words are synonymous where they are not; that is to say, the students tend to use a wide range of variables inside the work (they do not stick up to their main variables), in this concern, many students use variables like collaborative, cooperative, group work as synonyms, but when looking to their definitions ad principles in context we find that they are different. Moreover, 17.5% of the errors claim that students do not know what an independent variable and a dependent variable are and when to use them. Furthermore, 12.5 % of the errors are that the students do not make a difference between cause and effect variables and correlation variables (the type of relationship that exists between the variables). Finally, 5% of the errors at the title level relate to the inability of the students to locate their main variable and whether they are dependent or independent.

c. *Errors at the Levels of Research Aims and Research Questions*:

Table 4: Types of Errors at the level of Research Aims and Research questions

Errors illustrations	***F***	***(%)***
1. Disagreement between the aim cited in the title and the aims cited along other sections in the works (including research aims, hypothesis, and methodology sections).	22	30.55
2. Changing the type of the research throughout the study (between descriptive, correlation, and cause and effect).	30	41.67
3. They cannot state accurate aims to their studies (in research aim's section, students do not differentiate primary and secondary aims in	12	16.67

	their studies)		
4.	Disagreement between the research questions and the aim of research	8	11.11
	Total number of errors	72	100

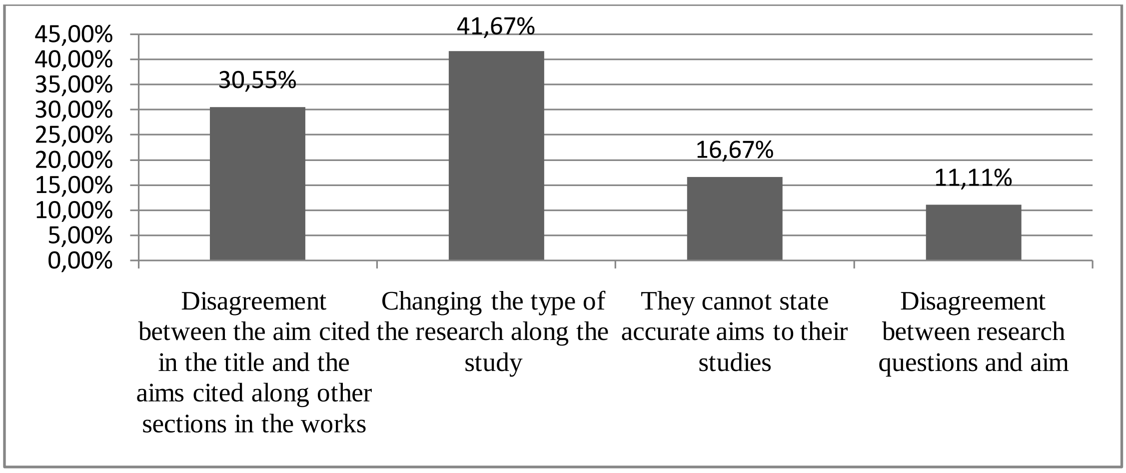


Figure 8: Types of Errors at the level of Research Aims and Research questions

The table above portrays the different errors that Master's studentss make at the levels of research aims and research questions. As we see the total number of errors in this section is 72 (100%) wherein 41.67% of these errors the students change the type of the research along the study (mix between descriptive, correlation, and cause and effect). The students here mainly claim at the beginning they aim at testing the cause and effect relationship of the independent and the dependent variables but in the practical part, they say that they aim to describe the attitudes of students towards one or both variables. Besides, 30.55% of these errors represent when students mix between different aims throughout the study, for example in so studies the main aim is to "test the effect of anxiety of test performance"; however, the students "hypothesize that anxiety has a negative effect of students' motivation and participation". In the methodology section, they say "in order to test the students' anxiety in oral sessions we opt for a descriptive design".

In addition, 16.67 % of the errors represent the situation where students cannot state accurate aims to their studies (research aims section). When the students tend to describe their aim, they confound it with research significance or they mix between their primary and secondary aims (in a study that investigates the effect of cooperative learning on students speaking abilities. When writing their aims, the students claim that their primary aim is to investigate how teachers deal with negative aspects the cooperative activities. Similarly, in 11.11% of the errors, the students ask research questions that are not adequate with the research aim. For instance, one of the works claims that the aim of the work is to test the effectiveness of e-blogs on developing the third years' writing skill. In the research question, students ask questions like: how does a questionnaire help in reaching good results?

d. *Errors at the level of Hypotheses*

Table 5: Students' errors at the level of hypothesis:

Errors illustrations	***F***	***(%)***
1. They change the dependent variable in the aim	8	10.52
2. The structure of the cause and effect hypothesis is wrong	30	39.48
3. They write a hypothesis in form of question(s)	8	10.52
4. They write a hypothesis that has no relation with the aim	7	9.21
5. They do not know what is a hypothesis (if we use a questionnaire ...)	1	1.32
6. Structure of the correlative hypothesis	3	3.95
7. Including a hypothesis to descriptive studies	5	6.58
8. They do not include a hypothesis in case of cause and effect	2	2.63
9. They make many hypotheses to one aim	10	13.16
10. Do not make a difference between a hypothesis and an assumption	2	2.63
Total number of errors	76	100

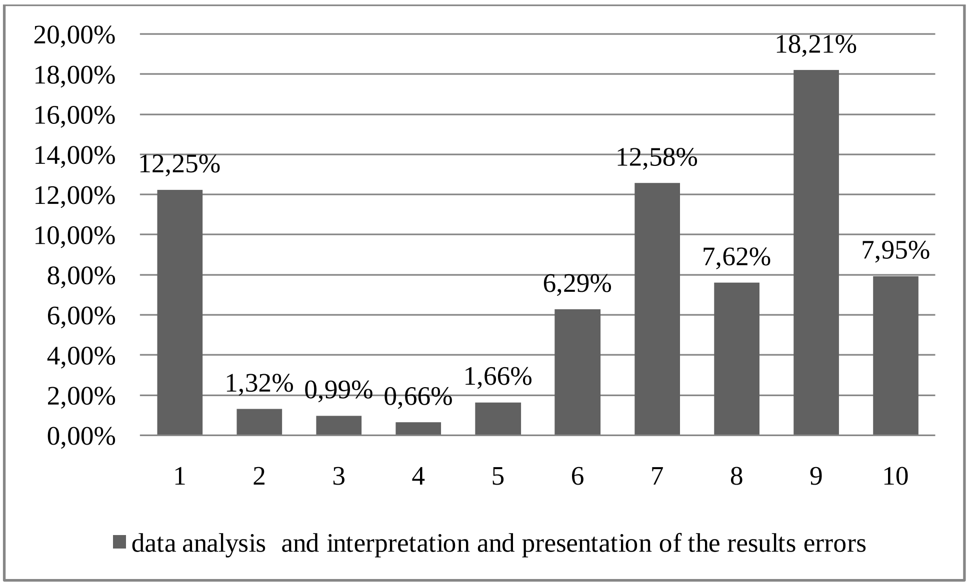


Figure 9 : Students' errors at the level of hypothesis

The above table and figure show that the total number of errors at the level of hypothesis is 76 (100%). As it is shown, 39.48% of the errors are in the structure of the cause and effect hypothesis. Moreover, 13.16 % of them have to do with making a lot of hypotheses when the aim of the work is only one. In addition, 10.52% of the errors are when students change the dependent variables; and in the same percentage (10.52%), the students write the hypothesis in form of questions. Furthermore, 9.21 of the errors are when students write hypotheses that have no relation with the aim. 6.58% of the errors in the projects understudy relate to when the students include a hypothesis to the descriptive studies, and we find 3.95% of the errors in the structure of the correlative hypotheses. Besides, 3.63% represent the errors of the students who do not make a difference between a hypothesis and an assumption; and similarly, 2.63% of the errors appear when the students do not include a hypothesis in case of cause and effect. Finally, 1.32% of the errors are illustrated when the students do not know what a hypothesis is (for instance, they hypothesize that if they use a questionnaire, they will reach valid results).

e. *Errors at the level of Sample and Population*

Table 6: students' errors at the level of sample and population

Errors illustrations	***F***	***(%)***
1. They do not include the description of the population	3	3.57
2. They do not include a description of the sample	4	4.76
3. They do not explain the sampling method	26	30.95
4. They do not argue and justify their sampling method decision	5	5.95
5. Both sampling method and argumentations are missing	44	52.38
6. They do not know which one is the sample (e.g. teachers or students)	2	2.38
Total number of errors	84	100

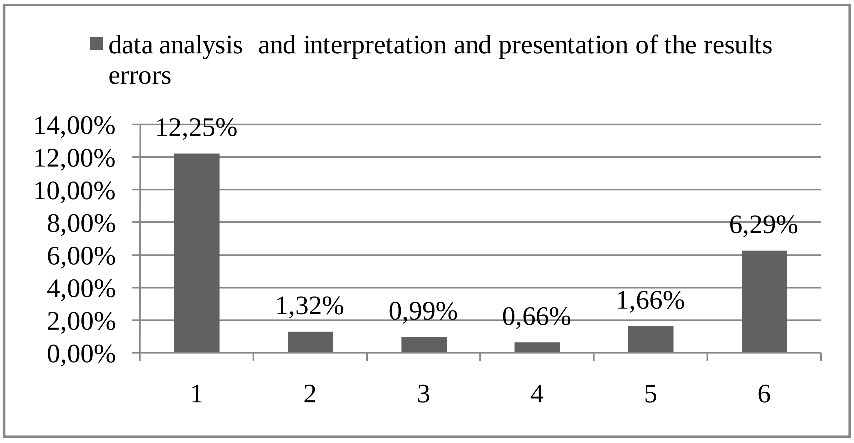


Figure 10: students' errors at the level of sample and population

The above table and figure report the students' errors found in the section of population and sample of Master two students' research projects. As we may see, the total number of errors is 84 (100%) where 52.38 % represent the errors where both sampling method and argumentations are missing; moreover, 30.95% of the errors are when the students do not explain the sampling method, 5.95% of the errors are the errors where the students do not argument and justify their sampling method decision. Furthermore, 4.76% of the errors refer to when students do not include a description of the sample, and 3.57 of the errors are when the students do not include the description of the population. Finally, 2.38% of the errors are when they do not know which one is the sample (here: the work bases on the role of ICTs in enhancing students speaking abilities and the researcher administered a questionnaire to teachers; in this case, the students claim that the sample is the teachers)

f. Errors at the level of Research Design

Table 7: Students' Errors at the level of research design

Errors illustrations	***F***	***(%)***
1. They do not differentiate between experimental and descriptive (non-experimental) designs	9	8.82
2. They do not justify the design choices	6	5.88
3. They do not know what is a design (APA design, qualitative design …etc)	6	5.88
4. They do not know the types of design (experimental method, descriptive method …etc)	13	12.75
5. They do not cite the design in the report	30	29.41
6. They use two design to test investigate ONE aim or answer ONE question	4	3.92
7. They do not differentiate between true, quasi, and pre-experimental designs	4	3.92
8. They do not know the right design to test the cause and effect relationship between independent and dependent variables.	30	29.41
Total number of errors	102	100

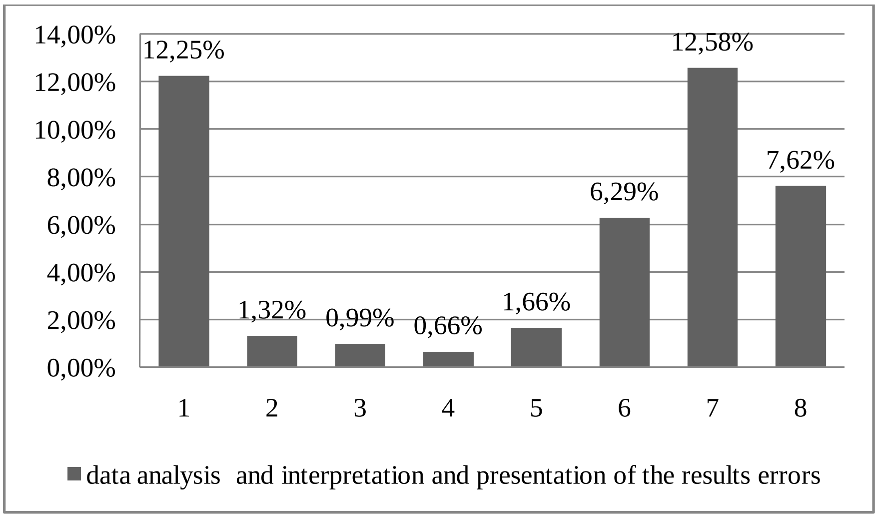


Figure 11: Students' Errors at the level of research design

The table and the bar chart above show that the different errors made in the part of the research design's total number of errors is 102 (100%). We may see that 29.41% of the total number of the errors represent the works that do not cite anything about the design; and similarly, 29.41% of the errors are represented by the inability of the student to know the right design to test the cause and effect relationship between independent and dependent variables, they mainly tend to use the descriptive design with employment or questionnaires as a tool. Moreover, the students in 12.75 of the errors do not know the types of design (experimental method, descriptive method …etc). Furthermore, in 8.82% of errors, the students do not differentiate between experimental and descriptive (non-experimental) designs as they use them interchangeably along the study sections. 5.88% of the errors represent the inability of the students to justify the design choices and in 5.88 % of the errors, the students do not know what is a design (the students claim that they use an APA design or a qualitative design …etc). Finally, the students in 3.92% of the errors use TWO designs to test investigate ONE aim or answer ONE question, and in 3.92%, they do not differentiate between true, quasi, and pre-experimental designs (as the students claim that use a true experimental design when they have not a control group ... etc.).

g. *Errors at the level of the Research Methods and Tools*:

Table 8: Errors at the level of research methods and tools

Errors illustrations	***F***	***(%)***
1. Disagreement between tools and methods and design	28	16.76
2. They use qualitative method to examine an influence or an impact	12	7.19
3. They mix between design and method	13	7.78
4. They do not justify or argue their choices (random decisions)	41	24.55
5. The arguments they provide are not appropriate or are wrong	4	2.4
6. Disagreement between the methodology (methods, tools and design) and the research aim (they are not appropriate to achieve the aim)	24	14.37
7. No information about when they administered the tools (pre or post ...etc)	4	2.4
8. No method cited in the research dissertation	22	13.17
9. They do not differentiate between the method and the methodology	2	1.2
10. They do not know the different research tools and their roles	15	8.98
11. The tools reported in the general introduction and the practical part are not the same	2	1.2
Total number of errors	167	100

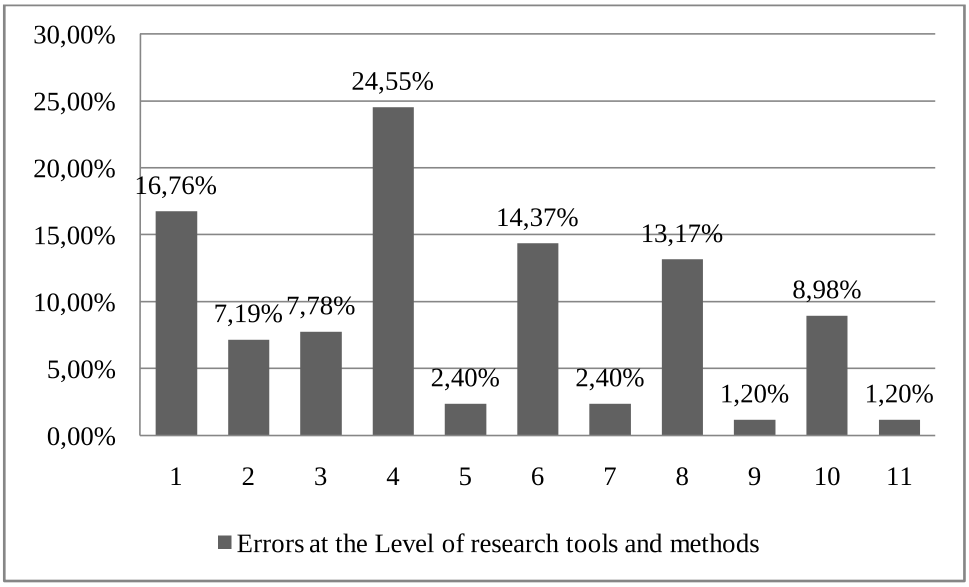


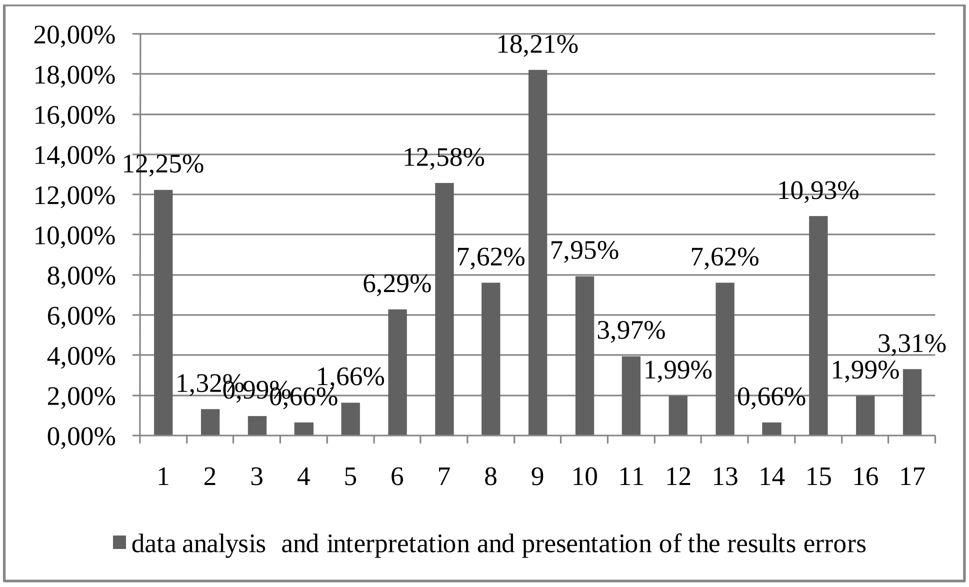
Figure 12: Errors at the level of research methods and tools

The table and the figure above show that the total number of errors at the level of research methods and tools is 167 (100%). More specifically, 24.55% of the total errors in this section are that the works do not include justifications or argumentations for their research methods and tools' decisions. Moreover, 16.76% of errors relate to the works which involve a disagreement between tools and methods and design; that is to say for instance the students may decide to investigate the effect of oral presentation projects in reducing communication apprehension, they tend to use a qualitative method and a questionnaire as a tool. In addition, 14.37% of the errors include disagreement between the methodology (methods, tools, and design) and the research aim (they are not appropriate to achieve the aim), as illustrated in the previous example, the methodology followed will not lead to valid results. More to the point, 13.17% of errors are that the works have not cited any method, in 8.98% of the errors, the students do not know the different research tools and their roles and in 7.78% they mix between design and method (the students claim that they opt for a descriptive method or experimental method); besides, the 7.19% of the errors in the works is that students use qualitative method to examine an influence or an impact. 2.4% of errors in the works are that they provide arguments to their decisions concerning methods and tools which are not appropriate or are wrong. Likewise, 2.4% of the total errors is that the students do not provide information about when they administered the tools (pre or post ...etc). Finally, in 1.2 % of the projects' errors relate to the fact that the students do not differentiate between the method and the methodology, and similarly, 1.2% of works' errors state that the students did not report the same tools in the general introduction and the practical part.

h. *Errors at the level of data analysis, interpretations and the presentation of the results*

Table 9: Errors at the level of data analysis, interpretations and the presentation of the results

Errors illustrations	***F***	***(%)***
1. There is no data analysis part	37	12.25
2. They do not know the difference between data analysis and data collection	4	1.32
3. They present the results of one tool only (in case they said they use two or more tools)	3	0.99
4. They do not know how to compare pre and post-tests	2	0.66
5. They present all the results of all the questionnaire in one paragraph or one figure	5	1.66
6. The choice of figures is random (they use mainly bar and pie charts)	19	6.29
7. They cannot display the tables in the right way (through Microsoft Word)	38	12.58
8. They make the tables' reading before the tables	23	7.62
9. There are no titles to the tables and the figures	55	18.21
10. They do not read the tables/figures	24	7.95
11. They do not use figures when needed	12	3.97
12. They present figures without tables	6	1.99
13. The tables' shapes (where to put the values, in lines or columns)	23	7.62
14. They mix different types of figures in one tool's results	2	0.66
15. They do not use the technical abbreviations and words for the data (like N they use it for frequency, Average for mean, and so on)	33	10.93
16. They do not know what to report in the data they collected	6	1.99
17. They just read the most frequent options in a questionnaire's results	10	3.31
Total number of errors	302	100



Figures 13: Errors at the level of data analysis, interpretations and the presentation of the results

The above table represents the different errors committed by the students at the level of the data analysis, interpretation, and presentation of the data [302 (100%)]. As we may see, 18.21% of the errors in this section are that the works do not include titles to the tables and the figures. 12.58% of them are that the students cannot display the tables in the right way (through Microsoft Word), 12.25% errors stand for the works which do not include a practical part, 10.93% of the errors represent the works do not use the technical abbreviations and words for the data (like N they use it for frequency, Average for mean and so on). Moreover, 7.95% of the errors stand for the works that do not involve the reading to tables and/or figures, 7.62% of errors in this section relate to making the tables' reading before the tables, and 7.62% of the errors in the works involve errors in the tables' shapes (where to put the values, in lines or columns). In addition, in 6.29% of errors, the choice of figures is random (they use mainly bar and pie charts so randomly where there aim for each). 3.97% of the errors are that the works do not contain figures when needed and 3.31% of the total errors relate to the fact that the works contain readings of the most frequent options in a questionnaire's results instead of reading the whole tables. In 1.99% of the errors, the students do not know what to report in the data they collected, and in 1.99% of the errors, they present figures without tables. Other errors involve that the students present all the results of the questionnaire in one paragraph or one figure (1.66%), they do not know a difference between data analysis and data collection (1.3%); besides, they present the results of one tool only (in case they said they use two or more tools) (0.99%). Finally, 0.66% of the errors in analyzed works are related to the fact that the students do not know how to compare pre and post-tests and similarly in 0.66%, they mix different types of figures in one tool's results.

i. *Errors at the level of results discussion and conclusions*

Table 10: the students' errors at the level of results discussions and conclusion

Errors illustrations	***frequency***	***Percentage (%)***
1. No discussion of results part	73	57.03
2. Discussion of results before the presentation of the data	2	1.56
3. The confound data interpretation and discussions	2	1.56
4. They make conclusions without sufficient evidence	46	35.94
5. They generalize results without sufficient evidence and arguments	5	3.91
Total number of errors	128	100

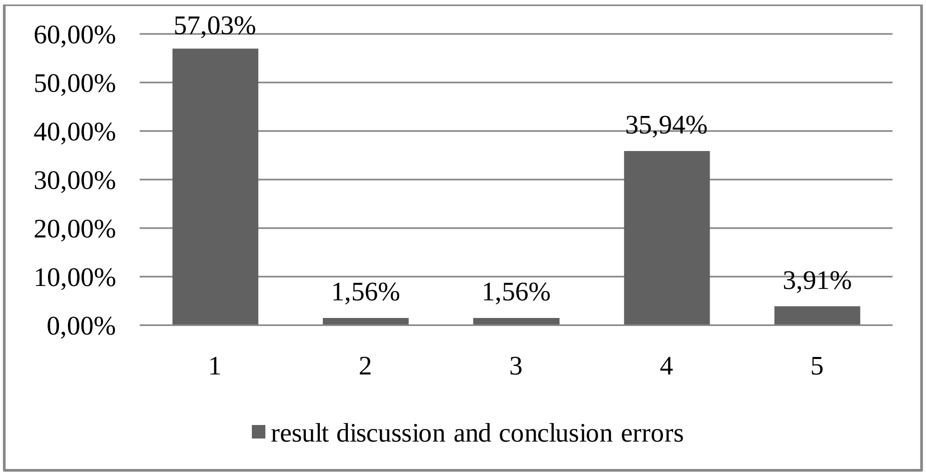


Figure 14: The students' errors at the level of results discussions and conclusion

The last section of the research process involves the results discussion and the conclusions. Therefore the above table and figure demonstrate the errors that we marked when analyzing the Master two research projects and the conclusions and through which we can see that the total number of the errors in this section is 128 (100%). Particularly, the majority of the errors (57.03%) show that the works do not involve a discussion part while in 35.94% of the total errors the students make conclusions without sufficient evidence. Moreover, in 3.91% of the total errors students generalize the results without evidence or arguments. Other errors include the students discussing the results before the presentations of the results (1.56%) and similarly, in 1.56% of the errors, students confound data interpretation and discussions.

j. Comparing the total errors of all the sections

Tables 11: the total number of errors

Error levels	***Frequency***	***%***
1. Errors at the level of the research title	35	3.48
2. Errors at the level of the research variables	40	3.98
3. Errors at the level of the research aim	72	7.16
4. Errors at the level of the research hypothesis	76	7.55
5. Errors at the level of the research population and sample	84	8.35
6. Errors at the level of research design	102	10.13
7. Errors at the level of research methods and tools	167	16.60
8. Errors at the level of data analysis, interpretations, and the presentation of the results	302	30.02
9. Errors at the level of results discussion and conclusions	128	12.72
Total number of errors	1006	100

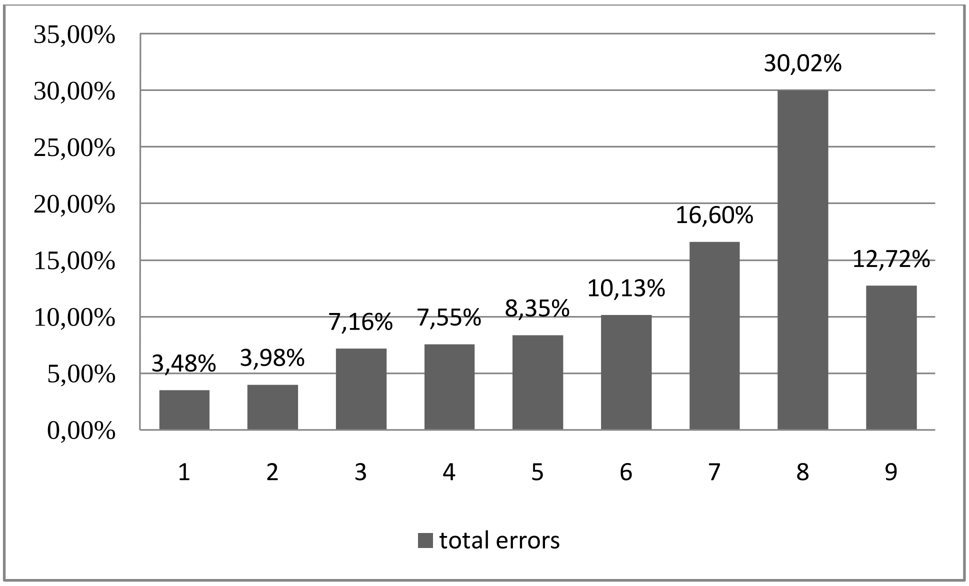


Figure 15: the total number of errors

The above table and figure demonstrate the total number of errors committed in all the research works. As we may see we find 1006 errors (100%) where the majority of errors are at the level of data analysis, interpretations, and the presentation of the results (30.02%), whereas 16.60 % of the total errors are found at the level of research methods and tools. Furthermore, 12.72% of the errors are committed at the level of results discussion and conclusions and 10.13% of the errors are made at the level of Research Design. In addition, we find that 8.35% of errors happen at the level of the research population and sample and 7.55% of the errors occur at the level of hypothesis. Finally, we find 7.16% of the errors in the section of research aim, 3.98% in the section of research variables, and 3.48% at the level of the research title.

To conclude, the error analysis aimed at describing, classifying, and defining the different errors students made when conducting research projects. We have found that the majority of the errors happen when the students analyze the data and present the in addition to the errors in the research methodology and the research title variable and hypothesis at low rates. However, it is worth mentioning that we found other errors which we have not cited as they are not related to our topic of research. Among these errors, we cite the reference errors (both in-text and reference list), plagiarisms, at the level of APA styles, spelling and grammatical errors, and so on.

V.2. PRE QUESTIONNAIRE RESULTS

V.2.1. The Questionnaire Description

In an attempt to quantify and describe the students' attitudes towards their lack of research and decision-making in research, we administered this questionnaire to both the experimental and control group. The questionnaire consists of five sections:

- The first section of the questionnaire aims at describing the participants who were under study. It constitutes of questions about age, genders, and the number of years studying English. These three have a major impact on people's decision making this is why we wanted to have control over them by ensuring the same characteristics with the control group).
- The second section is designed to describe the students' knowledge in research methodology and the different problems they met when making preliminary research.
- The third section aims at describing the students' awareness about the importance the decision-making in academic research, how they evaluate their decision making and the different problems they face when making decisions in research.
- The last section investigates the students' attitudes and expectations towards learning about statistics before introducing the module.
- Section five is reserved for further suggestions.

The questionnaire is then handed to 25 students for the experimental group and 25 copies were distributed to the control group. The following table describes the number of handed and returned copies:

Table 12: The response rate of the pre questionnaire

	handed		Returned	
	F	%	F	%
Experimental pre-questionnaire	25	100	21	84%
Control pre-questionnaire	25	100	25	100

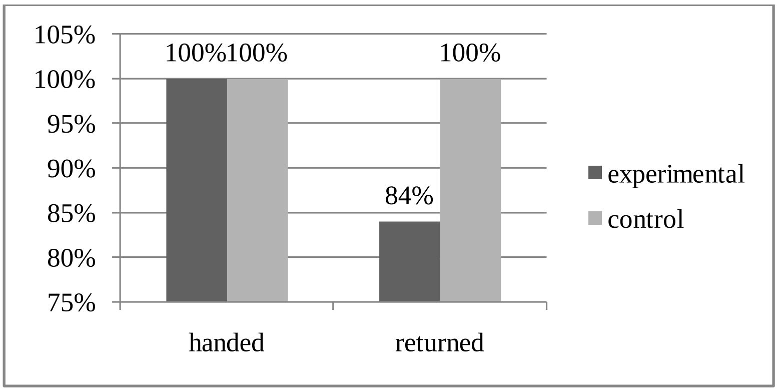


Figure 16: The response rate of the pre questionnaire

V.2.2. the Pre-Questionnaire's Findings

The results of the questionnaires are processed by the IBM SPSS Statistics 19 and they are presented in the following section:

1. ***Participants' Age***:

Table13: Experimental and Control groups' age

	Experimental Group		**Control Group**	
	F	%	F	%
22 years old	13	61,9	11	44,0
23 years old	7	33,3	13	52,0
24 years old	0	0	1	4,0
25 years old	1	4,8	0	0
Total	21	100	25	100

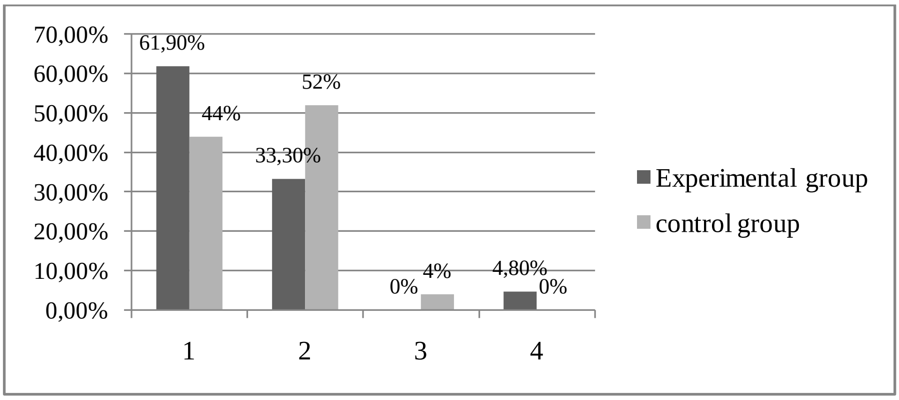


Figure 17: Experimental and Control groups' age

The above table and figure describe the experimental and control group's age. As we may see, 61.9% of the experimental students are at the age of 22; 33.3% of them are at the age of 23 and 4.8% are at the age of 25. Furthermore, as it is shown, the majority of the control group students (52%) have 23 years old while (44%) have 22 years old. Finally, 4% of the participants have 24 years old.

2. ***Gender***:

Table 14: Experimental and Control group's Gender

	Experimental group		**Control group**	
	F	***%***	***F***	***%***
Male	1	4,8	2	8,0
Female	20	95,2	23	92,0
Total	21	100,0	25	100,0

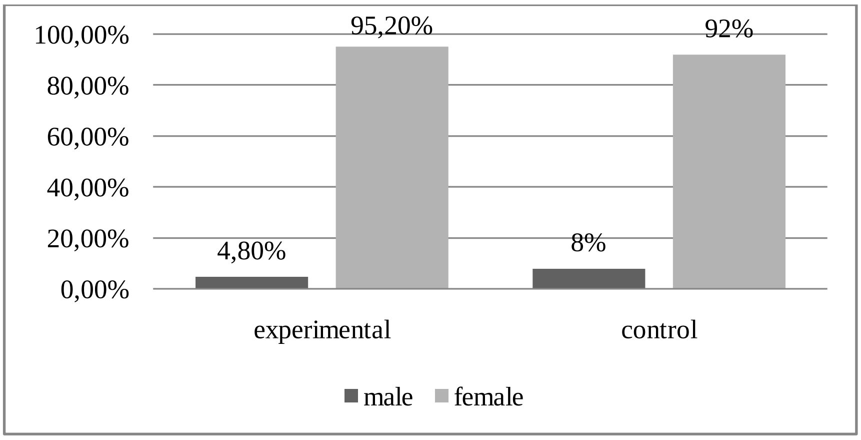


Figure 18: Experimental and Control group's Gender

The above table demonstrates the gender distinction among participants in our experiment. As it is shown, the majority of the participants are females (95.2%) and only 4.8% are male. Moreover, we observe from the above table that the majority of the students who participated in our study are female (92%) whereas (8%) are male.

3. ***How many years have you been studying English at the University***:

Table15: Participants' number of years studying at University

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
4 years	15	71.4	20	80.0
5 years	6	28.6	5	20.0
Total	21	100%	25	100.0

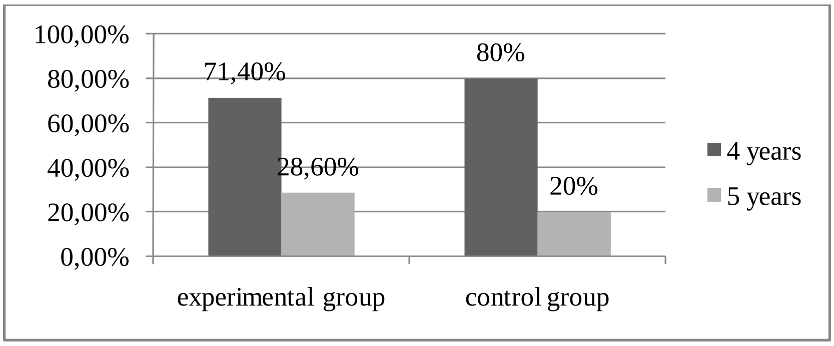


Figure 19: Participants' number of years studying at University

The majority of the participants (71.4%) have studied English for 4 years at the University where 28.6% have studied English for 5 years. The latter may be mainly those who have repeated or blocked the academic year. Concerning the control group, the table shows that most (80%) of the participants have been studying English for 4 years at the University while 20% of them studied for 5 years.

Section II: Academic Research

This section is designed to describe the students' knowledge in research methodology and the different problems they met when making preliminary research. The results are presented in this result section:

4. ***How long have you been studying research methodology***?

Table 16: Participants' Number of Years studying Research Methodology

	Experimental group		Control group	
	F	**%**	**F**	**%**
3 years	0	0	1	4.0
4 years	21	100.0	22	88.0
5 years	0	0	2	8.0
Total	21	100.0	25	100.0

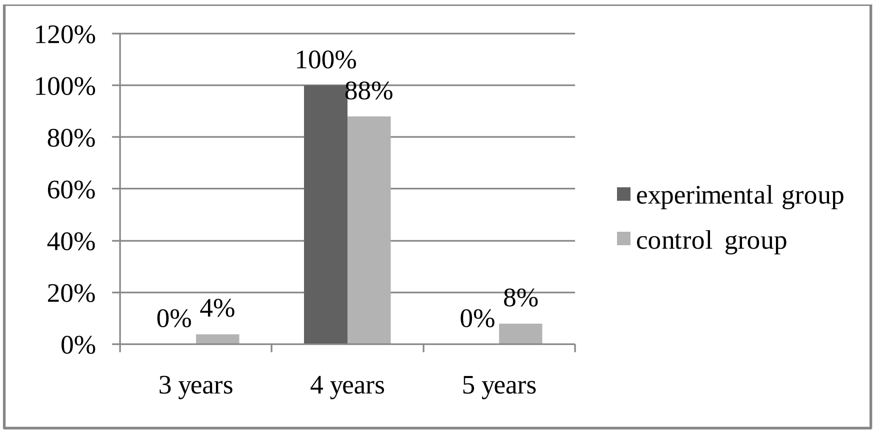


Figure 20: Participants' Number of Years studying Research Methodology

The module of research methodology is significant and indispensable as the final research projects of the students focus on their knowledge of how to conduct research. All the participants (100%) in our experiment have studied research methodology for 4 years.

We have asked the control group students about the number of years through which they have studied research methodology at the University. We find that most of them studied it for 4 years (88%) while only 8% studied for 5 years and only 4% studied it for one year.

5. ***How often did they conduct a preliminary research work(s)***?

Table 17: how often Students Conducted Preliminary research works

	Experimental group		Control group	
	F	**%**	**F**	**%**
Once	7	33.3	4	16.0
Twice	10	47.6	16	64.0
more than twice	4	19.0	5	20.0
Total	21	100.0	25	100.0

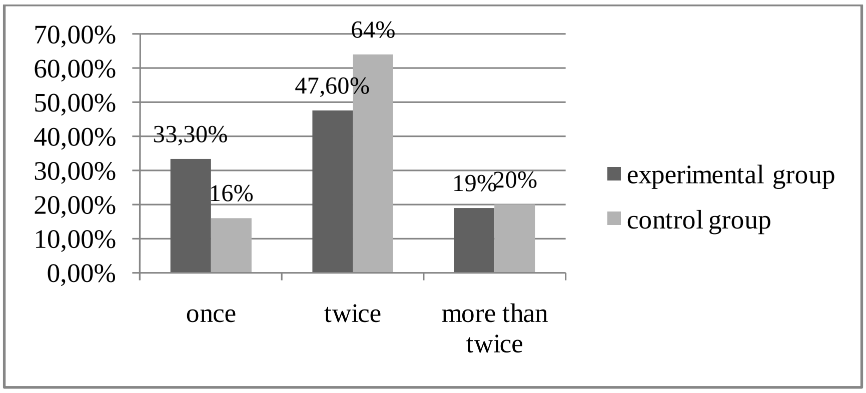


Figure 21: how often Students Conducted Preliminary research works

As we can read from the table, most of the experimental group’s students (47.6%) have conducted preliminary research twice where 33.3% say that they had undertaken only once. Finally, 19% claim that they had more than twice.

The above table and figure also summarize the students’ responses towards the number of times of conducting preliminary research work for the control group. We can observe that the majority conducted the research twice (65%) then 20% conducted it more than twice and finally, 16% conducted it once.

5.*a. Explanation*:

The majority of the experimental participants claimed that they have conducted preliminary research works (a research proposal mainly and some trials to apply the research proposal) starting from the second year at the university as an evaluation project in the module of research methodology. The few students who did not conduct the research in the second year declared that they had an experience with research in their third year. Then, all the participants said that they will have a research article for this current year (Master 1) which will present another experience for them.

The majority of the control group students explain that they have conducted research proposals and plans for research starting from their first years at the University. The majority then claim that the preliminary research (which they refer to as research proposal) has been conducted in their first and second years. Some others claim that they have done another research in their third year. Some reported that they have dealt with some questionnaires but were theoretically in their third year. Finally, all those who responded have claimed that they have a research project for their Master one where they will write a research article.

5.*b. What kind of problems did you meet in conducting these works*?

- *Experimental Group*:

As an attempt to understand the experimental group students' challenges when conducting the preliminary research works, we asked the participants to list the problems they faced. We have summarized the major problems in the following list:

- References
- Literature review, how to limit it (what to include and what not to include)
- How to use and how to deal with the data
- They know the steps but not how to apply them
- Differentiating research methods
- Research topics and references
- They do not know what to do with the data
- Lack of information about the topic
- Data collection and how to avoid plagiarism
- They do not know how to follow the research steps
- Deciding about the appropriate research design
- Low rate of questionnaire's responses
- Problem Statement
- The lack of mastery of methodology
- The data collection methods
- Misunderstanding about the research methodology, methods and tools

- *Control group*:

This question mainly asked the control group students to list the challenges they have met most frequently in their research. Their main answers are summarized in the following points:

- Writing down literature review, references and abstracts
- Deciding on the research topic and data analysis
- Defining the research problem
- Formulating research questions and in all other steps
- They do not receive any feedback about the work they submitted
- Difficulties in conducting research and collecting information

- Having a problem when moving from a step to another
- We do not really master the research methodology and literature review
- Time management
- They do not master all the research steps.
- Formation of research questions

6. ***What did help you <u>MORE</u> in completing these research projects?***

Table 18: factors that helped the students to accomplish the works

	Experimental group		Control group	
	F	**%**	**F**	**%**
Your personal effort (autonomy, inquisitiveness, intuition ...etc)	8	38.1	14	56.0
research methodology lectures	9	42.9	10	40.0
classmates, peers and or teachers	11	52.4	17	68.0
Total	/	/	/	/

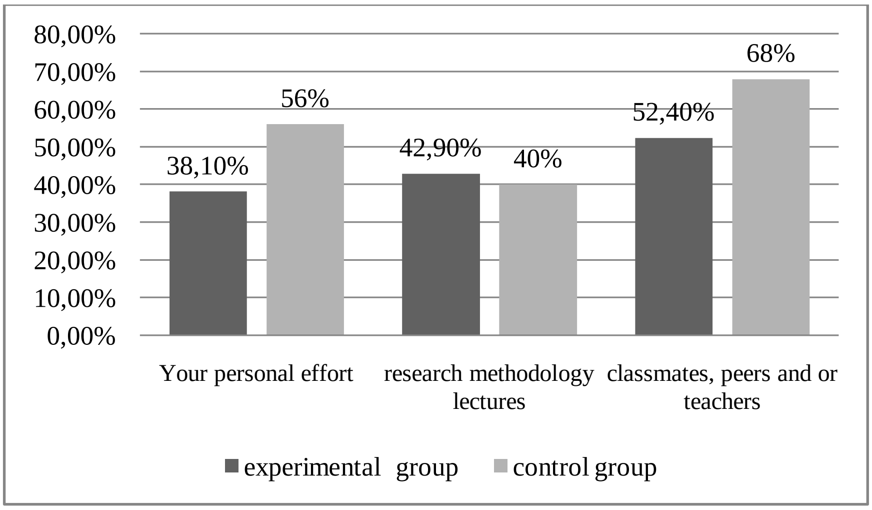


Figure 22: factors that helped the students to accomplish the works

We asked the experimental participants about what helped them in accomplishing their methodology-based projects. We can see that most of them (52.4%) maintain that the projects are done with the help of their classmates, peers, and teachers. Furthermore, 42.9% claim that it is the lectures of methodology that helped them; and finally 38.1% of them assert that due to their own efforts.

The above table also demonstrates the factors and strategies that helped the control group's students accomplish their projects. We see that the majority of the students (68%) see that their works have been completed with the help of their classmates, peers, and/or teachers. Others (56%) see that their own efforts, their autonomy, their inquisitiveness, and their intuition help them complete their research works. Others (40%) claim that the lectures on research methodology helped them.

Others Suggestions

The experimental group:

The majority of the experimental group's students added that the project is accomplished due to the Internet and websites, examples from previous works, experienced friends, libraries, personal effort, previous dissertations in the library, their own motivation, and so on.

The control group:

We opened a space in our questionnaire for the control group's respondents to list other factors that help them. The students explain:

- The orientation of the teacher helps them to understand the work better
- The lesson of how to conduct a research work and move from one step to another
- Internet where they get information and understand whatever they need and understand research steps,
- They use books

7. ***How do you perceive your acquired knowledge in research methodology***?

Table19: Students' evaluation of their Knowledge in research methodology

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Poor	5	23.8	3	12.0
Average	15	71.4	19	76.0
Good	1	4.8	2	8.0
No opinion	0	0	1	4.0
Total	21	100.0	25	100.0

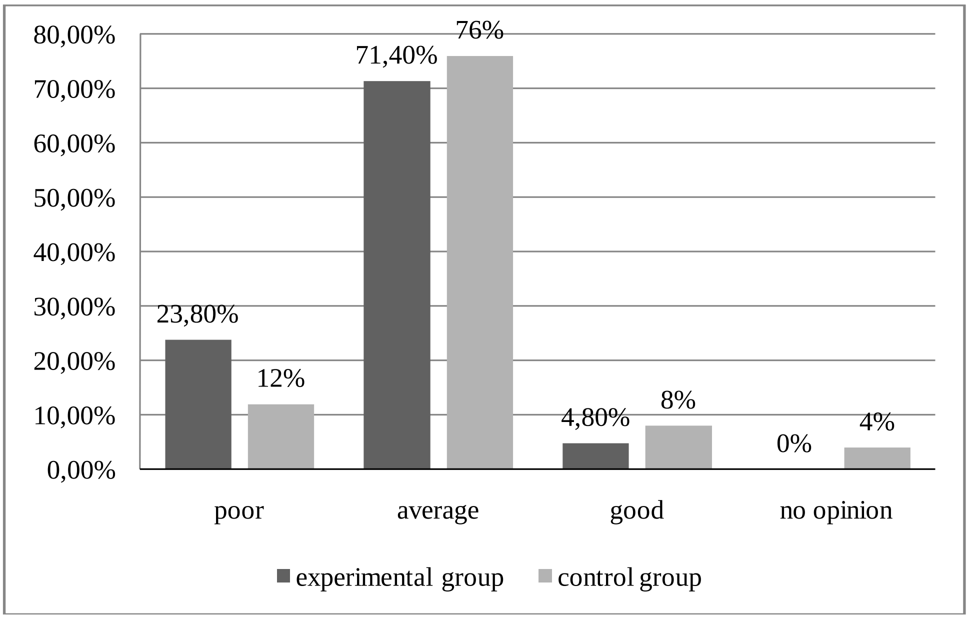


Figure 23: Students' evaluation of their Knowledge in research methodology

Most of the experimental students (71.4%) evaluate their methodology knowledge as being average. Whereas (23.8%) claim that their knowledge is poor. Finally, only (4.8%) argue that they have good knowledge. For the control group, the majority of the students (76%) perceive their knowledge in research methodology as average, (12%) of them perceive it as poor. Only 8% of the respondents see that they have good knowledge and 4% have not expressed their opinion.

8. What is (are) the most difficult phase (s) in the research?

Table 20: The most difficult phase (s) in research

	F	**%**	**F**	**%**
1. Deciding about the right topic of interest	11	52,4%	7	28,0
2. Defining and representing the research problem, aims, hypothesis …etc	4	19.0%	0	80.0
3. Collecting the data (tools, sampling, application …etc)	9	42.9%	11	44.0
4. Deciding on the data Analysis methods	10	47.6%	14	56.0
5. Making interpretations and drawing conclusions from the data obtained	6	28.6%	22	88.0
Total	/	/	/	/

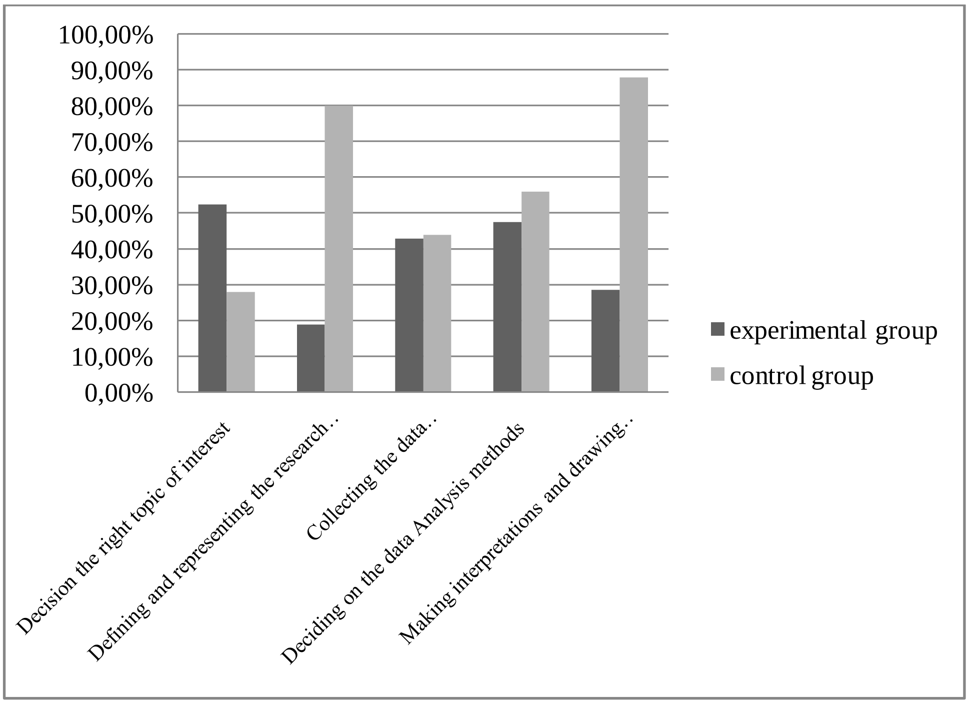


Figure 24: The most difficult phase (s) in research

We attempt to specify more the problems that students face in research. For the experimental group, we can see that the majority of them (52.4%) claim they face problems at the level of deciding on the right topic of interest. 47.6% face problems in deciding on the data analysis methods. In addition, 42.9% of the participants argue that they face problems with collecting the data that includes decisions about data collection tools, sampling methods, and application of the research. Moreover, 28.6% face challenges at the level of interpreting the data and drawing conclusions. Finally, 19% confront difficulties when defining and representing the problem under study, research aim, and hypothesis …etc.

For the control group, we see that the majority of the students (88%) find making interpretations and drawing conclusions as the most difficult phase. Moreover, 80% of the respondents find that defining and representing the research problem, aims and hypothesis, and so on as the most difficult research step while 56% find deciding upon the data methods as the most difficult. Furthermore, 44% of the participants find the data collection phase as the most difficult, and 28% find deciding about the right topic is the most challenging step of the research.

9. ***Explain the different constraints you have met during this (these) research work (s)? (What makes the above steps difficult?)***

To get more explanations about the above problems we asked the students to elucidate and give more details about the constraint they have met.

- *Experimental group*:

We have summarized the main explanations provided by the students in the below points:

- They cannot differentiate the types of data (quantitative or qualitative)
- The lack of feedback concerning the topics,
- The lack of knowledge about how to choose the sample and how to interpret the data.
- The lack of authentic evaluated experiences with the data (they were imagining the situations for some lectures like data analysis)
- The confusion between the research methodology, design, methods, and tools (they cannot differentiate them.
- They have a bad attitude towards research methodology lectures.
- It is hard to establish a relationship between the variables
- The inability to organize the data once they have them.
- The problem with how to construct an interesting topic, then how to collect the data, and how to analyze them.
- The theoretical part is the most difficult
- Lack of knowledge about methodology
- Lack of knowledge about research design,
- They cannot distinguish between the research variables and their types and the relationship between them.
- Difficulties in knowing what tool to use to reach their aims

- *Control Group*:

To have a deep description of the research challenges and the factors that push the students to feel that the above steps are challenging, we opened them this space to express their opinions. They maintain that:

- The topic should be interesting and relevant and this is very hard as a first experience

- They confused about whether the research needs qualitative, quantitative, or mixed methods
- They had problems with stating the variables and the relationship between them and stating the research problem in general
- They find difficulties in linking between variables
- They just based on the internet for all the research process
- They do not know how to move from an element to another
- The lectures focus only on theory and this did not help them develop research skills (they did not have enough practice, they had only theory).
- It is difficult to decide on the topic first and then the decision about what are the tools and the applications they should follow and which are suitable with the nature of the title and the problem.
- Some students chose a topic which they could not handle
- The literature review is time-consuming and the statistical part is complicated.
- Lack of experience and lack of knowledge in methodology: they cannot do anything autonomously;
- Concerning data collection, facing difficulties in finding information about the topic,
- Concerning drawing conclusions, They face difficulties in methods, they have not any idea about how to analyze and interpret and then draw conclusions

10. ***Do you think that the content of research methodology lectures provide you with the necessary knowledge to take the right decisions during the research process***?

Table 21: Whether research methodology lectures provide the students with the necessary knowledge to make the right decisions during the research process

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Yes	13	61.9	20	80.0
No	8	38.1	5	20.0
Total	21	100.0	25	100.0

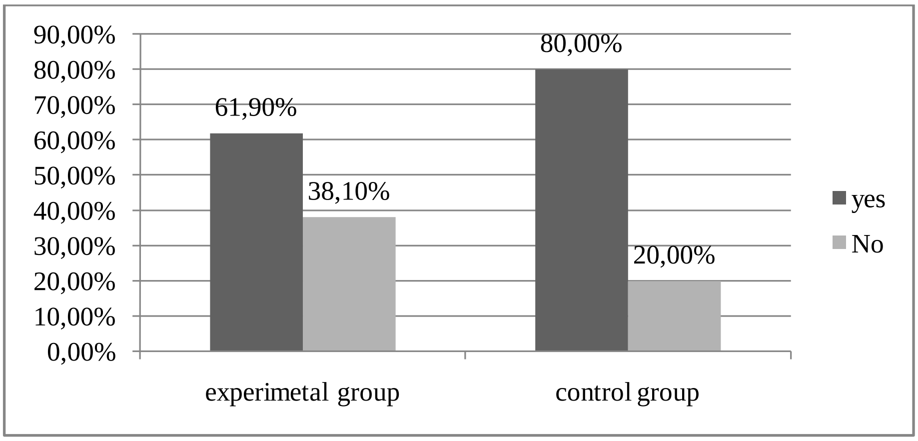


Figure 25: Whether research methodology lectures provide the students with the necessary knowledge to make the right decisions during the research process

The above table and figure represent the participants' attitudes towards whether the methodology lectures can afford the students with the necessary knowledge to make the right decisions during the research process. We can observe that the majority of the experimental group's students 61.9% claim that they provide the necessary knowledge and 38.1% say that they do not endow them with the necessary knowledge.

The table and figure also explain the control group students' attitudes towards whether research methodology lectures provide the necessary knowledge to make the right decisions during the research process. We can see that 80% say yes and 20% say no.

If "No", could you please list some of the points (content) that the Research methodology lectures did not include and that will help you more to take the decisions during the research process?

Even though the majority of the students said yes to the main question but they have also stated the shortcoming of these lectures. Most of the students based on the idea that all that they have studied in the Research methodology lectures were theoretical and this is the most repeated answer.

- The experimental group students claim that:
    - Research Methodology (RM) lectures base on theoretical information whereas research is practical. Basing only on the theory cannot help students to make the right decisions.

- Different research concepts seem to be similar and the theoretical research methodology does not offer authentic examples that make the students differentiate between them.
- Teachers provide different information so that the students feel confused.
- Lack of practice on the data collection and data analysis methods.
- Teachers rely on the students to discover the practical field of research.

- The control group answers to the above question are summarized in that:
  - The lectures help but the content not sufficient
  - What to include in the two chapters how to conduct statistics
  - The lecture base on general knowledge where the students' need very specific details
  - What kind of methods to choose and how to choose the methods that suit the problem; these are very important more than learning about what are the research steps.

Section III: Decision Making In Academic Research

11. ***Have you met any situation where you had to make decisions during the research process***?

Table 22: Whether the participants met decision making situations

	Experimental group		Control group	
	F	**%**	**F**	**%**
Yes	14	66.7	12	48.0
No	7	33.3	10	40.0
No opinion	0	0	3	12.0
Total	21	100.0	25	100.0

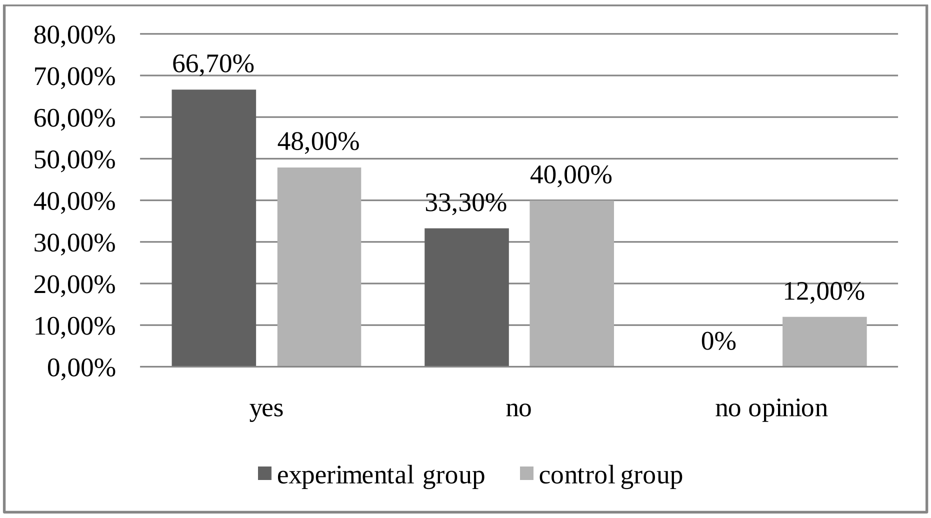


Figure 26: Whether the participants met decision making situations

The majority of the experimental group students (66.7%) claim that they had a situation where they had to decide their research. On another side, 33.3% say that they had not this situation. For the control group, 48% of the respondents had an experience where they had to make decisions whereas 40% claim that they had not any situation in which they have to decide on their projects. Finally, 12% did not express their opinions.

When was it?

For more details about the situations, we asked the students to explain when they had to make this (these) decision(s).

- *The experimental group*: The answers of the students are mainly summarized in the following points:

- Deciding about the topic (the variables, the relationship between them ...etc)
- The decision about the method and the design, references, sources to use …etc
- The decisions about collecting the data especially research design
- Every step of the research process

- *The control group*: The respondents explain that they had more likely to make decisions when (summarized):

- Formulating the problem and Writing the literature review
- Choosing the right methodology
- How to limit my research area and topic

- Deciding about the tools to choose, the method, and the research design
- When making a research proposal in the first year
- Deciding about the data analysis method

12. Which among the following research steps, you were very likely to make decisions?

Table 23: Research steps at which students had to make decisions

	Experimental		**Control**	
	F	**%**	**F**	**%**
The research topic of interest and topic formulation	10	47.6	13	52.0
Defining and representing the research problem	9	42.9	19	76.0
Collecting the data	1	4.8	18	72.0
Analyzing the data	6	28.6	21	84.0
Making interpretations and drawing conclusions from the data obtained	2	9.5	21	84.0
Total	/	/	/	/

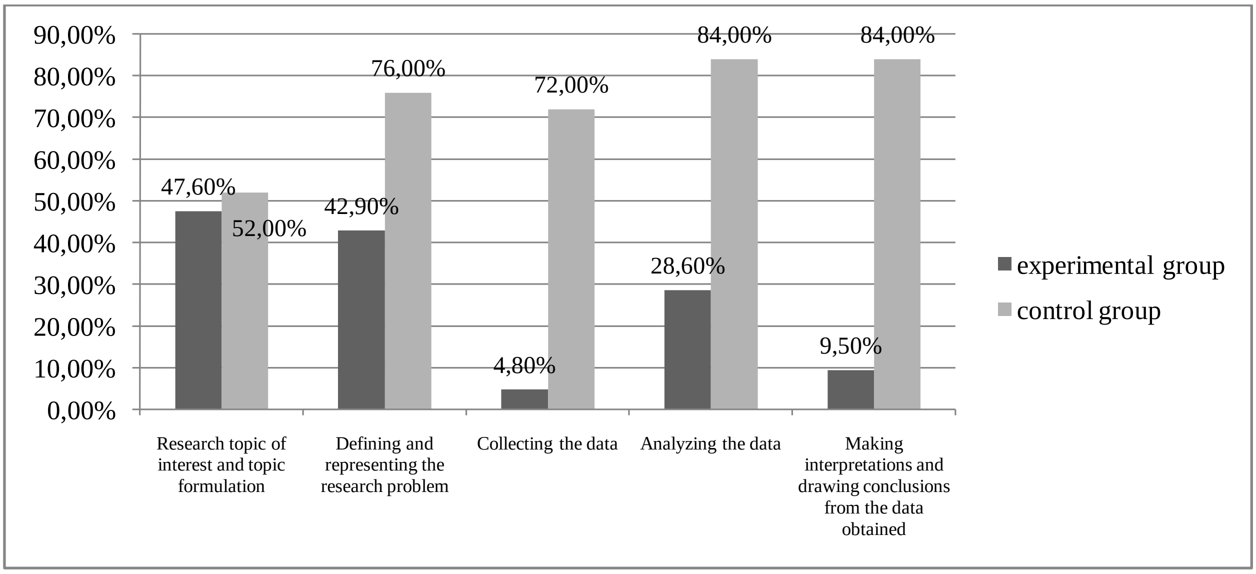


Figure 27: Research steps at which students had to make decisions

We provided the students with different steps at which the students have to make decisions. As we can notice from the experimental group's answers: 47.6% had to make decisions when they have to decide about the topic and to formulate it; moreover, 42.9% of them claim that they are more likely to make decisions when they have to define and represent the research problem. In addition, we find 28.6% of the participants are more likely to make decisions when analyzing the data; whereas, 9.5% of them argue that they are likely to make decisions when making interpretations and drawing conclusions. Finally, 4.8% of the participants are more likely to make decisions when collecting the data.

We can read from the table that 84% of the control group respondents say that they make decisions more at the interpretation and conclusions step. At the same rate (84%) say that they are more likely to make decisions when analyzing the data. Moreover, 76% of them claim that the decisions are more likely to be done when defining and representing the research problem. Besides, 72% claim that they make decisions more likely when collecting the data. Finally, 52% note that they do through the decision making process when deciding and formulating a research topic.

Which decisions to which research step have you been able to make?

We asked this question to ask for more details about the research decisions that the participants were able to make.

- *The experimental group*:

The students' answers are summarized in:

- The decision that was approximately reported by all the students is the decision about the topic and the problem to be studied.
- Then most of the students were able to decide on the research aims of the study
- Some students were able to decide on the hypothesis to solve the problem.
- The decision about what to include as research questions
- The decision about problem statement (after they make the title clear it will be easy to decide what to write in the statement of the problem)
- Decisions about whether the data are qualitative and quantitative
- Decisions about the variables

- *The control group*:

The students' decisions (that are mostly repeated by all the respondents) are summarized in the following points:

- All the students argued that they all made decisions about the topic which should be interesting suitable narrowed and so on.
- Deciding about the data which is appropriate to their topic
- Deciding about how to analyze the data
- Making interpretations and drawing conclusions.
- Deciding about the tools when collecting the data

13. ***Have you been confident about the different choices you had to take or you have been hesitating***?

Table 24: Participants' confidence towards their choices

	Experimental group		Control group	
	F	**%**	**F**	**%**
Confident	4	19.0	9	36.0
Hesitant	17	81.0	16	64.0
Total	21	100.0	25	100.0

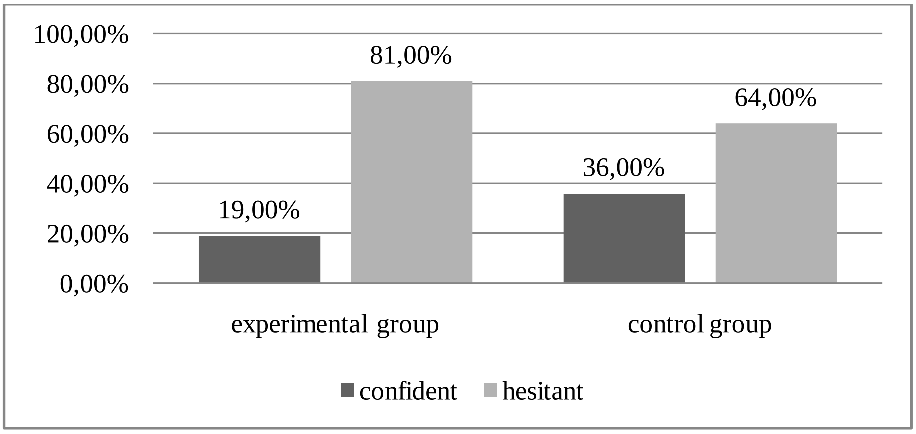


Figure 28: Participants' confidence towards their choices

The table and the figure represent the student's opinion about whether their level of confidence when making decisions. We can see that the majority (81%) are hesitant while 19% were confident. Concerning the control group, we notice that 64% of the students feel hesitant and 36% of them are confident.

Justifications:

- *The experimental group*:

The experimental students justified their answers about the above question:

- They are not sure of what the finding mean are they positive or negative concerning the aim or the hypothesis
- They were hesitant because they do not know whether the decision is right or not
- They feel they need to be guided.
- They cannot think of the next step (they can find neither chronological nor logical link between the research steps)
- They claim that they always ask peers and teachers about what they have to do because of the lack of information they have.
- They are hesitant because of the lack of background in methodology
- They always asking whether the results and the decisions are valid or not.
- They are hesitant because of the lack of experience

Those who were confident have not provided any justification of their confidence

. - *The control group*:

a. *Hesitant*:

- They don’t have a good experience in making decisions that is why they are hesitant
- It is impossible to be sure about research because data are changing (what they study
- Hesitant about variables and the topic
- They have not been supervised so they do not know whether their decisions are right or not.
- They feel sometimes that they do not collect the right information or they do not do the step as it should be.
- They do not know if they read enough or not to make the right decision
- Hesitant because they see everything difficult

b. *Confident*

- Because they check the information before they make their choice
- They are confident about the research topic because it comes from their inspiration
- Because all the choices were according to their interest so are sure.

14. ***What might be the challenges you might meet when making decisions during the research process***?

Table 25: Challenges met when making decisions

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
They are not enough knowledgeable about the research and about choosing the appropriate tools, methods, and designs.	12	57.1	11	44.0
The lack of knowledge about how to use research sources (references)	9	42.9	18	72.0
Do not know how interpret and critically evaluate the data obtained	11	52.4	16	64.0
Do not know how to get a conclusion from the data obtained.	0	0	23	92.0
Do not know how to present the results through tables, figures, and how to read them.	9	42.9	15	60.0
Total	/	/	/	/

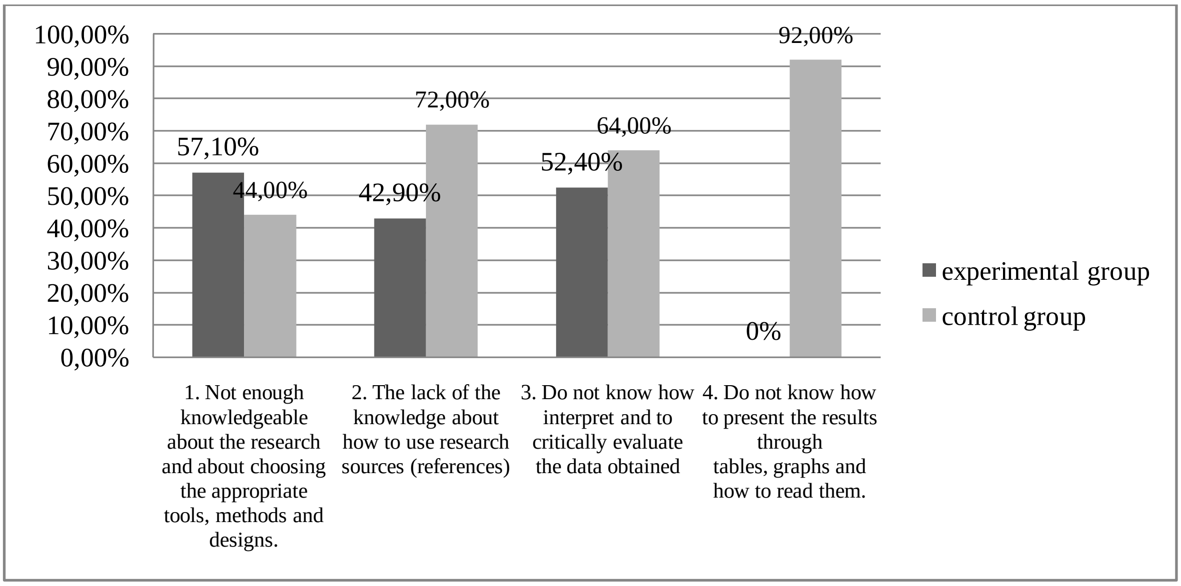


Figure 29: Challenges met when making decisions

The above table and figure present the decision-making challenges met by the participants when making research. As we can observe from the experimental group's results, 57.1% claim that they have not enough knowledge about the research, about choosing the appropriate tools, methods, and designs. 52.4% of the participants do not know how to interpret and critically evaluate the obtained data. Moreover, 42.9% find that they have a lack of knowledge about how to use research sources. Similarly, 42.9% of the participants do not know how to present the results through tables, figures, and how to read them. As we can see none of the students (0%) reported the challenges about drawing conclusions from the data.

We can see that the majority of the control group participants (92%) think that they do not know how to get a conclusion from the data, 72% have a lack of knowledge about how to use research sources. Then, 64% of the students do not know how to interpret and critically evaluate the data obtained. 60% do not know how to present the results through tables, figures, and how to read them. Finally, 44% do not have enough knowledge about the research and the appropriate research tools, methods, and designs.

15. ***According to you, what are the causes of these difficulties***?

Table 26: Causes behind decision making difficulties

	Experimental group		Control group	
	F	%	F	%
Lack of scientific reasoning	3	14.3	17	68.0
Lack of practice with authentic data	13	61.9	10	40.0
Lack of statistical knowledge and education	8	38.1	17	68.0
All above	6	28.6	20	80.0
Total	21	142.9	/	/

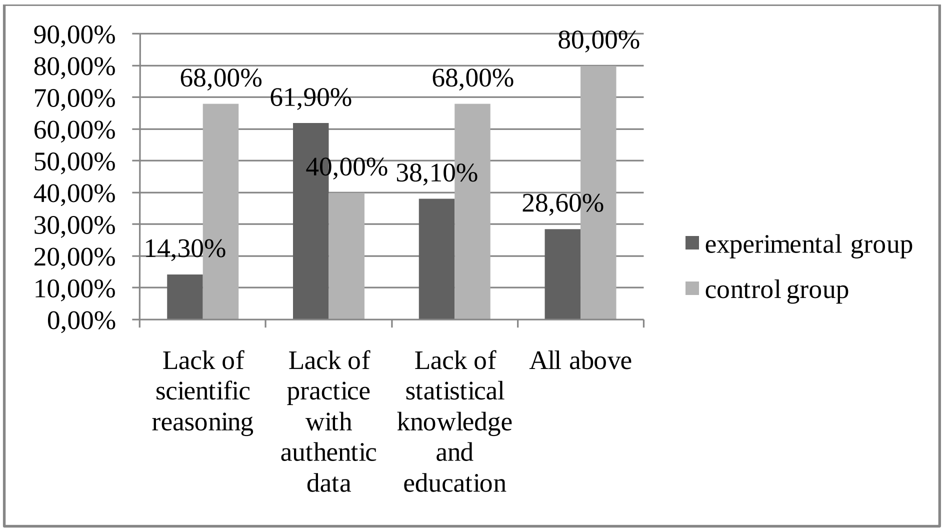


Figure 30: Causes behind decision making difficulties

The above table and figure reveal that the majority of the experimental group students (61.9%) find that they face problems because of the lack of practice with authentic data. Then, 38.1% maintain that the above challenges are met because of the lack of statistical knowledge and education while 14.3% argue that it is because of scientific reasoning. Finally, 28.6% claim that the challenges are because of all the provided options.

Concerning the control group, The majority of the students (80%) think that they met these challenges because of the lack of scientific reasoning, the lack of practice, and the lack of statistical knowledge and education. however, 86% think that the main cause is only the lack of scientific reasoning; at the same rate, 68% think that the only cause is only the lack of statistical knowledge and education. Finally, 40% claim that the main cause for these challenges is the lack of practice with authentic data.

16. ***Are you confident about the systematic way of defining a research problem and resolving it***?

Table27: Participants confidence towards the systematic way of defining a research problem and resolving it

	Experimental group		**Control group**	
	F	%	F	%
Yes	8	38.1	12	48.0
No	13	61.9	8	32.0
No answer	0	0	5	20.0
Total	21	100.0	25	100.0

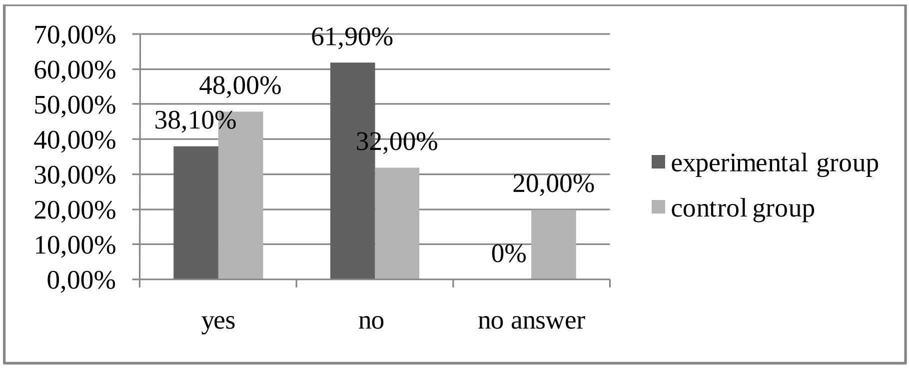


Figure 31: Participants confidence towards the systematic way of defining a research problem and resolving it

The table and figure show the level of participants' confidence concerning the scientific way of defining a research problem. As it is demonstrated in the table, 61.9% of the students claim that they are not confident, whereas 38.1% claimed that they are confident. They also present the control group students' confidence about the systematic way of defining a research problem. We see that 48% are sure and 32% are not and 20% did not express their opinion.

What is the procedure you use to solve your research problems with enough reasoning?

The experimental group had not provided any answer to this question whereas the control group's answers are summarized in the following points:

- Asking teachers for help and guidance to not mix things or to be out of the topic;
- Collecting information using questionnaires, samples, and so on
- Relying on an observation made on a specific population.
- Check online to see the point of view of specialized research works;
- Asking someone who is experienced or having more knowledge about the topic;
- Identifying the problem, reading books, and asking teachers

17. ***When do you think of the appropriate research design***?

Table 28: thinking about the research design

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
before the data collection	16	76.2	9	36.0
After the data collection	5	23.8	9	36.0
No answer	0	0	7	28.0
Total	21	100.0	25	100.0

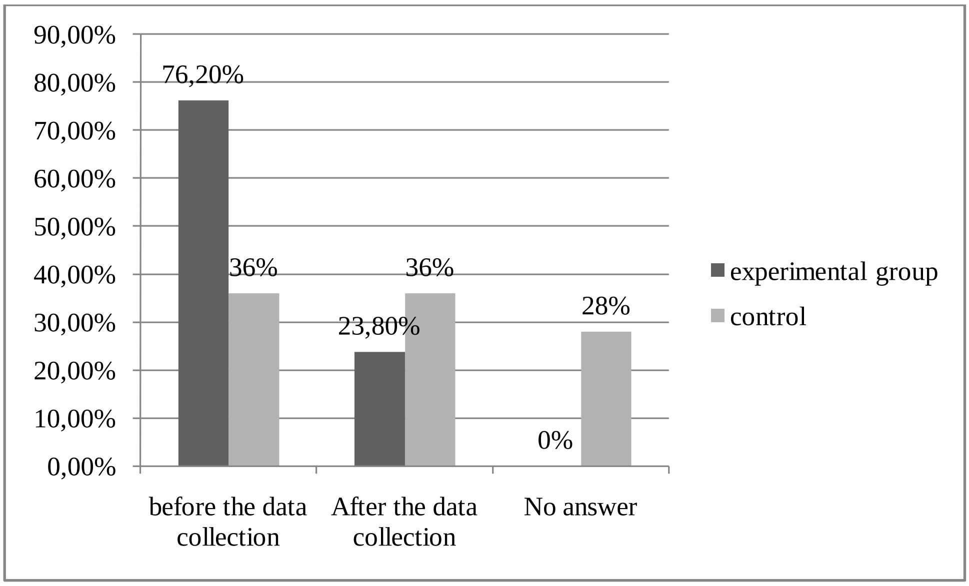


Figure 32: thinking about the research design

The above figure representations show the experimental group students' procedure when deciding about the research design. We observe that 76.2% of the students think about their design before the data collection and 23.8% think of the research design after the data collection. The table also shows when the control group students decide on the research design. We see that 36% decide upon the research design before they collect the data, and 36% decide after the data collection. Finally, 28% have not provided an answer.

Explanations and Justifications:

We have summarized the students' justifications and comment about the above questions if the following points:

- *Experimental group*:

- They think of the design after thinking about the research methodology and research tools
- They claim that they think about it before in order to not mix the different tools and methods
- They think about it before because it encloses the whole research
- They think about it before because it provides information about the methods and tools

- *Control group*:

For those who said after:

- To see whether the research design is appropriate for their research problem or it is not.
- They say after because the step of research design comes after the data collection step.

For those who said after:

- to understand my research well and resume time
- to have the idea clear in their minds of how to proceed in their research work

18. ***Are you always confident about your own decisions during the research decisions***?

Table 29: Whether participants are confident about the decisions

	Experimental Group		Control group	
	F	%	F	%
Yes	6	28.6	10	40.0
No	15	71.4	9	36.0
No answer	0	0	6	24.0
Total	21	100.0	25	100.0

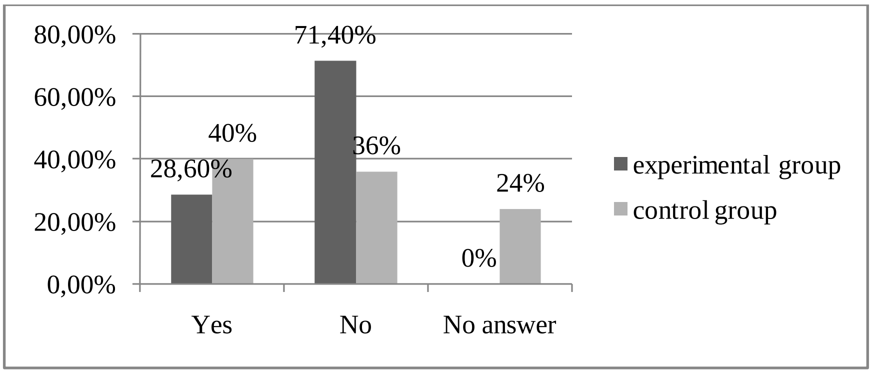


Figure 33: Whether participants are confident about the decisions

The table demonstrates the students' confidence when making research-related decisions. We read from the table that 71.4% of the experimental group participants do not feel confident and 28.6% are confident. For the control group, we can see that 40% are confident and 36% are not confident while 24% did not show their opinion.

19. ***When you have to choose among alternatives during your research process, do you effectively justify your choice or do you proceed randomly***?

Table 30: Whether participants provide justifications to their choices or give random choices

	Experimental group		Control group	
	F	%	F	%
giving effective reasons	8	38.1	9	36.0
random choices	13	61.9	9	36.0
No answer	0	0	7	28.0
Total	21	100.0	25	100.0

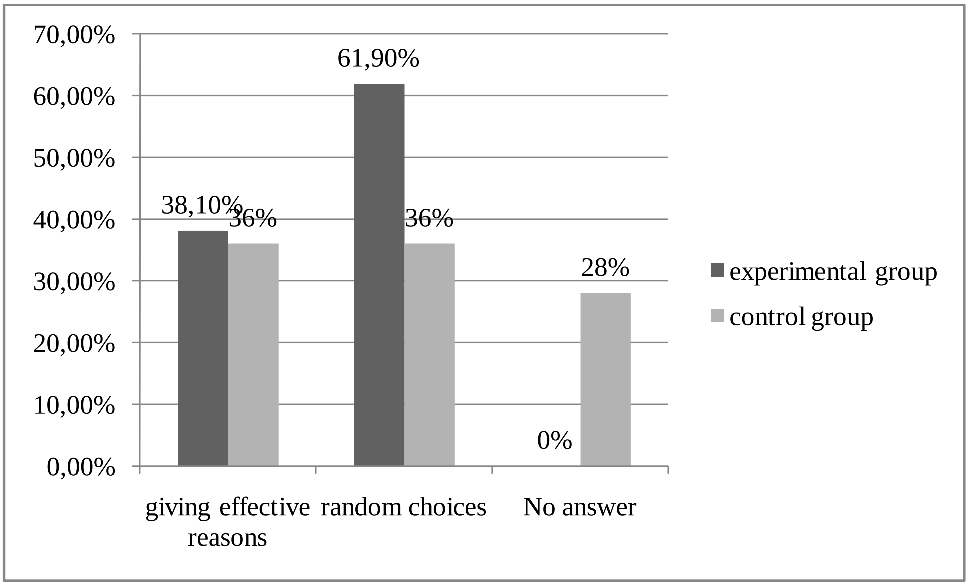


Figure 34: Whether participants provide justifications to their choices or give random choices

The table and the figure above present the students' responses to whether they give arguments when they decide on a given choice or alternative. We notice that 61.9% of the experimental group make random choices and 38.1% of them give effective reasons.

Concerning the control group, the table and the graph demonstrate the students' answers to whether they justify their decisions with good reasons or they just make random choices. The results, then, show that 36% give effective reasons and 36% make random choices. Finally, 28% did not express their opinions.

If you provide the reasons, how do you generate these argumentations?

- *Experimental group*:

Those who said they give good reasons for deciding upon a given choice are few, and few of them explained that they give arguments through:

- Basing on logic
- Explaining the limitation that lead the one to choose the alternative

- *Control group*:

The control group explained that the arguments they give are generated

- Through searching arguments and evidences
- With scientific reasoning

20. ***When making your decisions during the research projects, do you rely on your own knowledge and reasoning or you ask for help from your classmates and other students/ teachers about the appropriate choice***?

Table 31: Participants opinions towards on what they base their decisions:

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Rely on own Knowledge	8	38.1	9	36.0
Rely on others	11	52.4	9	36.0
Both	0	0	1	4.0
no answer	2	9.5	6	24.0
Total	21	100.0	25	100.0

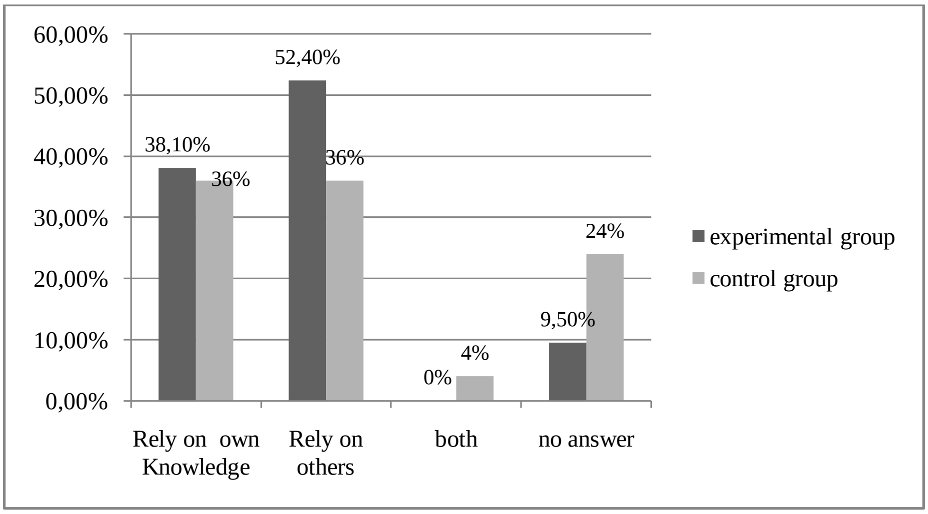


Figure 35: Participants opinions towards on what they base their decisions

The table and the above figure demonstrate that the majority of the experimental group (5.4%) relies on classmates' and teachers' help while 38.1% of them rely on their own knowledge. Finally, 9.5% did not express their opinion. They also show that 36% of the control group's participants reply on themselves (own knowledge and their own reasoning) to make decisions; and 36% rely on others (through asking classmates, peers, and teachers). 4% claim that they make use of their own knowledge and they ask others. Finally, 24% did not express their opinions.

Justifications

The students have explained their reasons about relying on others through the following points:

- *Experimental group*:

- Research methodology is quite a hard and complicated field; the students need to be guided.
- The lack of knowledge about the research methodology requires the teachers to help the students
- To strengthen and develop the research methodology knowledge
- This helps the students to feel more comfortable and confident about the decisions
- The students get rid of the confusions
- Solving the ambiguity of many problems that students face

- *Control group*:

Students rely on own self

- Because they need to rely on themselves starting from now as they are going to work alone in Master two

Students' reasons about relying on others

- Others may have more experience and more knowledge than them
- Their reasoning and decisions and knowledge are not enough and asking others is important.
- Others can provide more help
- Others may know things that they do not know;
- To make sure of their answers and their knowledge

Students who said both

- Because they need to collaborate with others to be confident about themselves.

21. ***According to you, what can help you in being successful when making decisions during the academic research process***

Table 32: factors helping in making better decisions

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Learning about how to reason and to present evidences	12	60.0	15	60.0
Consulting new resources for enhancement	7	35.0	22	88.0

Asking help from the others	7	35.0	20	80.0
Keep confident about yourself and widen knowledge by yourself	8	40.0	13	52.0
Total	/	/	/	/

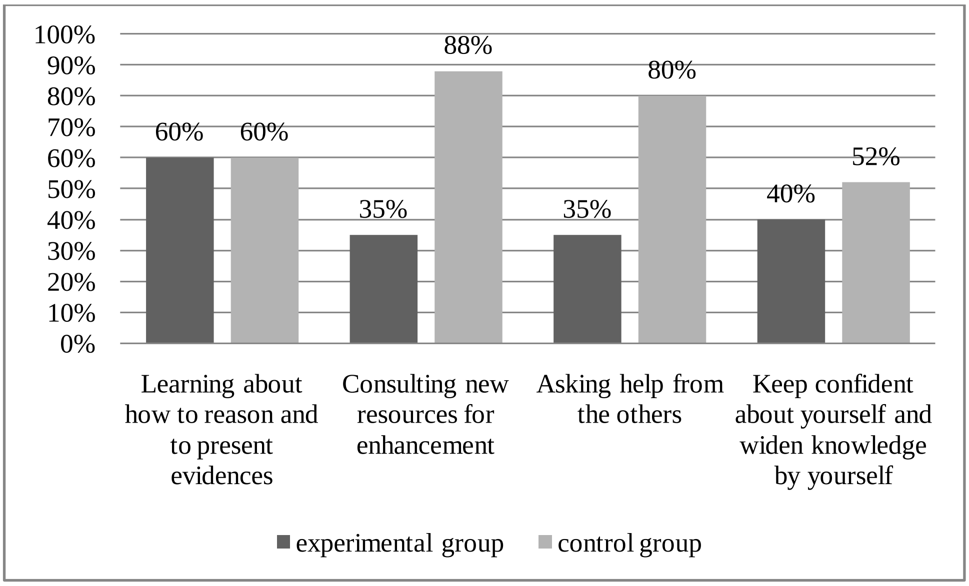


Figure 36: factors helping in making batter decisions

The table summarizes the students' attitudes towards the strategies that can help them in making better decisions. For the experimental group, we can see that the majority of the students (60%) think that learning about how to reason and to present evidence while 40% think that they should learn how to keep confident about themselves and widen their knowledge by themselves. In addition, 35% think that consulting new sources would help them in making better decisions, and finally, 35% think that asking for help from others might also help. For the control group, as is clear in the table most of the students (88%) agree that consulting new resources for enhancement helps in developing their decision making, where 80% think that asking others' help could be supportive. Moreover, 60% think that learning about how to reason and how to present evidence could be helpful while 52% of the respondents think that decision making relies on keeping confidence in themselves and widen their knowledge by their own selves.

Section IV: Students' Attitudes towards Statistics Education

Researchers define statistics education as: the practice of teaching and learning of the different procedures of collecting, displaying, analyzing, and drawing conclusions from quantitative data.

22. ***As an EFL student, how do you feel about learning statistics***?

Table 33: Students feeling towards studying statistics

	Experimental group		Control group	
	F	**%**	**F**	**%**
You are anxious	8	32.0	24	96.0
It is challenging	6	24.0	22	88.0
You appreciate it	1	4.0	24	96.0
You find it enjoyable	1	4.0	23	92.0
It will be helpful	9	36.0	13	52.0
Total	21	100.0	/	/

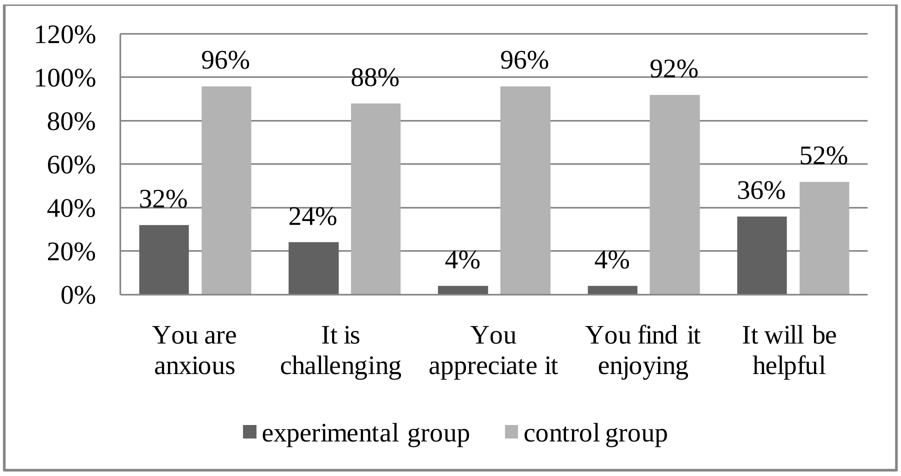


Figure 37: Students feeling towards studying statistics

We attempted to know the students' feelings and expectations about studying statistics before starting the lectures, we find that 36% of the respondents expect that statistics will be helpful but 32% feel anxious. Besides, 24% of them expect that statistics is challenging. 4% feel that they will appreciate it and 4% expect that they will enjoy it. Concerning the control group, we observe that the majority of the respondents expect that they will appreciate it; however, at the same rate, 96% feel anxious about studying statistics. Then, 92% think they will find it enjoyable, and 88% think that it will be challenging. Finally, only 52% think that it will be helpful.

Experimental Group's Justifications:

1. *Challenging and anxious:*

- They have not the habit of studying mathematics or statistics and they do not have any prior knowledge about it.
- Statistics is difficult

- It is a branch of mathematics that is very hard for EFL students who are mostly from literary streams. Many students claim that they hate mathematics and anything related to it.
- They do not know anything about it, they have never dealt with it
- It is complicated
- Statistics knowledge is hard to be grasped. They think they will have difficulties in understanding it.

2. *Enjoying, helpful and appreciating it:*

- It will help them in the research process
- It is a different field far from language sciences, dealing with is a change to their domains and this may take them off from the language learning routine.
- It is enjoying because it is like a game
- It can help them to know how to make decisions during the research
- It will help them to know how to test and how to reason.

Control Group's Justifications:

1. *Challenging and anxious*:

- They do not Master statistics, Excel, and so on
- They have no previous knowledge about statistics as they didn't study it before
- They have not statistical knowledge as they are students from foreign language descipline.

2. *Enjoying, helpful, and appreciating it:*

- They did not study statistics but they think it is helpful in the quantitative research
- It is helpful in developing self autonomy
- It makes research more appropriate
- It helps them with quantitative research
- It helps them to sort out the research results and conclusion
- It helps be logical and do things because they will have arguments

23. ***Do you think that if you are taught about how to reason when making research, you will be able to take your own decisions***?

Table 34: Participants' opinions towards the role of teaching reasoning principles in making decision during the research process

	F	%	F	%
Yes	17	81.0	16	64.0
No	3	14.3	3	12.0
no answer	1	4.8	6	24.0
Total	21	100.0	25	100.0

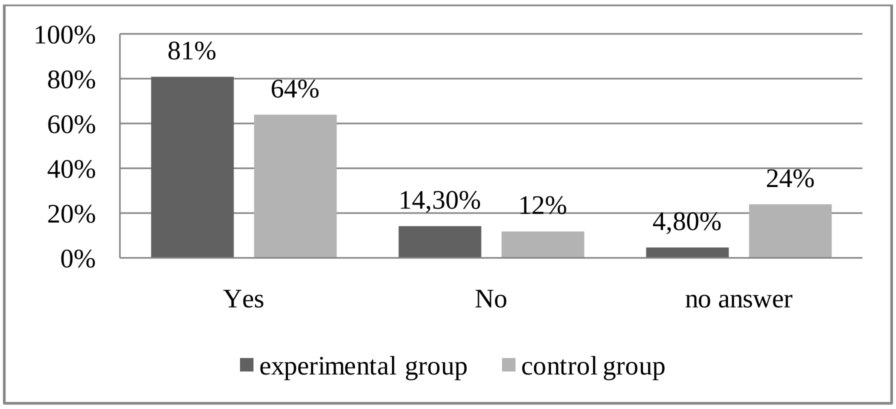


Figure 38: Participants' opinions towards the role of teaching reasoning principles in making decision during the research process

This table represents the students' expectations of whether statistics can help them make their own decisions in the research process. We can notice that most of the students (81%) claim that they do think so whereas 14.3% do not expect this. Finally, 4.8% did not express their attitude.

For the control group, we can see that 64% feel that if they are taught statistics they will learn how to reason and find arguments for their own decisions while 12% do not feel they will learn how to reason. As we can also see, 24% of the students have not provided their opinions.

Experimental Group Justifications:

There are only a few students who justified their answers. The main provided justifications are summarized in:

- It may clarify a logical way to conduct the research
- Reasoning help to better understand the situation, then to take the appropriate decision

Control Group Justifications

Those who said yes: YES

- Reasoning plays an important role when making decisions.
- Science is reasoning and engaging in scientific research is thinking with reason
- Things will be more clarified, so the decision will be easy to be made
- They will know how to give reasons appropriately. The reasoning is important for good research
- The reasoning would lead them to be autonomy
- Once given enough information, it will be easy to make decisions.
- They need an input to produce an output.

Those who said no

- Students should always receive help
- Reasoning is something to acquire not to be taught

24. ***Statistics education deals with making the students aware of the LOGICAL procedure and the REASONABLE way of conducting research: from constructing the title to the conclusion. Do you think that if you are taught about this, your difficulties will be reduced***?

Table 35: whether teaching about logic and reason help in overcoming decision making difficulties

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Yes	12	57.1	13	52.0
No	7	33.3	3	12.0
no answer	2	9.5	9	36.0
Total	21	100.0	25	100.0

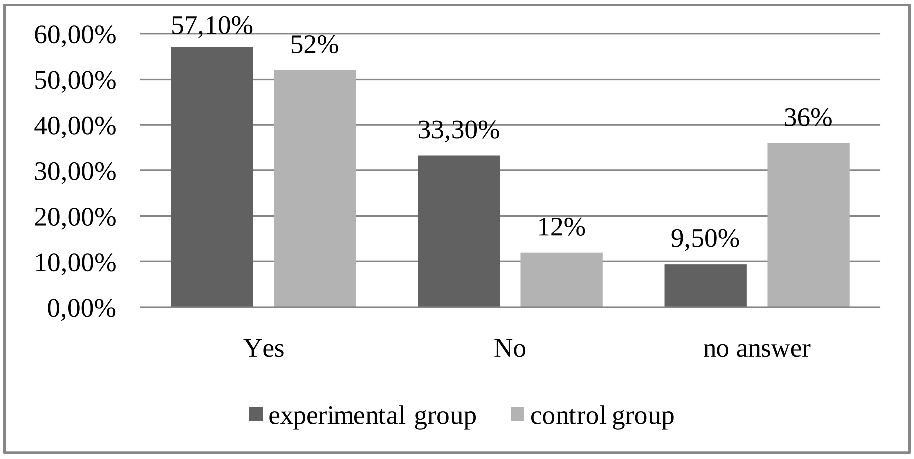


Figure 39: whether teaching about logic and reason helps in overcoming decision making difficulties

The students' attitudes to whether statistics lectures that provide a logical procedure to conduct research might help them overcome the difficulties they confront in research are presented in this table. The majority of the experimental group students (57.1%) assert that it will help them and 33.5% think that it will not help them. Finally, 9.5% did not describe their attitudes.

The table and the figure also represent the experimental group students' expectations towards whether statistics education may reduce students' decision-making difficulties. As we may see, 52% think that it will help them to reduce the challenges when making decisions and 12% do not think so. At last, 36% have no provided an answer to the question.

Experimental group justifications (if they say yes):

- Yes, because it develops their knowledge about different things
- That will reduce the obstacles they meet during the research process
- They can trust their way of thinking because it follows the logic
- That will clarify many ambiguities we have about research
- That will help them have trust in their decisions
- It helps them in better understanding the research steps

Control group justifications (if they say yes):

- Statistics will help them find precise information and reach exact conclusions
- Statistics will help in developing autonomy and critical thinking
- Statistics will help them know how to final the research work

- Statistics will be helpful and important for the whole research
- The reasoning is basic in scientific research
- Statistics will help them know what is right and what is wrong
- The logical process is important in research

25. Do you think that statistics education will help you to make autonomous decisions?

Table 36: participants' opinions towards whether statistics education will help them to make autonomous decisions

	Experimental group		Control group	
	F	**%**	**F**	**%**
Yes	14	66.7	13	52.0
No	5	23.8	3	12.0
no answer	2	9.5	9	36.0
Total	21	100.0	25	100.0

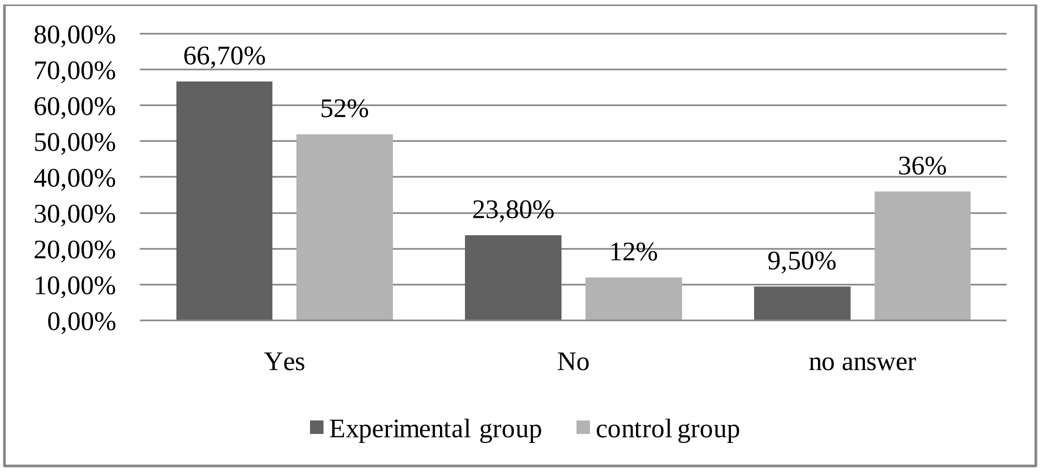


Figure 40: participants' opinions towards whether statistics education will help them to make autonomous decisions

The table shows that the majority of the experimental group students (66.7%) think that statistics education will help them be autonomous in the research. 23.8% think that it will not help them whereas 9.5%did not express their attitudes.

Furthermore, the table shows that 52% of the control group's participants think that statistics education will help them be more autonomous when making decisions whereas 12% do not think so. In addition to that, 36% of the participants have not provided any answer.

Section V: Further Suggestions

Would you please add other suggestions concerning statistics education and its importance in your academic research process?

This section aims at opening to students a free space to express their suggestions about statistics education and its importance in the research process before starting the lectures of statistics.

1. ***Experimental group suggestions:***

There were not many students who provided suggestions. The main answers of the students are abridged in the following points:

- Statistics Education is a continuity of Research Methodology and helps in their research
- Statistics education helps in providing details about the research steps

2. **Control group suggestions**

The suggestions provided by the respondents are summarized in these two ideas:

- Statistics will help them develop critical thinking and logical thinking and develop autonomy

- The module of methodology concerns how to conduct research, this should be taught from the start (first year) effectively, it should give an idea of how to do it step by step with practice.

V.3. POST QUESTIONNAIRE RESULTS

V.3.1. Questionnaire Description

The post questionnaire aims at measuring the students' knowledge and attitudes about the academic research after being introduced to statistics (for the experimental group) to compare the results. The questionnaire, which includes four sections, evaluates students' attitudes in different levels: the first section estimates the participants' readiness to conduct research, the second section evaluates the students' ability to make decisions and finally the third assesses the success of statistics' lectures in achieving the desired aims from the participants' perspectives. The third section is addressed only to the experimental group. Finally, the fourth section is for further suggestions.

Therefore, the Questionnaire in handed to 25 students from the experimental group and 25 students from the control group. The number of handed and retuned questionnaires is illustrated in the following table:

Table 37: the rate of the handed and returned questionnaires for experimental and control groups

	The handed questionnaires		The returned questionnaires	
	F	%	F	%
Experimental group	25	100.0	25	100.0
Control group	25	100.0	20	80.0

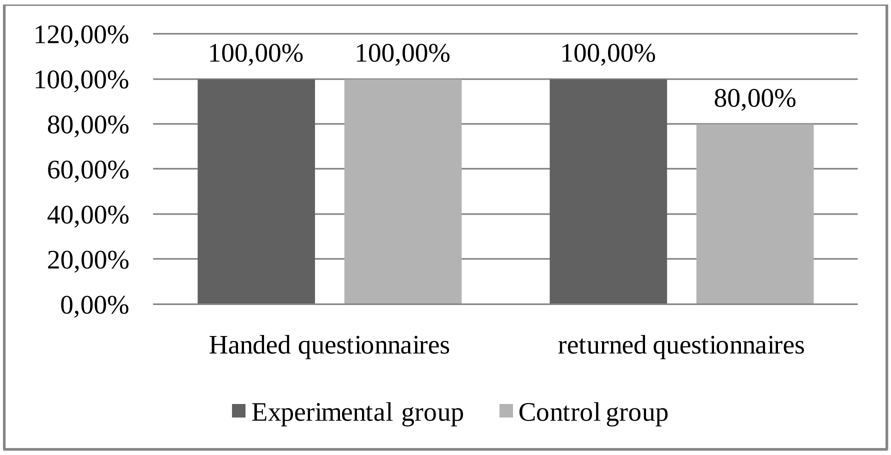


Figure 41: the rate of the handed and returned questionnaires for experimental and control groups

V.3.2. Post Questionnaire's Findings

Section One: Readiness to conducting academic Research

1. ***How many research-related modules are you studying this year (Master1)? Can you list them?***

We asked the students about the different research-related modules that they have been studying during this year (Master one). To spot the differences between the control and the experimental groups when studying research methodology:

- *Experimental group*:

The students have been engaged into three modules concerning the academic research:

- ➢ The first Developing Research Skills (DRS)
- ➢ The second is Writing a Research Paper (WRP);
- ➢ Finally; Statistics Analysis in Quantitative Research (SAQR).

- *Control group*:

The control group was engaged into two modules:

- *Research methodology* in which they studied the research steps and the organization of the research.
- *Academic writing*: where they have been taught about the academic writing style when writing down research.

2. Have you noticed any development in your research Knowledge and skills thanks to these modules?

Table 38: whether the students developed their research methodology skills

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Yes	23	92.0	11	55.0
No	1	4.0	6	30.0
No opinion	1	4.0	3	15.0
Total	25	100	20	100.0

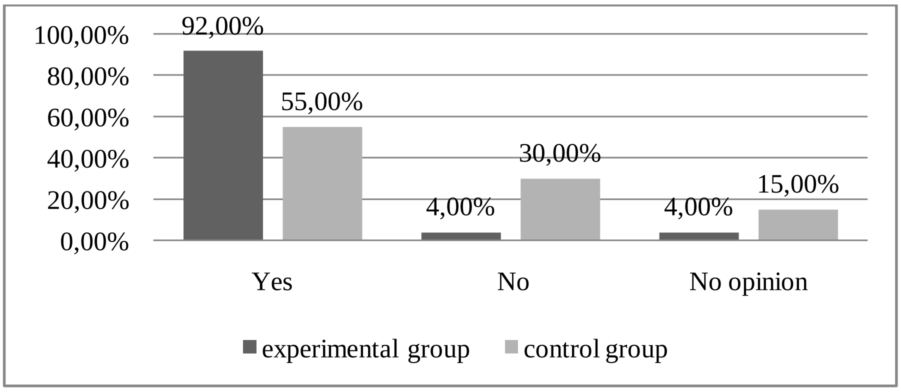


Figure 38: whether the students developed their research methodology skills

According to the above table, the majority of the experimental group participants (92%) of the students noticed a development in their research knowledge and skills; while 4% did not notice this development and 4% have no opinion. For the control group, the table demonstrates that most of the students feel that they have developed their research knowledge and skills while 30% have not developed them. At last, 15% did not state their opinions.

3. ***Which among these modules have helped you most? What are the major concepts achieved from each module?***

- *For the experimental group:*

Table 39: the most helpful modules in developing research methodology skills for the experimental group

	Experimental group	
	F	**%**
Developing Research Skills	5	20%
Writing a research paper	8	32%
Statistical Analysis in Quantitative Research	14	56%
Total	/	/

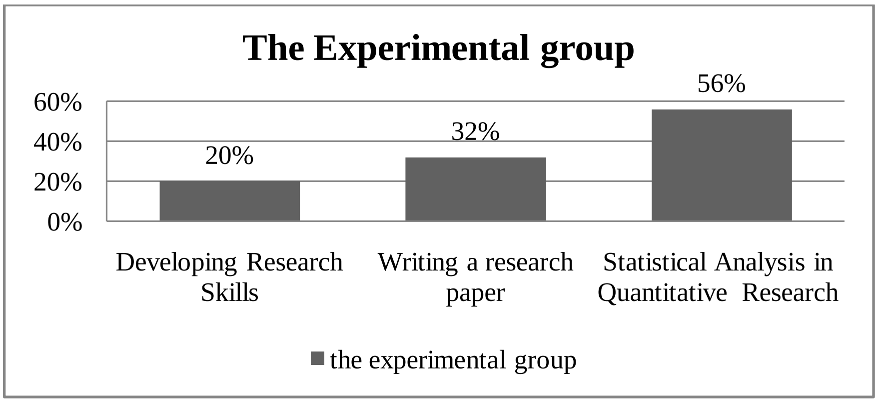


Figure 43: the most helpful modules in developing research methodology skills for the experimental group

The above table demonstrates that 56% of the students think that the module of Statistical Analysis in Quantitative Research (SAQR) helped them most in developing their research abilities; while 32% of the participants claim that their knowledge and skills have been developed due to the module of “Writing a Research Paper” and finally 20% claim that the development is due to the module of “Developing Research Skills”.

For more details, we asked the respondent to support their answer with justifications through listing the major concepts achieved due to each module:

3.a. Writing a Research Paper (WRP)

The major benefits of the module of "Writing Research Paper" according to the students are summarized in the following points:

- They have learned how to organize the research steps when writing down the dissertations
- They have learned how to conduct research
- They have learned a lot of things and corrected many concepts that they believed are true since their first years.
- It helped them in organizing the research steps.
- They have learned how to write a research proposal correctly.
- They have learned how to write a literature review and how to prepare a research proposal
- They have learned how to write a research paper
- With the practice they have done in this module, they have understood the way research is conducted.

3.b. Developing Research Skills (DRS)

The students reported that the module of "Developing Research Skills" module helped them mainly acquire the following points:

- They have learned a lot of things and corrected many concepts that they believed are true since their first years.
- The Research Skills module helped me develop knowledge about the four skills making references and using the internet.
- This module added to them the knowledge about how to write a research proposal.

3.c. Statistical Analysis in Quantitative Research (SAQR)

The SAQR was beneficial to Master's studentss in acquiring the following notions:

- They have learned how to collect and analyze the data from the module of Statistics.
- They have learned how to conduct experiments and how to analyze them.

- They have learned how to present data in tables and how to read them (in SPSS). In addition, they have learned the appropriate decisions about the appropriate title, about the tools to use, they can think clearly about the research procedures.
- They have learned so much about data analysis and the SPSS software
- They have learned a lot of things and corrected many concepts that they believed are true since my first years.
- It clarified to them the different kinds of research and how to deal with each one.
- Through the statistical analysis module, they have learned mainly how to analyze the data
- It helped them in learning how o collect data and analyze it appropriately.
- It gave them an idea about how to analyze, collect data, methodology, and the steps of the research proposal.
- They have learned new things like inferential and descriptive analysis and the SPSS software.
- They have learned how to collect data and mastering drawing conclusions from our samples

- *The control group*:

Most of the students claim that the module of *research methodology* (RM) had helped them more in enhancing their knowledge and skills. This module has taught them how to organize the research work and enhance many research-related concepts and correct their misunderstanding about research and research steps. Moreover, the practical work (mainly a research proposal and a research article) provided great help for a better understanding.

From another point of view, some students reported about the role that the “ESP” (English for Specific Purposes) module played in developing their skills. The module mainly helped them to know how to analyze a chapter of a book. Moreover, some others talked about the important role the module of “Course Design” played in developing their planning strategies

.

4. ***Do you feel ready to conduct an academic research for the next year? Can you justify?***

Table 40: Students’ readiness to conduct the academic research

	Experimental group		Control group	
	F	**%**	**F**	**%**
Yes	11	44.0	6	30.0
No	11	44.0	12	60.0
Ready but not totally	3	12.0	2	10.0
Total	25	100.0	20	100.0

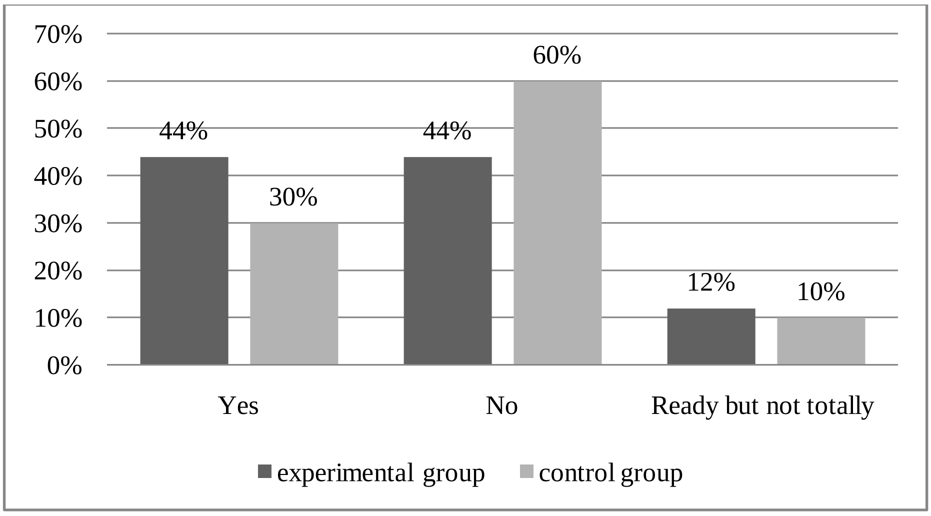


Figure 44: Students' readiness to conduct the academic research

The above table shows that 44% of the experimental students do not feel that they are ready to conduct research and 44% of the participants claim they do not feel ready to conduct research. Finally, 12 % of the participants were hesitant about being ready. The reasons provided by the students are summarized in the following points:

❖ *Experimental group*:

Justifications for being ready:

- They feel they can conduct research because they started knowing how to collect the data and how to analyze them and how to make a conclusion about the results. All these gave them some confidence.
- They feel able to conduct research because they have the basic knowledge about the research methods of conducting research
- The lectures on statistics help the plan well for a research proposal and about data collection and data analysis. Therefore, through what they have seen, they think it is probably possible for them to conduct research.

- They know how to conduct research and they are aware of the different steps that they should follow when conducting it.
- The modules of research methodology help them in organizing the steps and understanding them.
- They feel they have learned many things during practical works that they have done this year.
- They know how to do research (the steps and how to organize them)
- Since they have already attempted to conduct a research proposal so I will be able to do it in the next year.

Justifications for not being ready:

- Some of the participants think of conducting qualitative research on which they have not enough (or sometimes as expressed by students no knowledge) about qualitative research
- They think that they still have many things to learn and for now they have not enough knowledge about other steps of research.
- They claimed that they have learned new things but they are not enough.
- They need more time and more practice to deal with all research steps and procedures.
- They are not sure of what to do next year.
- They feel that they still have difficulties concerning many points especially the methodology.
- They need more practice.

Justifications for being ready but not totally

- They think they are ready to conduct research but not totally because theoretical parts are totally different from the practical ones.
- They are ready to conduct academic research but not totally because they know they will go through some troubles concerning references.
- Some of the participants mentioned that they are ready but not really because they think that methodology is not an easy task, they should widen their knowledge about it
- They think ready but not at the extent of feeling very ready because they think that there are other things they do not know.

❖ *Control group*:

Justifications for those who said not ready:

- According to the respondents, many details need to be clarified about the research
- Many of them say that have not enough experience in conducting research mainly about how to write the research dissertation.
- So others said that research is complicated and needs much effort and they are very lazy to accomplish a research work.

Justifications for those who said they are ready:

- They have understood the lectures of research and research steps
- They see that there is no difference between them and the students who have already accomplished a work (previous Master's studentss)
- The knowledge they still need to develop it during the research process.

5. ***How do you evaluate your Knowledge of these research steps (put the appropriate letter in front of the suggestions):***

- *Experimental group's Results*

Table 41: Experimental group students' self evaluation of their knowledge in research steps

	Very good		**Good**		**Low**		**very low**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
1. Data collection (including research variables , aims, designs, methods and tools)	2	8%	21	84 %	1	4%	1	4%
2. Data Analysis (including the data analysis methods ad tests)	3	12%	10	40 %	9	36 %	3	12 %
3. Data Interpretations and drawing conclusions	1	4%	9	36 %	8	32 %	7	28 %
4. Data communication	1	4%	2	8%	12	48 %	10	40 %

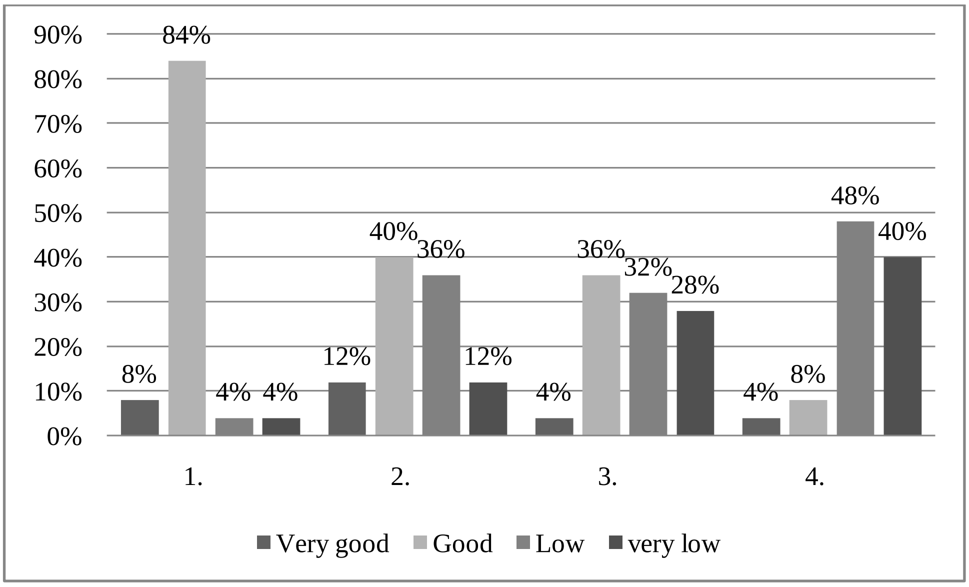


Figure 45: Experimental group students' self evaluation of their knowledge in research steps

The table and the figure show that 84% of the experimental participants evaluate their knowledge in the data collection phase of research as being good, whilst 8% of them assert that they had very good knowledge about the data collection phase. Moreover, 4% of the students evaluate their knowledge as being not good while 4% see that their knowledge is very low.

Concerning the data analysis phase, the knowledge of 40% of the students is good, 36% is not good, 12% is very good and finally, 12% of them claim that their knowledge is very low.

For the data interpretation and conclusions drawing, we notice that 36% of the respondents feel that their knowledge is good, 32% of them is not good 28% very low, and finally 4% very good.

Finally the data communication including organizing tables and figures and so on, we see that 48% find their knowledge is not good and 40% as very low, 8% find it good and finally 4% as very good.

- *Control Group's Results*

Table 42: Control group students' self evaluation of their knowledge in research steps

	Very good		**Good**		**low**		**very low**		**No answer**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Data collection (including research variables , aims, designs, methods and tools)	1	5.0	7	35.0	2	10.0	6	30.0	4	20.0

Data Analysis (including the data analysis methods ad tests)	1	5.0	5	25.0	5	25.0	5	25.0	4	20.0
Data Interpretations and drawing conclusions	1	5.0	7	35.0	5	25.0	5	25.0	2	10.0
Data communication	2	10.0	5	25.0	5	25.0	5	25.0	3	15.0

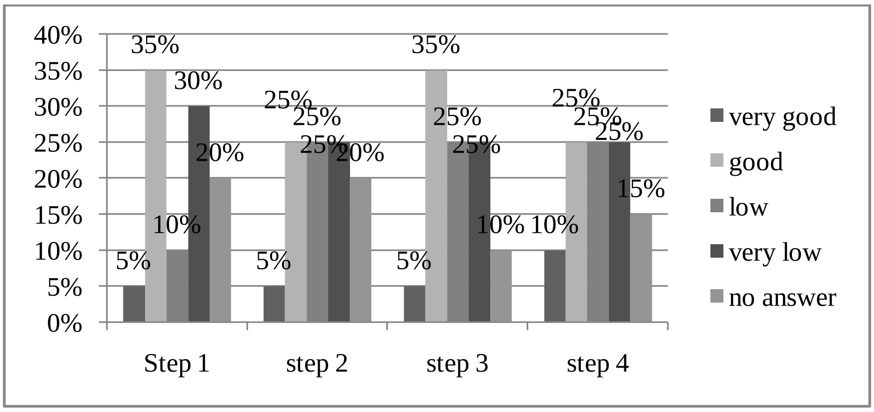


Figure 46: Control group students' self evaluation of their knowledge in research steps

Table 41 shows that the majority of the respondents (35%) find that their knowledge concerning the data collection phase is good and 5% of them find it low. However, 30% of the students report that their knowledge about data collection is very low and 10% find it not good. At last, 20% have not provided their opinion.

Concerning the data analysis phase, 25% of the students find their knowledge good and 5% find it is very good; whereas, 25% see their knowledge as not good and 25% as very low. Finally, 20% did not report their opinion.

Similarly, 25% of the respondents say that they have good knowledge about data interpretations where 1% say that they have very good knowledge. On another side, 25% report that their knowledge is not good and 25% of them say that they have very lo knowledge concerning this research step. Finally, 10% have no provided an answer to this question.

As far as data communication is concerned, 25% of students report that they have good knowledge about how to write results down and how to communicate data in tables and figures, and 10% say that their knowledge is very good. on the other hand, 25% say that they have not good knowledge and 25% say that they have very low knowledge. At last, 15% did not answer the question.

Section II: Learners' Decision Making Skill in Research

6. ***How confident do you feel about any decision you have to make concerning the research process?***

Table 43: Students confidence about their decisions in their research process

	Experimental group		Control group	
	F	%	F	%
Very confident	1	4.0	0	00.0
Confident	5	20.0	4	20.0
Somehow confident	17	68.0	4	20.0
Not confident	2	8.0	7	35.0
No answer	0	0.0	5	25.0
Total	25	100.0	20	100.0

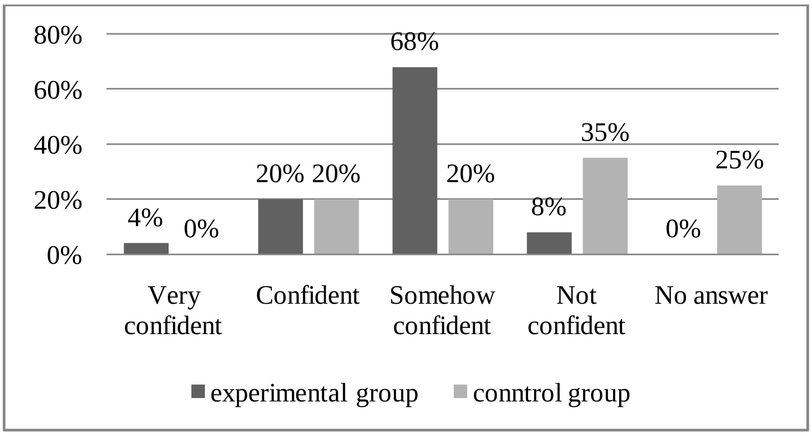


Table 47: Students confidence about their decisions in their research process

The above table represents the students' confidence level when making decisions concerning the research process. For the experimental group, 68% of the participants find that they are somehow confident while 20% feel confident, 8% not confident and 4 % very confident. Furthermore, as we can read from the table, 20% of the control group respondents feel confident about their decisions they made during the research they have conducted during this year. On the other hand, 20% feel somehow confident. Finally, 35% of the respondents do not feel confident. Finally, 25% did not give their answer.

7. ***What makes feel confident (from somehow to very confident) about your decisions?***

We asked the students to support their answers to the above question by stating the most important reasons that help to boost their confidence this year.

The experimental group:

The students expressed their gratitude towards the research methodology modules (mainly SAQR and WRP) and mainly the works that provided a pre-experience phase to the students in research. The main reasons generally are summarized in:

- Seeking feedback from classmates and teachers when doing something in any step of writing the research paper
- From practice that they have been engaged to.
- The modules they have been engaged in, help in acquiring the basics of research before undertaking the real research in Master two.
- Their motivation adding to the practice they have been gone through this year.
- The knowledge that they constructed this year
- The teachers' help, feedback, instruction, and pieces of advice towards research.
- The fact that they do not decide randomly. they focus and think and analyze before making any decision
- The works of research that they have made autonomously and find a good evaluation from my teachers
- Many things became clear this year for the students; they learned very important things concerning the research (the procedure to follow and so on).

The control group:

The students that feel from somehow confident to very confident has justified their answers by saying:

- They had some practice this year that enhanced both their attitudes and skills.
- The help of the teachers
- The research methodology lectures
- Self-motivation (they say to themselves they can do it)

8. ***Do you feel uncertain about the decisions you have to make in your academic research process?***

Table 44: students' uncertainty in making research related decisions

	Experimental group		Control group	
	F	%	F	%
Yes	21	84	11	55.0
No	3	12	3	15.0
No answer	1	4	6	30.0
Total	25	100	20	100.0

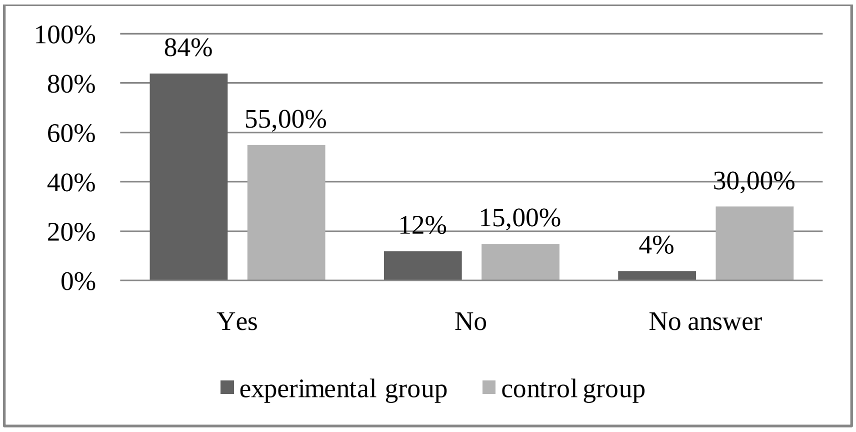


Figure 48: students' uncertainty in making research related decisions

This table demonstrates whether students are uncertain or not about the decision they have to make during the research process. We can see that 84% of the experimental group feel uncertain about the future research decisions and 12% feel certain while 4% have not provided any answer. Moreover, the table shows that 55% of the control group students are uncertain about the decisions that they will make in their academic research and 15% feel certain concerning their decisions. Finally, 30% have not reposted their opinions.

9. ***If yes, do you think that this Uncertainty is due to the lack of information about research Methodology?***

Table 45: Students' attitudes about whether uncertainty is due to the lack of information about research methodology

	Experimental group		Control group	
	F	%	F	%
Yes	16	64.0	11	55.0
No	5	20.0	3	15.0
No answer	4	16.0	6	30.0
Total	25	100.0	20	100.0

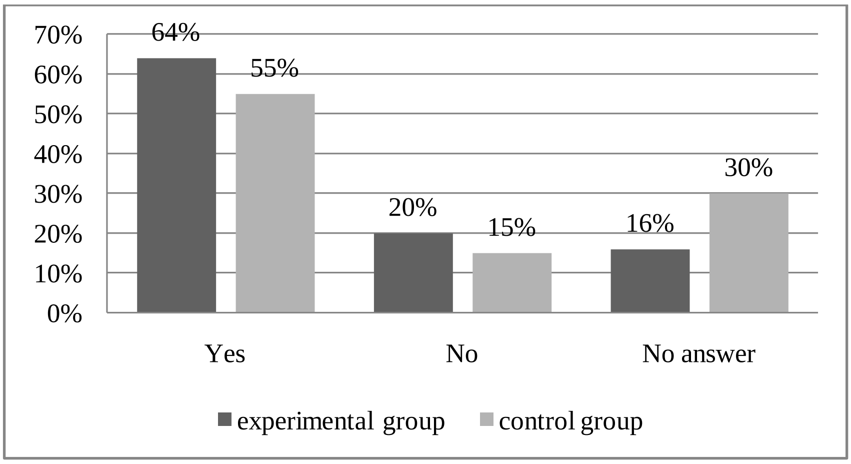


Figure 49: Students attitudes about whether uncertainty is due to the lack of information about research methodology

To explore the reasons for their uncertainty if any, we asked the students whether their uncertainty is due to the lack of information about research methodology. 64% of the students confirm that they are uncertain because of their lack of information in the methodology. 20% claims that it is not the reason and 16% did not provide any answer.

10. On what do you base your decisions during the research process?

Table 46: Students' attitudes towards on which basis they make their decisions

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Reasoning (observe and analyze using the facts and the knowledge you have about the research)	10	40.0	3	15.0
Your knowledge (both theoretical and practical) about the research	10	40.0	10	50.0
Taking others' opinions	1	4.0	1	5.0
Your inner feeling (gut feeling)	1	4.0	1	5.0
All above	10	40.0	5	25.0
Total	/	/	20	100.0

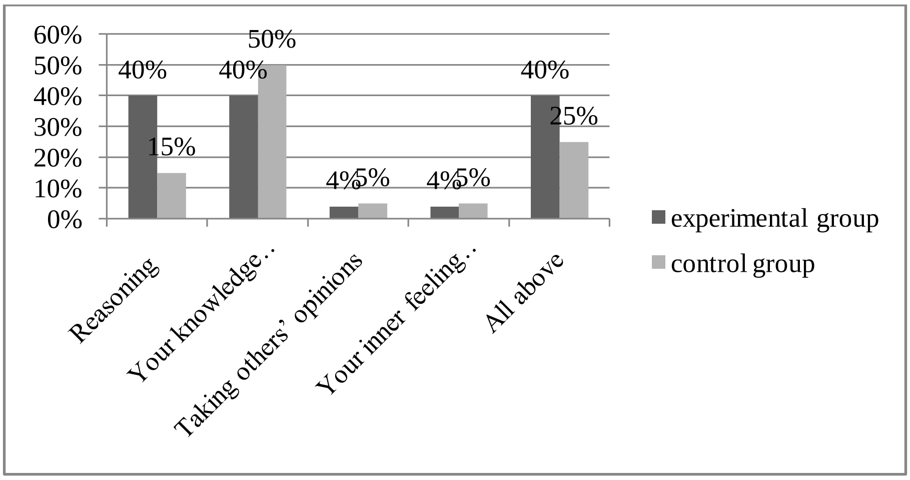


Figure 50: Students' attitudes towards on which basis they make their decisions

We have asked this question in an attempt to explore the basis on which students base their decisions on the research process. 40% of the experimental group students use only their reason (basing on observation and analysis using facts and knowledge they have about the research process). 40% apply only their knowledge, and 4% use only their intuition (inner feeling), 4% base on only asking about others' opinions. However, 40% claim that they use all the propositions including reasoning, knowledge, others' opinions, and inner feelings. For the control group, we can see that 50% base on their theoretical and practical knowledge about research while 15% base on reasoning and analyzing using their knowledge. Moreover, only 5% said they rely on their inner feeling and 5% take others' opinions. Finally, 25% say that use all the options (reason, their knowledge, thee others' opinions, and the inner feeling).

11. ***What can affect negatively your decisions in research***?

Table 47: Factors affecting negatively students' decision making

	Experimental group		Control group	
	F	%	F	%
When you have not enough information	19	76%	14	70.0
When you have much information	5	20%	1	5.0
When there are many people you have asked	7	28%	1	5.0
When you are emotionally attached to one decision (you like that decision for example)	1	4%	2	10.0
Affected by your own desires (even if the decision is not logical but you take it because it helps you reach your hidden desire)	1	4%	1	5.0
All above	4	16%	1	5.0
Total	/	/	20	100.0

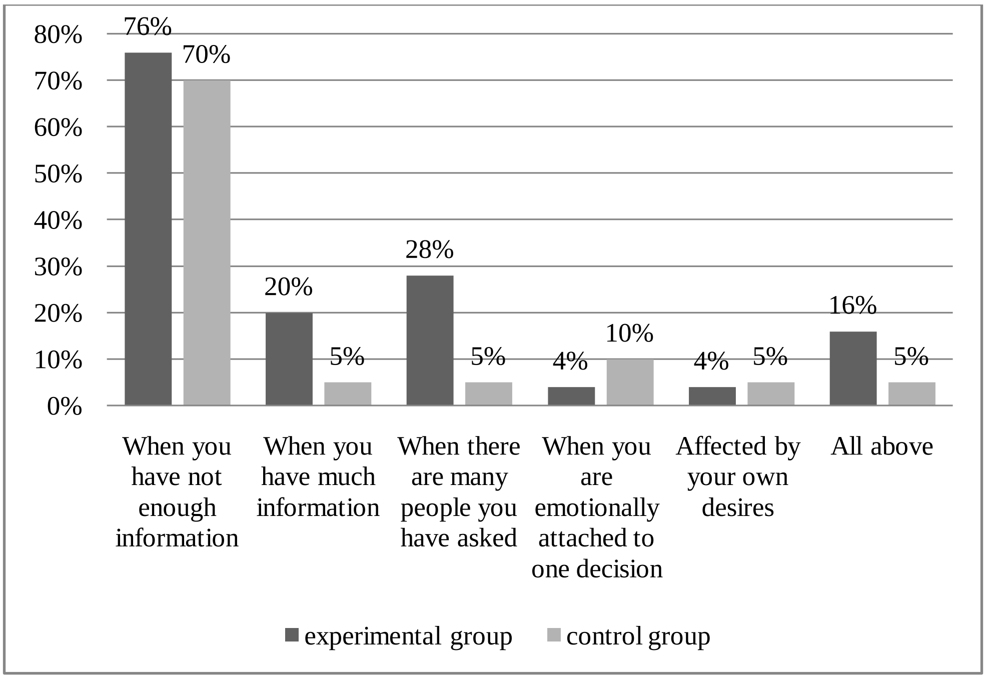


Figure 51: Factors affecting negatively students' decision making

We asked the experimental students about their opinions concerning the negative effect that the above propositions may have on the students' decision-making. The results displayed in the table show that 76% of the respondents think that lack of information affects negatively their decisions. Moreover, 28% claim that their decisions are negatively impacted when they ask so many people. 20% maintain that what affects negatively their decisions is when they have much information. 4% claim that it is negatively affected by their emotional attachment and 4% are affected by their own desires. Finally, 16% claim that all of the options may have a negative effect on their decision skills.

The table shows also that most of the control group students (70%) think that the lack of information affects negatively their decision making during the research process, and 10% think that emotional attachment to a given option can have a negative effect on making the right decisions, Moreover, 5% think that decision making is negatively affected when there is much information about the issue; and in the same rate: 5% of the respondents who claim that asking too many people can have a negative impact on the decision making, 5% say that the own desire also have a negative impact and 5% say that the decision making is impacted by all the above-stated factors.

12. ***Do you think you become able to make decisions during the research process autonomously?***

Table 48: students' attitudes towards whether they developed autonomy in research

	Experimental group		**Control group**	
	F	**%**	**F**	**%**
Yes	3	12.0	3	15.0
No	22	88.0	12	60.0
No answer	0	0.0	5	25.0
Total	25	100.0	20	100.0

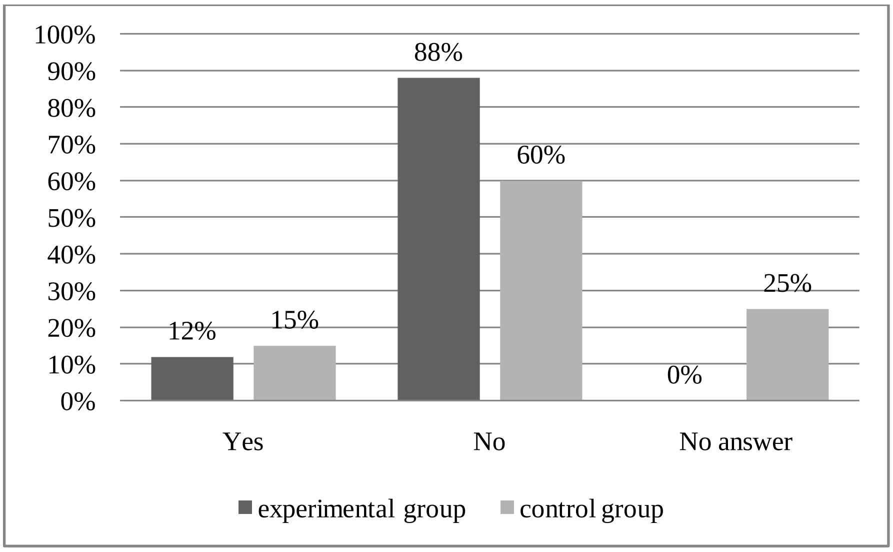


Figure 52: students' attitudes towards whether they developed autonomy in research

We asked the students whether they feel autonomous to make decisions concerning the research process. 88% of the experimental students claim that they are not while 12% claim that they are. Moreover, the table shows that the majority of the control group students do not feel they can make decisions autonomously whereas 15% felt that they can make their decisions alone. Finally, 25% did not report their opinions.

If yes, please explain how did statistics lectures help you be more autonomous in making decision?

The only group who provided answers to this question is the experimental group. The students that answered yes provided the following reasons:

- Statistics lectures help in fostering their autonomy because they provided sufficient information on which they can rely on during the research process. For example, they know how to choose the appropriate design, to collect the data and how to analyze them and then generalize conclusions.
- Yes, because it allows them to be more precise in taking decisions.

Section III: Statistics Education

As far as this section is concerned, the control group students have not provided their answers as they have not been engaged in statistics education. The experimental group's answers are reported here.

13. Did you study statistics?

Table 49: Experimental students' answers towards whether they studied statistics

	Experimental group	
	Frequency	Percentage
Yes	25	100%
No	0	0%
Total	25	100%

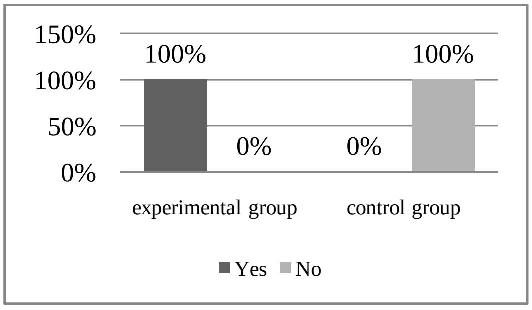


Figure 53: Experimental students' answers towards whether they studied statistics

This question explores the students' opinions about whether the students studied statistics (attended most of the lectures). We observe –through the above table- that the total students answered yes (100%). The control group did not have statistics or attend with the other group.

14. If yes, have you benefited from the module?

Table 50: Students attitudes toward whether they have benefited from statistics module

	Frequency	Percentage
Yes	25	100%
No	0	0%
Total	25	100%

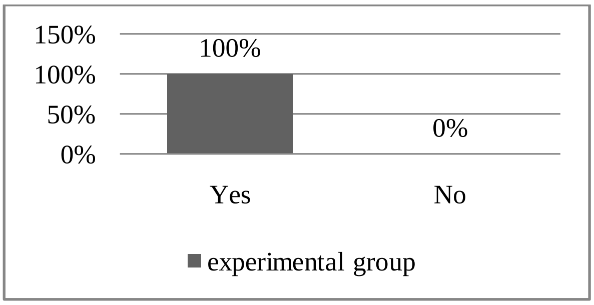


Figure 50: Students attitudes toward whether they have benefited from statistics module

After attending the lecture, we aimed at knowing whether the module was helpful or not. The table shows that the whole sample (100%) think that the module of statistics was beneficial for them.

15. What have you benefited from statistics lectures?

Table 51: The benefits of statistics lectures

	F	**%**
You can decide easily upon the type of relationship between the variables (correlative, experimental and exploratory)	15	60%
You can decide easily about how to choose your sample.	16	64%
You can decide easily upon the data collection methods and procedures (decide which design, method, and tools is appropriate to the type of relationship above)	10	40%
You can decide easily about data analysis methods (the data analysis tests that are appropriate to prove the relationship between the variables and the type of data you collected?	9	36%
You can decide which conclusion to draw from the data you have analyzed?	8	32%
You can decide how to present your data in tables and figures?	9	36%
All the above	6	24%
None of above	0	0%
Total	/	/

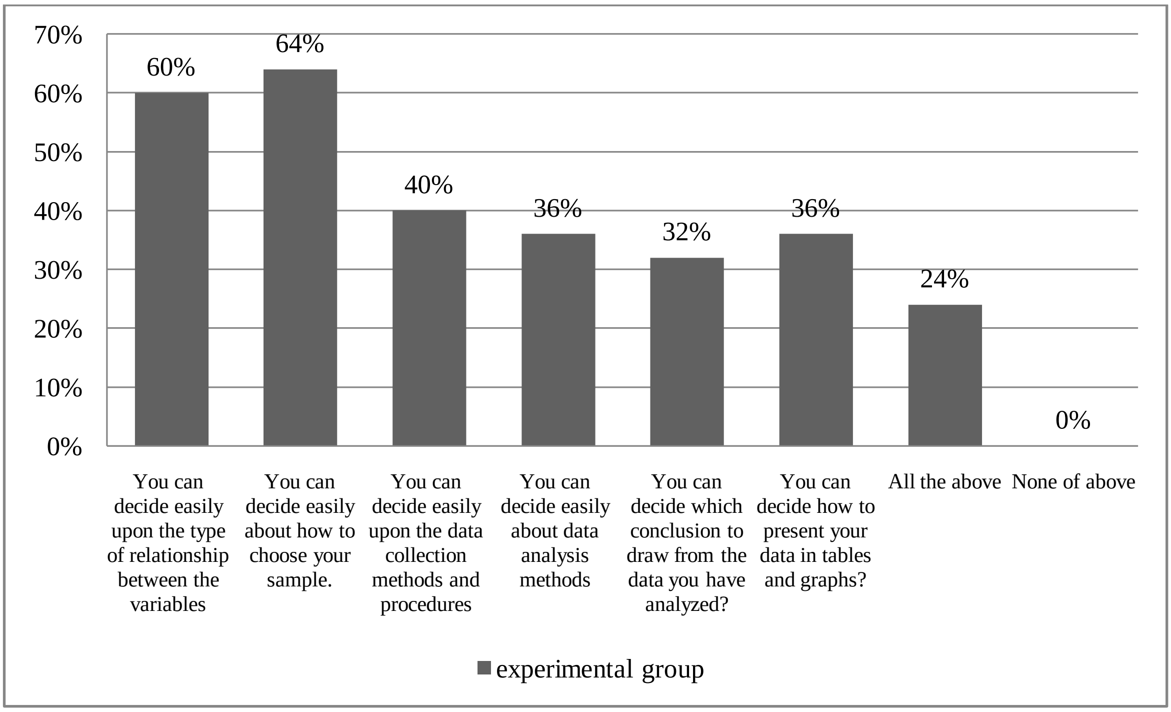


Figure 55: The benefits of statistics lectures

The above table and figure demonstrate that 64% have learned from the statistics lectures to decide upon the right sampling method, while 60% have learned how to decide about the type of relationship between variables. Moreover, 40% of them learned how to decide about the data collection methods, 36% about the data analysis methods, 36% deciding about how and what figures and tables to use. In addition, 32% have learned about deciding on the data interpretation and drawing conclusions. Finally, 24% of the respondents claim that they have benefited all the above points from a statistics education.

16. ***Can you explain briefly what did the lectures of statistics add to your research knowledge?***

For more details about the benefits of statistics lectures to the students, we asked the students to express freely about what statistics educations added to their research knowledge. We summarized their answers in the followings:

- Students are able to collect data, analyze them and interpret them and convert them into readable and meaningful information.
- Students are able to use data analysis tests but before and most importantly how to choose and decide about to research title’s constituents.

- They added theoretical and practical knowledge of the research process. How to use the SPSS software for research purposes.
- The lectures supported the students' skills and knowledge in research methodology with more detailed and concise information.
- Statistics clarified clearly how to conduct a research proposal, suggest a hypothesis to solve a problem.
- Statistics raised their confidence and their motivation to conduct research.
- Statistics helps them understand research more deeply and helps them make their choices and decisions based on the data and the appropriate methods that they should use when collecting the data.
- Statistics added to their knowledge a lot of information about the research process, the relationship between variables all the procedures, and data of how to collect analyze, and draw conclusions from tables.
- Statistics taught them how to employ logic and reason to collect read and interpret the results. Moreover, statistics education especially introduced them to how to face challenges while observing and analyzing the data.
- They learned about choosing their samples easily and deciding about the appropriate method and data collection tools. Furthermore, using the SPSS software to enter the data, describe them and analyze them, to perform descriptive and inferential statistics through this software, all these are major benefits they have benefited.
- The module added to their knowledge a lot of things concerning academic research especially the steps of proving or disapproving the research hypothesis.
- They have learned about the different types of relationships between variables, how to proceed with the research for each type of research. In addition, they have learned how to present the data in tables and how to read these tables.
- It helped them to understand how to conduct research in a successful and straightforward manner

When reporting these benefits, students also asserted the importance of having more time to practice more because all that has been seen during the lecture are very important.

17. What did you like most about the lectures of statistics?

Table 52: students' attitudes toward what they liked about the lectures of statistics

	F	***%***
They helped you to reason and to think logically well when it comes to the different choices in the research process	7	28%
The decisions you may take and the way to take them during research seem clear.	5	20%
The lectures were enjoying	7	28%
using technology (internet, PCs) during the practical parts of the lectures	12	48%
all above	6	24%
Total	/	/

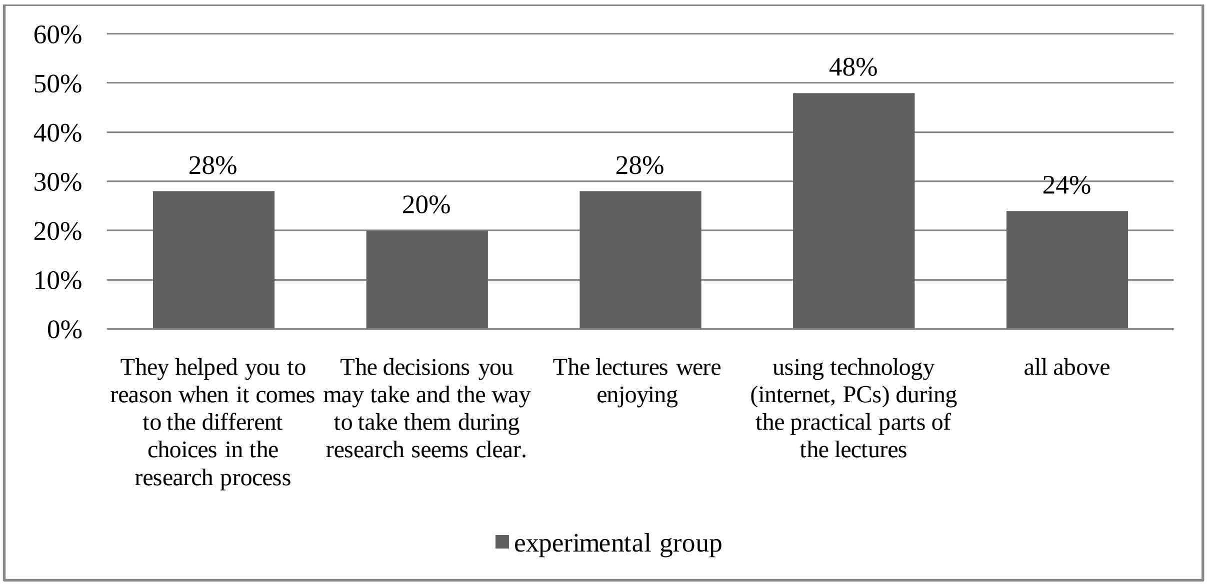


Figure 56: students' attitudes toward what they liked about the lectures of statistics

After attending the lectures of statistics, we asked the student what they have liked most about these lectures. As it is illustrated in the above table, we can see that 48% like using technology (including the internet and computers) during the practical parts of the lectures. 28% think that the lecture was enjoyable. 28% think that they like the fact that these lectures help them use reason and think logically when making choices for their research. 20% like the fact that these lectures clarified to the students the different decisions that they may make and the way to take them during research. Finally 24% of the students like all the provided propositions.

Others:

We have provided the students with a free space to express additional points (that are not mentioned in our propositions) concerning what they like about statistics lectures. The additional points are summarized in:

- The calling of mathematics during the analysis of data
- Working on the SPSS
- The fact that they facilitated their understanding of how to collect data and how to analyze them in order to draw conclusions
- Some of them discovered that Statistics are easy to be understood and the lectures were enjoyable.

18. What did not you like about the lectures of statistics?

Table 53: students' attitudes towards what they have not liked about statistics

	F	***%***
Statistics are hard to understand	18	72%
I did not benefit anything from them	0	0%
I hate research and I do not wish to conduct it	2	8%
They are boring	0	0%
No opinion	5	20%
Total	/	/

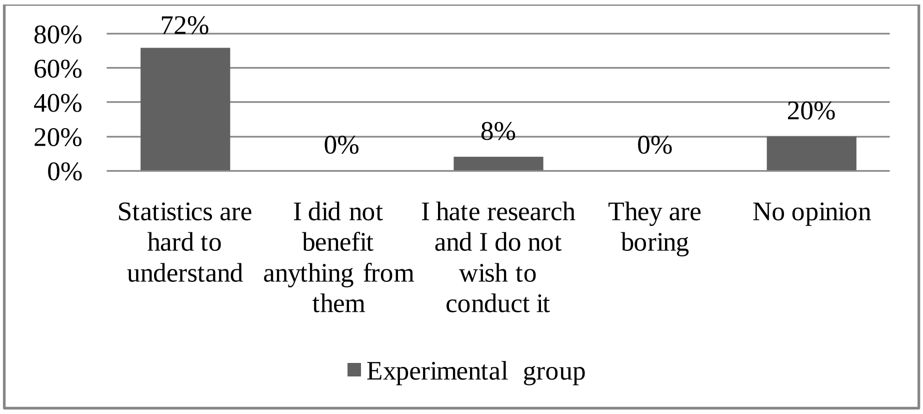


Figure 57: students' attitudes towards what they have not liked about statistics

This question relates to what students dislike concerning statistics' lectures. 72% of the students find that statistics are hard to be understood, 20% with no opinion; and finally, 8% claim that they hate research, and they do not wish to conduct it.

Others:

- Some students provided with more suggestions concerning what they dislike about statistics' lectures:
- There are so many similar methods that confuse them.
- They think that there are a lot of details that might not be needed for their research process, so these should not be taught.
- The first time of working with technology and software such as the SPSS, made the lectures hard a bit.
- It is somehow hard to interpret the data so as to draw final conclusions.
- The lectures need much of the concentration and this is tiring

19. How did you find working with the SPSS?

Table 54: students' attitudes toward SPSS

	Frequency	Percentage
Easy	12	48%
Hard	13	52%
Total	25	100%

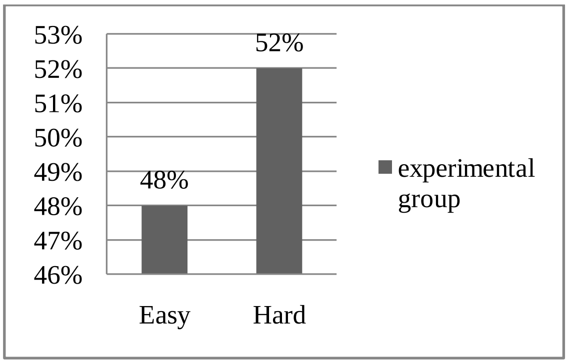


Figure 58: students' attitudes toward SPSS

The above table presents the participants' opinions about working with the SPSS. We can see that 52% claim that it is hard where 48% claim that it is easy.

Explaining the reasons

1. EASY TASK

The students who claim that working with the SPSS is an easy task provided the following reasons:

- Some students have some experience with it (studied in other branches)
- It is easy because they have dealt more with practice in the classroom and the concepts that we have dealt with were not really hard.

- The SPSS facilitates the process by doing all the calculations for them.
- In SPSS everything is organized and you just need to follow the steps and everything will be easy.
- Practice through this software allow them to understand easily more than when they were studying it theoretically (in theory they were just imagining but in practice, they were dealing with real data).
- Working with the SPSS needs just some time of practice with some concentration and it will be easy for everyone.
- The teacher's explanation.
- It was very complicated just at the beginning, but after some practice it became easy.

2. HARD TASK

The students, who said that working with the SPSS is a hard task, supported their opinions with the following reasons:

- It has a lot of procedures to follow which are somehow complicated and the students need more time to understand them.
- It is the first time they work on it and this is why they face difficulties. SPSS is a new program so it is hard to get used to the different types of outputs and how to draw conclusions from there.
- There are a lot of actions and options and sometimes they mix between some options in the SPSS we need more practice to get used to them.
- It is complicated and it deals with mathematics.
- There are a lot of steps and procedures to follow and this makes it complicated. However, they think that they need more practice sessions to understand well.

20. According to you, did the statistics lectures enable you to make research decisions in the right way?

Table55: students' attitudes towards whether statistics lectures help them make decisions

	Frequency	Percentage
Yes	24	96%
No	1	4%
Total	25	100%

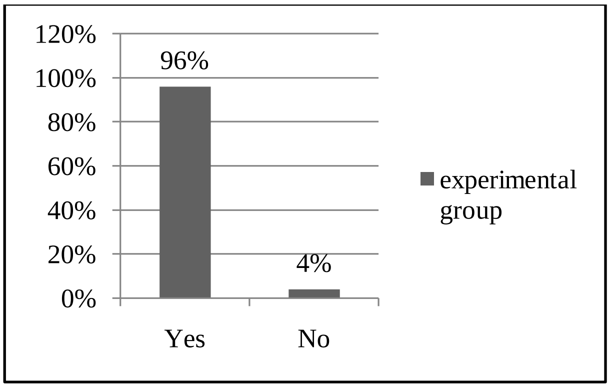


Figure 59: students' attitudes towards whether statistics lectures help them make decisions

This table presents the students' opinions about whether statistics lectures help them take the right decisions. We can see that 96% of them argue that these lectures help them and 4% claim that they do not.

Then, we asked the students to explain their answers; their explanations mainly turn around these points:

- They can make appropriate decisions as they can relate different research aspects with each other, for example: relating decisions about the sample with the choice of research design, methods, and so on.
- Statistics clarified to them the way research works (different tools and methods and design etc)
- Working with SPSS made them confident about the calculations and the procedure to analyze the data, so they can be confident about the results.
- Statistics give very clear results which help them make decisions without a lot of thinking.
- Statistics help them decide about the type relationship between variables and the appropriate procedure and tools and methods and how to choose the appropriate sample to use etc. all these became clear due to this module.
- Through this module, we learned how to make our choices and what type of arguments to prove a specific type of relationship.

- Statistics showed them how to decide upon the right design, how to decide upon the data collection tools, methods, and procedure, this is how their decision skill is developed.
- They understood more and clearly what are the different decisions they have to make and when they should make them. it helped them working with the SPSS.
- Statistics allows them to find logical results through logical processes
- Everything about statistics is related to the logical calculation and this gives more reliable results and objective
- Through basing their decisions on different aspects of their study not only one
- They have learned to make decisions that fit the aspects of research to obtain reliable data

21. Do you think that Statistics lectures helped you overcome the decision making problems in the research process that you have faced at the beginning of the year?

Table 56: Students' attitudes towards statistics lectures helped them overcome the decision making problems

	Frequency	Percentage
Yes	19	76%
No	5	20%
No opinion	1	4%
Total	25	100%

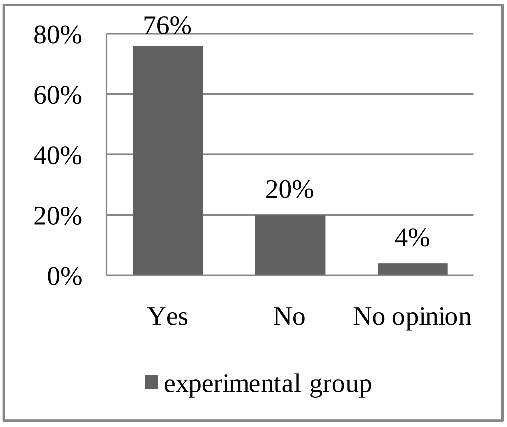


Figure 60: Students' attitudes towards statistics lectures helped them overcome the decision making problems

This table demonstrates the results concerning the participants' opinions about whether Statistical lectures help them overcome the decision making problems. Therefore, as we can see, 76% say that statistics lectures allow them to overcome decision problems while 20% claim that they did not help them. Finally, 4% had not mentioned their opinion.

For more details about their opinions, we asked them to specify the research steps at which they can make better decisions and that statistics lectures helped them to develop. Their answers turn around these points:

- Decisions about research tools, research methodology, and design, and also the use of SPSS
- Decisions that are based on the types of relationship between variables and the appropriate research tools, research methodology, research methods, and research design. Finally, they have learned the decision-making procedures through the SPSS.
- Decisions when we come to draw conclusions about the hypothesis(es)
- Decisions about the sample,
- All the decision that concern with the data (collection, analysis and reading, and drawing conclusion)
- All the decisions that concern all the types of data (nominal, ordinal, continuous, and numeral).
- Decisions about Experimental research (including manipulation, control, and randomization), quantitative data inferential statistics
- Decision mainly about the research design and how to draw conclusions from these results
- We were introduced to the SPSS that facilitates us dealing with data and drawing conclusions.
- Decisions about how to present the data in tables and figures
- Decisions about how to choose the method and the methodology; how to analyze the data and how to prove the reliability of the research

22. Did statistics education help you look into details before making any decision during research process? (explain how)

Table57: students' attitudes towards whether statistics education helps them look into details before making any decision.

	Frequency	Percentage
Yes	20	80%
No	1	4%
No opinion	4	16%
Total	25	100%

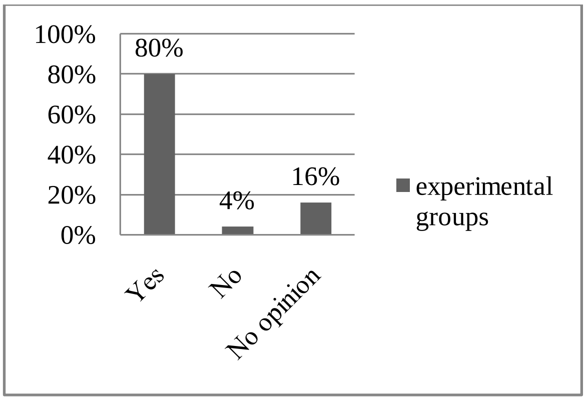


Figure 61: students' attitudes towards whether statistics education helps them look into details before making any decision.

The above table and figure represent the students' attitude towards whether the lectures of statistics help them look into details before making research decisions. We notice that 80% expressed that they helped them and 4% say it did not help them; and finally, 16% have not expressed their opinion.

- The explanations stated by the students are summarized in the followings:
- Looking at the choice of the tools in which one is appropriate to the topic and the method
- When conducting scientific research, they think they have to be very careful before taking any decision.
- They claim they learn to decide and understand the research title first so as they can decide about the other parts of the research and this is something we learned from the lectures of statistics;
- They should make decisions about data collection first then making their statistical analysis decisions that are appropriate to the aim of their research.
- Statistics education helps them to have a general view and detailed information about the research process.
- They helped them look at the details because every logical decision needs details to be appropriate
- They should analyze the research pan before taking action.
- Yes, to choose the appropriate tools and method appropriate to the topic

- They helped them understand that each decision they make should not be from their desire but the correct procedures when dealing with every step of the research.
- They have learned that before making any decisions they should look and take into consideration a lot of things
- It helps them look for the details for example even for selecting the sample we should see whether it should be random or not (when, where, and why).
- Before making the decision, we have to look for different aspects in our study
- Statistics helped them for example questionnaire is not enough for the cause and effect hypothesis they should make pre and post-tests with manipulation.
- Statistics provide them with the real image of research, it shows them what to follow and what to avoid.
- They learned through statistics that they have to gatherer enough information and what type of the data needed and lot other things.

23. ***Did statistics educations help you have more control over your decisions during the research process (for example to make logical decisions instead of emotional or the most liked or easy ones)? (explain how***)

Table 58: Students' attitudes towards whether statistics education helps them have more control over their decisions during the research process

	Frequency	Percentage
Yes	20	80%
No	0	0%
No opinion	5	20%
Total	25	100%

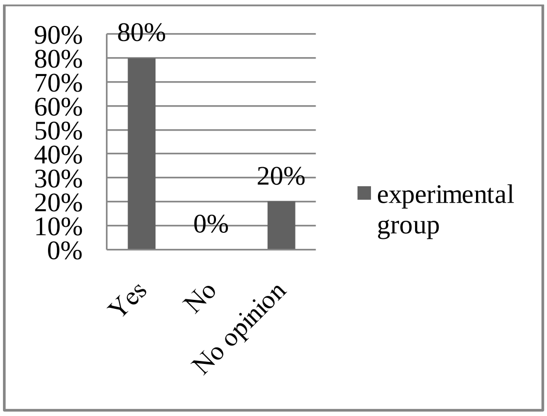


Figure 62: Students' attitudes towards whether statistics education helps them have more control over their decisions during the research process

This table and the figure show that 80% of the students responded by yes which connotes that statistics education enables them to have control over their emotional decisions during the research process. 20% of the students did not express their attitudes.

Concerning the explanations, the students expressed that statistics education help them differentiate between what emotional and logical decision:

- Even if they like or prefer a data analysis (collection) method over another, they choose the appropriate one.
- Statistics are real and logical decisions. It focuses on what is objective and deals with scientific research not what is related to emotions. This is something they learned through statistics.
- They have learned to choose the right and the appropriate decision.
- Before, they do not make a difference between research tools, methods, methodology, and design. They used to make choices according to their preferences but due to the lectures they are aware of the difference and they choose the appropriate ones.
- It helps us in making logical decisions because we are dealing with scientific research where they have to be objective and avoid emotional decisions
- They learned that decisions should be logical and objective,
- They can know whether the research decisions are logical or emotional. They are now aware of what logical decisions are.
- They have learned to slow down when making decisions in research because research is systematic. It is something they have learned through statistics lectures.
- When making research their aim is to collect reliable data the reliable data cannot come from easy choices but logical and objective choices.
- Choosing a choice that they like does not mean it is wrong, but they should make sure they have logical arguments that support its application.
- They have learned through statistics that any decisions should focus on different aspects of the research, like the type of the data and the title ad hypothesis, and so on.
- Through statistics, they became more precise in making decisions
- The results obtained from statistics cannot be interpreted as we like, there is a scientific procedure to interpreting results.
- They have learned that they should give arguments when making choices.

24. Did statistics educations help you be more confident in your decisions during the research process? (explain how)

Table 59: Students' attitudes towards whether statistics education helps them be more confident in their decisions during the research process

	Frequency	Percentage
Yes	20	80%
No	1	4%
No opinion	4	16%
Total	25	100%

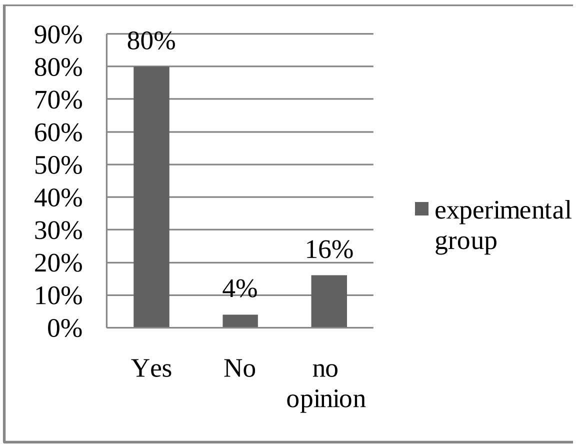


Figure 63: Students' attitudes towards whether statistics education helps them be more confident in their decisions during the research process

We have asked the students whether the lectures they have taken in statistics help them to be confident concerning their decisions. The above table and the figure demonstrate that 80% of the students say yes, whereas 4% say no. from another side, 16% did not express their opinions.

We have summarized the explanations provided by the students who said yes in the following points:

- They have more Knowledge about research, and they understand more about the decisions in academic research (the most repeated reason).
- The steps of research seem more clear and concise due to the lectures on statistics
- When choosing the right decision, the results will be valid and correct
- Statistics explained the steps to follow in order to conduct our research in an organized and interrelated way.
- The lectures helped them know the correct decision from the wrong ones
- They believe their decisions are based on data analysis methods and data and not random
- During the statistics education lectures they had the chance to take a greater look at how good data collection can contribute to the success of any research work, so yes they are more confident now than before.

- The practice during the lectures helped in raising their confidence.
- The lectures guide them in make arguments for decisions.

25. Did statistics education help you look for better choices in your decisions during the research process (choices that lead to better results not the choices that are easier to complete)? (explain how)

Table 60: Students' attitudes towards whether statistics educations help them in looking for better choices in their decisions during the research process

	Frequency	Percentage
Yes	20	80.0
No	0	0.0
No opinion	5	20.0
Total	25	100.0

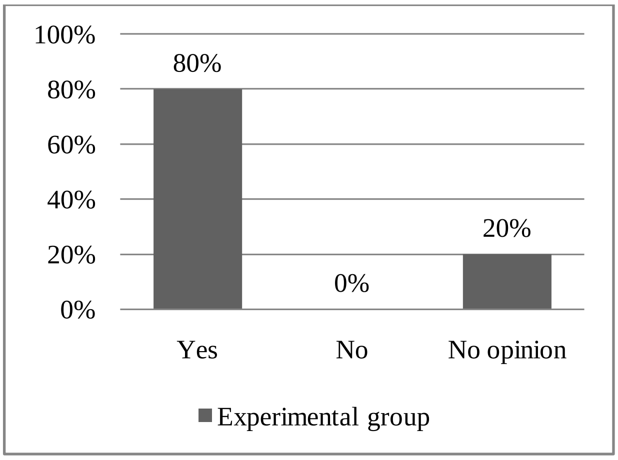


Figure 64: Students' attitudes towards whether statistics educations help them to look for better choices in their decisions during the research process

The above table and the figure show that 80% of the respondent responded with yes which means that statistics education help them to search for the choices that provide better results and not choosing the choices that are easy to complete. However, 20% of the participants did not express their opinion.

The chief explanations provided by the respondents are that the statistics lecture raised their awareness about decisions in the research process. The importance of right decisions according to them leads to reliable results and thus to solve the problem understudy. The explanations are summarized as follows:

- When they design a test or a questionnaire for example and they find it is not appropriate, they re-design another without looking at the effort wasted with the first.
- Through statistics, they understood that they have to make the right decisions even if they do not know how to deal with it or they are hard to apply.
- Right choices lead to appropriate and accurate results to the research problem, so when have to choose the appropriate choice whatever the matter is.
- Since they know that they should follow reason to reach reliable results, they believe that good choices are those lead by reason and base on good arguments.
- Correct choices lead surely to valid conclusions and choices that lead to completing the work with looking at its quality is not good research. They understood this through statistics education.
- They learned that easy choices lead to nothing but difficult choices lead to success.
- They have learned on which basis to make choices and accept the result or reject them and so on. Moreover, Statistics lectures have shown them how to generalize the results and conclusions. What they have learned made us aware of all these processes.

26. Did statistics education help you base your decisions on logical reasons during the research process? (explain how)

Table 61: Students' attitudes towards whether statistics education helps them base their decisions on logical reasons during the research process

	Frequency	Percentage
Yes	21	84.0
No	1	4.0
No opinion	3	12.0
Total	25	100.0

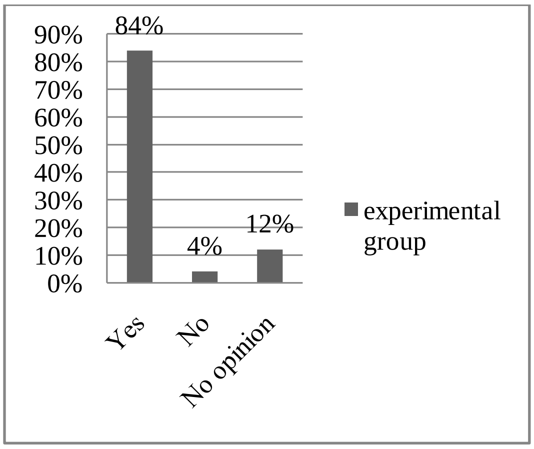


Figure 65: Students' attitudes towards whether statistics education helps them base their decisions on logical reasons during the research process

The above table and figure display that 84% of the participants claim that statistics lectures enable them to base their decisions on reason and 4% claim that they did not help them. 12% of the participants did not give their opinion about the questions.

- The explanations provided by the students are mainly:
- They learned that basing decisions on personal emotions lead to wrong results.
- They learned to be logical in their decisions through not making emotional decisions and provide reasons for every single choice.
- They think that they need to work with logic and reasoning because it is a scientific research
- Reasoning leads to real and objective results for the research problem.
- Illogical and emotional lead to confusions
- Statistics allows them to choose what seems adequate to different aspects of the study
- They have learned that logical thinking leads to reliable results
- They have learnt through statistics that logic leads to correct conclusions

Section VI: Further Suggestions

Would you please add any other suggestions concerning statistics education and what knowledge these lectures add to your ability to make decisions in your academic research process??

Most of the suggestions provided by the participants claim that lectures on statistics added too many things to their skills however they should have more time and more practice to reach better results. In specific, we summarized the students' suggestions into these points:

- According to what they have been attending they are able to use the SPSS and know how to organize questionnaires data, tests, and scales and how to analyze them.
- Statistics is really important and beneficial to researchers and helps them reach correct and valid results which make the research successful.
- Statistics is beneficial and helps the researcher to be confident in his choices and decisions but it is preferable to give more time and more sessions to this module to be explained slowly especially for the SPSS software.
- The statistics lectures help us in dealing with data comparing the findings and know when the results are reached or not.

- There should be more options to help beginner users to use the SPSS because the first time they use it, it seems too difficult to use it. They face difficulties in installing the SPSS and they hope there were some methods to facilitate the process of installing it.
- They think that statistics should be studied earlier to grasp all notions related to research step by step. Statistics lectures helped them in many things but they still think that they should have more knowledge about it because they believe that what they had is not sufficient.
- Statistics lectures help in comparing the data finding in our research, and how to know if the research aim is reached or not.
- Lectures should constitute both theory and practice to every single notion they study.
- Statistics lectures give more knowledge about how to draw conclusions and make decisions and how to use materials appropriately and how to analyze data using different methods.
- The practice helps to memorize steps and statistical models and enhances comprehension
- they think they benefited and developed their capacities especially when dealing with academic research (they suggested that it would be more beneficial if they had more time dealing with statistics practice)
- Statistics showed them how to conduct research how to combine the steps and how to draw conclusions and how to generalize from the data and how to present the figures and the tables. The lectures taught them how to use the SPSS which is very important in research.

V.4. DECISION MAKING AMONG EXPERIMENTAL AND CONTROL GROUPS

V.4.1. Aim of the scale

This study investigates the effect of statistics education on EFL learners' decision making In order to achieve the aim we conducted an experimental study with 25 students as a control group and 25 students as experimental group (for the control group even though they did not give back the questionnaire because it is long, they answered the scale). To measure learners' decision-making skills, we administered a modified scale adopted from French DJ, West RJ, Elander J, and Wilding JM (1993) Decision-Making Questionnaire. The scale was administered before the experiment and after the experiment. In order to test whether there is a significant difference between the means of pre-scale and post scales and to compare the means of the experimental and control group.

More specifically, the Scale is used to test the development of the overall decision making skill (using the means of the whole items) then specifying which decision-making style has been developed due to the provided lectures of statistics (see that the scale is divided into seven subscales that represent seven decision making styles).

Finally, the results are then calculated using IBM SPSS Statistics 19. The results are shown in the following sections:

V.4.2. The Overall Decision Making Scale Results

V.4.2.1. Descriptive Statistics

Generally, the results obtained from the scale- in both pre and post periods- are presented in the following table:

Table 62: Descriptive Statistics for both experimental and control group (Pre and post studies)

		N	Mean	Std. Deviation
pre- Scale	***Experimental group***	25	2.88	.25
	Control group	25	3.16	.44
Post Scale	***Experimental group***	25	3.41	.28
	Control group	25	3.12	.26

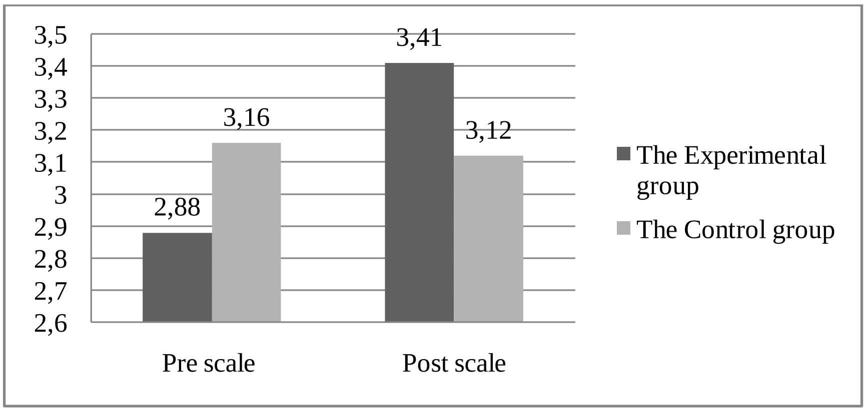


Figure 66: Descriptive Statistics for both experimental and control group (Pre and post studies)

The above table and figure show that the experimental group's decision-making skill mean in the pre-study is 2.88 (SD=.25) while the group's mean in post-study increased to 3.41 (SD=.28). On another side, the mean score of the control group in the pre-study is 3.16 (SD=.44) while the mean score of the same group in the post-study decreased to 3.12 (SD=.26).

V.4.2.2. Paired Samples T-tests for both experimental and control

We opt for a paired t-test to see whether the difference in the means of the pre and post-decision-making scale for both experimental and control groups is statistically significant. The results are shown in the following table:

Table 63: Dependent t-test for the difference between pre and post scales

	Pre-scale		**Post-scale**		**N**	**95% CI For mean difference**	**T**	**df**	**Sig. (2tailed)**
	Mean	**SD**	**Mean**	**SD**					
Experimental group	2.88	.25	3.41	.28	25	[-.715, -.362]	-6.309	24	.000
Control group	3.16	.44	3.12	.26	25	[-.165, .260]	.462	24	.648

This table presents the results of the paired t-test which has been conducted to compare the means of the pre and post-decision-making skills in pre and post-studies for both experimental and control groups. The table demonstrates that there is a statistically significant difference between the means of the pre (M=2.88 and SD=.25) and post-decision-making scale (M=3.41 and SD= .28) of the experimental group, we can see that $t(24)= -6.309$, $p= .000$; $p < .05$.

For the difference control groups' decision making, we can see that there is no statistically significant difference between pre decision making (M=3.16 & SD= 44) and post scale (M=3.12 & SD= .26); $t(24)= .462$; $p=.648$) . We observe that $p > .05$.

V.4.2.3. Independent T-Tests

To see whether there is a statistically significant difference between the experimental and the control groups in pre and post-sales we opt for an independent t-test. The results are shown in the following table:

a. *Independent t-test of experimental and control groups (Pre Scale):*

Table 64: Independent t-test results for the difference between experimental and control the pre-scale

	Experimental group			***Control group***			***95% CI For mean difference***		***T***	***df***	***Sig. (2 tailed)***
Pre Scale	**M**	**SD**	**N**	**M**	**SD**	**N**	Lower	upper			
	2.88	.25	25	3.16	.44	25	.081	.497	2.799	48	.007

The table shows that the mean of the experimental group (M=2.88) is lower than the mean of the control group (M=3.16) in the pre scale. As it is also shown in this table, there is a significance difference between the decision makings skill of the experimental (M=2.88 & SD=.25) and the control group (M=3.16 & SD=.44) in the pre scale: $t(48)= 2.799$, $p= .007$. Here we can notice that $p < .05$.

b. *Independent t-test of experimental and control groups (Post Scale):*

Table 65: independent t-test results for the difference between experimental and control groups post-scale

	Experimental group			***Control group***			***95% CI For mean difference***		***t***	***df***	***Sig. (2 tailed)***
Post Scale	**M**	**SD**	**N**	**M**	**SD**	**N**	lower	Upper			
	3.41	.28	25	3.12	.26	25	-.45	-.14	-3.85	48	.000

We can see from the table that the mean of the experimental group (M=3.41 & SD=.28) is higher than the mean of the control group (M=3.12 & SD=.26). In addition, the table demonstrates that this difference in the means is statistically significant: $t(48)= -3.85$, $p= .000$ and $p< .05$.

V.4.2.4. ANCOVA Results

Since there was a difference between the experimental and control group in the pre-scale, we opt a way ANCOVA to control for any effect that the pre-scale (covariate) may have on the results of the post-study and to empower the results of the independent t-test of the post-study. The ANCOVA results are shown in the following section:

a. *Descriptive Statistics before Adjustment of the Post Scale:*

Table 66: The Descriptive Statistics of the Control and Experimental post-study

Groups	Mean	Std. Deviation	N
Control group	3.12	.26	25
Experimental group	3.41	.28	25

The above table shows again the summary statistics of both control and experimental groups in the post-study. As we can see, each group constitutes 25 students (N= 25 for each group). The Mean of the experimental group is 3.40 and the standard deviation is .28. In opposition, the control group's mean is 3.12 with a standard deviation of .26.

b. The ANCOVA results

Table 67: ANCOVA Results for the Control and Experimental Post-Study

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1.127[a]	2	.563	7.487	.002	.242
Intercept	8.247	1	8.247	109.576	.000	.700
Pre Scale	.023	1	.023	.309	.581	.007
Groups	.841	1	.841	11.171	.002	.192
Error	3.537	47	.075			
Total	539.465	50				
Corrected Total	4.664	49				
a. R Squared = .242 (Adjusted R Squared = .209)						

The ANCOVA revealed that: f (1, 47) = 11.17; p = .002; p < .05; .192. This means that there is a statistically significant difference between the control and experimental groups' decision-making means after controlling for the pre-scale results. The Partial Eta Squared reveals a small effect size (basing on Cohen's guidelines 0.1 is a small effect size for a significant difference). The estimation of the means of each group and statistical difference after adjusting for the covariate (pre-scale) are presented in the following tables:

Table 68: Control and experimental Post Scales' adjusted means

tested groups	**Mean**
Control group	3.131[a]
Experimental group	3.410[a]

As we can see, after controlling for the pre study the control groups adjusted mean in the post scale (M=3.13) is lower than the adjusted mean of the Experimental group (M=3.41).

Table 69: The difference between the Control and Experimental Post-Scale

(I) tested groups	(J) tested groups	Mean Difference (I-J)	Sig.[a]	95% Confidence Interval for Difference[a]	
				Lower Bound	Upper Bound
Control group	experimental group	-.280	.002	-.448	-.111
Experimental group	control group	-.280	.002	.111	.448

As we can observe from the above table, there is a statistical significance between the adjusted means of control and experimental groups as p=.002; p<.05. Therefore, we can conclude that the pre scale results have no effect on the post scale results.

V.4.3. Decision Making Styles

As it is mentioned before, the questionnaire developed by French DJ, West RJ, Elander J, and Wilding JM (1993) is divided into 7 subscales. Each subscale represents a decision-making style. In order to know the type of decision-making style which has been developed through the experiment, we opt for a t-test procedure (both paired and independent t-tests) to measure whether there is a statistically significant difference between control and experimental pre and post levels of each style. The results are, then, presented in the following tables:

V.4.3.1. *Pre and Post Decision Making Styles of Experimental Group*

A paired t-test procedure has been employed to see whether there a significant difference between the Experimental group's decision-making style in the pretreatment period and the post-treatment period. The results are shown in the following table:

Table 70: Pre and post decision making styles of experimental group

Decision Making Style	**Pre-scale**		***Post scale***		**N**	***95% CI For mean difference***		***t***	***Df***	***Sig. (2 tailed)***
	M	**SD**	**M**	**SD**		Lower	Upper			
Thoroughness	3.08	.66	3.70	.52	25	-1.006	-.233	-3.313	24	.003
Control	2.83	.47	3.35	.66	25	-.851	-.188	-3.233	24	.004

Hesitancy	3.10	.53	3.70	.53	25	-.934	-.265	-3.700	24	.001
Social resistance	2.44	.51	2.84	.73	25	-.797	-.002	-2.078	24	.049
Optimizing (perfectionism)	3.24	.72	3.80	.69	25	-.961	-.158	-2.882	24	.008
Principled (Idealism)	2.74	.61	3.50	.66	25	-1.123	-.397	-4.321	24	.000
Instinctiveness	2.70	.52	3.00	1.01	25	-.791	.191	-1.260	24	.220

The above table represents a comparison between the decision-making styles of the experimental group in the pre and post-studies. As we may notice, there are statistically significant differences between the pre and post-decision-making styles for the experimental group except for the Instictiveness style.

More precisely, we see that there is a significant difference between pre (M=3.80 and SD= .66) and post thoroughness style (M= 3.70 and SD= .52) in the experimental group: $t(24)= -3.31$, $p= .003$; $p < .05$.

Concerning the control style of decision making, we can also see that there is significant difference between pre scale results (M= 2.83 and SD =.47) and the post scale results (M= 3.35 and SD= .66): $t(24)= -3.23$, $p= .004$; $p < .05$.

Hesitancy decision-making style has also been developed as it is shown in the descriptive statistics; the mean of the pre-scale results (M= 3.10 and SD=.53) is lower than the mean of the post scale (m=3.70 and SD=.53). The difference between the mean statistically significant: $t(24)= -3.70$, $p= .001$; p < ,05.

In addition, there is a significant difference in the means of social resistance decision-making style. As we can observe, the mean of the pre-scale (M=2.44 and SD=.51) is lower than the post scale mean (M=2.84 and SD=.73): $t(24)= -2.07$, $p= .049$; $p < .05$.

Concerning the Optimizing decision-making style, we can notice that the mean of the pre-scale (M= 3.4 and SD =.72) is lower than the mean of the post-scale (M=3.80 and SD = .69). We notice that the difference between these means is statistically significant: $t(24)= -2.88$, $p= .008$; $p < .05$.

Then, the difference between the means of pre and post principled decision-making style is statistically significant: the pre-scale mean (M=2.74 and SD =.61) is lower than the means of the post scale (M=3.50 and SD=.66): t(24)= -4.32, p= .000; p < .05.

Finally, the results of the last decision-making style, Instinctiveness, revealed that there is not a statistically significant difference between the means of pre and post-scales. As we can see; even though the pre-scale mean (M =2.70 and SD =.50) is lower than the mean of the post scale (M=3 and SD =1.01); however, the t-test results show that this difference is not significant: t(24)= -1.260, p= .22; p > .05.

V.4.3.2. Pre and post decision making styles of the control group

We have adopted a paired t-test procedure to compare the means of decision-making styles and to know whether the difference between the means is statistically significant or not. The results are shown in the following table:

Table 71: Pre and post decision making styles of the control group

Decision Making Style	**Pre-scale**		***Post scale***		**N**	***95% CI For mean difference***		***t***	***Df***	***Sig. (2 tailed)***
	M	**SD**	**M**	**SD**		Lower	Upper			
Thoroughness	3.60	.54	3.26	.62	25	.0097	.6702	2.125	24	.044
Control	3.32	1.71	3.04	.45	25	-.4671	1.0431	.787	24	.439
Hesitancy	3.54	.71	3.40	.70	25	-.2903	.5837	.693	24	.495
Social resistance	2.70	.50	2.65	.60	25	-.2989	.4056	.312	24	.757
Optimizing (perfectionism)	3.08	.93	3.44	.86	25	-.8708	.1508	-1.45	24	.159
Principled (Idealism)	2.78	.76	3.04	.53	25	-.6602	.1402	-1.34	24	.193
Instinctiveness	2.52	1.11	3.10	.81	25	-1.128	-.0317	-2.18	24	.039

The above table shows the t-tests' results of the control group at the level of decision-making styles. We can see that all the styles are not statistically significant as the p values are higher than .05 except for thoroughness in which there is a significant decrease and for the instinctiveness style in which there is a significant development.

More specifically, there is a statistically significant difference between the means of the pre thoroughness scale (M=3.60 and SD =.54) and the post scale means (M= 3.26 and SD =.62). As we can see in the table the mean of the pre-scale is higher than the mean of the post scale where we can say that is a decrease in the means. This decrease is said to be significant: $t(24)=2.12$, $p= .044$; $p < .05$.

Concerning Instinctiveness, we see that there is a significant development between the pre and post-periods. We can observe that the mean of the pre scale (M= 2.52 and SD =1.11) is lower than the post scale's mean (M=3.10, SD =.81): $t(24)= -2.18$, $p= .039$; $p < .05$.

Regarding the other styles, we can see that there not a significant difference between the means of the pre control decision making style (M= 3.32 and SD =1.71) and the mean of the post scale (M =3.04, SD= .70): $t(24)= .787$, $p= .43$; $p > .05$.

There is not a statistically difference between the pre-scale mean of hesitancy decision-making style (M=3.54 and SD =.71) and the post mean (M=3.40 and SD =.70): $t(24)=.693$, $p=.495$; $p > .05$.

Social resistance's results has shown no significant development between the pre scale mean (M=2.70 and SD=.50) and the post scale results (M=2.65 and SD =60): $t(24)=.312$, $p= .757$; $p > .05$.

In addition, Optimizing decision making style's results has also revealed no significance difference between the pre mean (M=3.08 and SD=.93) and the post mean (M=3.44 and SD =.86): $t(24)= -1.45$, $p= .159$; $p > .05$.

Finally, we observe that there is not a significant difference between the means of the Principled decision-making style of the pre and post-scales. As we can observe, the pre scale mean (M=2.78 and SD =.76) is lower than the mean of the post scale (M=3.04 and SD= .53): $t(24)= -1.34$, $p= .193$; $p > .05$.

V.4.3.3. Comparing control and experimental decision-making styles (pre scale)

We adopted an independent t-test procedure, in this section, in order to test whether there is any difference between the control and experimental groups' decision-making style in the pre-treatment period. The results are shown in the following table:

Table 72: Comparing control and experimental decision making styles (pre scale)

Decision Making Style	Experimental Group			Control Group			95% CI For mean difference		t	Df	Sig. (2 tailed)
	M	SD	N	M	SD	N	lower	Upper			
Thoroughness	3.08	.66	25	3.60	.54	25	-.8654	-.1745	-3.026	48	.004
Control	2.83	.47	25	3.32	1.71	25	-.8658	-.1741	-1.395	48	.170
Hesitancy	3.10	.53	25	3.54	.71	25	-1.211	.219	-2.471	48	.017
Social resistance	2.44	.51	25	2.70	.50	25	-1.224	.232	-1.851	48	.070
Optimizing (perfectionism)	3.24	.72	25	3.08	.93	25	-.7980	-.0820	.678	48	.501
Principled (Idealism)	2.74	.61	25	2.78	.76	25	-.7987	-.0812	-.204	48	.839
Instinctiveness	2.70	.52	25	2.52	1.11	25	-.5563	.0230	.732	48	.467

In general, the table shows that there are no statistically significant differences between the experimental and control groups' Control, social resistance, Optimizing, Principled, and Instictiveness decision-making styles. However, for thoroughness and hesitancy styles we can see that there is a significant difference.

Therefore, we can see a significant difference between the control group's mean (M=3.60 and SD = .54) and the mean of the experimental group (M= 3.08 and SD =.66): t(48)= -3.026, p=.004; p < .05. It is worth mentioning here that the group that has a higher mean is the control group over the experimental group.

Concerning Control decision-making style, the results revealed that there is no statistically significant difference between the mean of the experimental group (M= .83 and SD =.47) and the control group's mean (M=3.32 and SD = 1.71): t(48)= -1.395, p=.170; p> .05.

We can see that there is a significant difference between the means of experimental and control groups' means of hesitancy decision-making style. As we can see the mean of the control group (M=3.54 and SD =.71) is higher than the mean of the control group (M=3.10 and SD =.53): t(48)= -2.471, p=.017; p < .05.

Furthermore, the mean of the control group (M=2.70 and SD =.50) is higher than the mean of the experimental group (M =2.44 and SD =.51) at the level of social resistance decision-making style. Basing on the independent t-test results, we can conclude that this difference is not statistically significant: t(48)= -1.851, p=.070; p> .05.

The optimizing decision-making style's results in the table show that there no significant difference between the control and the experimental groups. As we notice from the table: the mean of the experimental group (M =4.24 and SD =.72) is higher than the mean of the control group (M=3.08 and SD = .93). The independent t-test procedure shows that there is not a significant difference between them: t(48)= .678, p=.501; p> .05.

Similarly, the results show no significant difference between the control group mean (M= 2.78 and SD =2.74) and the experimental group means (M=2.74 and SD =.61) at the level of the principled decision-making style. The difference is not statistically significant as the t-test results demonstrate: t(48)= -.204, p=.839; p> .05.

Finally, for the instinctiveness decision making style, the t-test results show that there is not a significant difference between the control (M =2.52 and SD =1.11) and experimental group (M =2.70 and SD =.52): t(48)= .73, p=.467; p> .05.

V.4.3.4. ***Comparing control and experimental decision making styles (post scale)***:

We opt for an independent t-test procedure to test whether there are statistically significant differences between the control and experimental groups' means of the decision-making styles in the post-treatment period. The results are shown in the following table:

Table73: Comparing Control and Experimental Decision Making Styles (Post Scale)

Decision Making Style	**Experimental Group**			**Control Group**			***95% CI For mean difference***		***t***	***Df***	***Sig. (2 tailed)***
	M	**SD**	**N**	**M**	**SD**	**N**	Lower	Upper			
Thoroughness	3.70	.52	25	3.26	.62	25	.11362	.7663	2.711	48	.009
Control	3.35	.66	25	3.04	.45	25	-.0124	.6364	1.934	48	.059
Hesitancy	3.70	.53	25	3.40	.70	25	-.0486	.6619	1.735	48	.089
Social resistance	2.84	.73	25	2.65	.60	25	-.1975	.5709	.977	48	.334
Optimizing	3.80	.69	25	3.44	.86	25	-.0870	.8070	1.619	48	.112

(perfectionism)											
Principled (Idealism)	3.50	.66	25	3.04	.53	25	.1170	.8029	2.697	48	.010
Instinctiveness	3.00	1.01	25	3.10	.81	25	-.6223	.4223	-.385	48	.702

The table demonstrates a significant difference between the means of the control and experimental groups' thoroughness style and principled style. Concerning the other styles, we observe that there is not a significant difference.

Therefore, the table demonstrates a significant difference between the experimental group (M = 3.70 and SD = .52) and the control group (M = 3.26 and SD =.62): t(48)= 2.71 , p=.009; p< .05.

The results of the control decision-making style reveal that there is not a statistically significant difference between the experimental group mean (M=3.35 and SD =.66) and the control group mean (M =3.40 and SD =.45): t(48)= 1.93, p=.059; p> .05.

Likewise, hesitancy decision-making style's results show that there is not a statistically significant difference between the experimental groups' mean (M =3.70 and SD =.53) and the experimental group mean (M =3.40 and SD =.70): t(48)= 1.73, p=.089; p> .05.

Moreover, there is not a significant difference between the experimental group's mean (M =.84 and SD = .73) and the control group's mean (M= 2.65 and SD = .60) in the social resistance style: t(48)= .977, p=.334; p> .05.

Similarly, we can observe in the table that there is not a significant difference between the control and experimental group means at the level of optimizing style. As the table demonstrates: the experimental group mean (M = 3.80 and SD =.69) is higher than the control group's mean (M=3.44 and SD =.86); however, this difference is not statistically significant: t(48)= 1.61, p=.112; p> .05.

As for principled style, we see that the difference between the two groups' means is statistically significant. We notice that the mean of the experimental group (M=3.50 and SD =.66) is higher than the mean of the control group (M = 3.04 and SD= .53). This difference is said to be statistically significant as we can see: t(48)= 2.967, p=.010; p< .05.

Finally, the table discloses that there is no statistically significant difference between the two groups. The mean of the experimental group (M= 3.00 and SD =1.01) is lower than the control group's mean (M =3.1 and SD =.81). This difference is not statistically significant: t(48)= -.385, p=.702; p> .05.

V.4.3.5. The ANCOVA results for thoroughness decision making style

As we notice in the previous results section, we see that the experimental group had a significant development of thoroughness style in the post-treatment period. We have seen that there was a significant difference between the control and experimental groups in which the group which has a higher mean was the control group. For better insurance, we opt for the ANCOVA procedure to support the independent t-test results and to show that the significant difference exists even without the existence of the difference in the pre-treatment phase. The results of the ANCOVA are presented in the following tables:

a. *Descriptive statistics before adjustment of the post scale:*

Table 74: Descriptive Statistics before Adjustment of the Post Scale

Groups	***Mean***	***Std. Deviation***	***N***
Experimental group	3.70	.52	5
Control group	3.26	.62	25

Before presenting the adjusted values, it is worth mentioning the original values. As we may see, the control group's mean (M =3.26 and SD =.62) is lower than the experimental group's mean (M =3.70 and SD =.52).

b. *The ANCOVA results*

Table 75: Thoroughness ANCOVA results

Source	***Type III Sum of Squares***	***df***	***Mean Square***	***F***	***Sig.***	***Partial Eta Squared***
Corrected Model	2.535[a]	2	1.267	3.795	.030	.139
Intercept	21.628	1	21.628	64.766	.000	.579
pre_thoroughness	.115	1	.115	.343	.561	.007
Groups	1.664	1	1.664	4.984	.030	.096
Error	15.695	47	.334			

Total	623.750	50				
Corrected Total	18.230	49				
a. R Squared = .139 (Adjusted R Squared = .102)						

The above ANCOVA table demonstrates that: f (1, 47) = 4.98; p = .03; p < .05; .096. This reveals that there is a statistically significant difference between the control and experimental groups' thoroughness decision-making style's means after controlling for the pre-scale results. The Partial Eta Squared reveals a small effect size (basing on Cohen's guidelines: less than 0.1 is a small effect size for a significant difference).

The estimations of the means of each group after adjusting for the covariate (pre-scale) are presented in the following tables:

Table76: Control and experimental Post Scales' adjusted means of thoroughness style

The groups	The means
Experimental group	3.679[a]
Control group	3.281[a]

As we can see, the control group's adjusted mean in the post scale (M=3.28) is lower than the adjusted mean of the Experimental group (M=3.67) after adjusting for the covariate (the pre thoroughness results).

Table 77: Statistical significance between the adjusted means of control and experimental groups' thoroughness

(I) groups	(J) groups	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
experimental	Control	.398*	.178	.030	.039	.757
Control	Experimental	-.398*	.178	.030	-.757	-.039

The above table shows a statistical significance between the adjusted means of control and experimental groups as p= .03; p< .05. Therefore, we can conclude that the pre scale results do not affect the post thoroughness scale's results.

V.5. DIAGNOSES TESTS

V.5.1. Testing the soundness and accuracy of the decision making skill

In order to see whether there is a development in the decision-making skills of the Master's students before and after the experiments, we tend to test the students before and after the two research phases (Data Collection Phase and Data Analysis and Conclusion Phase). The tests entail a list of the different errors committed in pre and post-tests. The tests' description and tests' results are then presented in the following sections:

V.5.2. Tests' description:

a. *The pre and post data collection test*:

We administer a test to our experimental group at the beginning of our experiments to examine their ability to make the decision and explain and/ or justify their choices when collecting the data. We provide the students with five research topics (see appendix 4) in which different decisions will be made. We ask the students to decide about the research design, methods, tools, hypothesis for each type of research and we ask the students types of data and their role in the choice of the research design and the role of sampling in the reliability of the results.

In the post phase, we asked the students to choose their own topics of research and decide upon the appropriate aim, hypothesis, deciding upon the appropriate sampling method, the appropriate research design, research methods, and research tools. Then we ask questions to know whether students are able to relate the data analysis phase with the data collection phase. Every choice and decision should be supported with appropriate explanation and/ or justification.

b. the pre and post data analysis tests:

The pre-data analysis test examines the students' ability to locate the most important points in data collection that play an important role in the data analysis decisions. This includes mainly the research aim and types of data. Then we test their ability to differentiate between data analysis procedures that are appropriate to the five research topics provided at the beginning (see appendix 4). The second activity aims at examining the students' ability to evaluate previously made decisions. Each answer should be supported by sound argumentations.

The post-data analysis test is divided into two parts: the first examines the students' ability to analyze their own data and make conclusions (including, essentially, presentation of data in tables and figures). The second part examines their ability in working on the SPSS software (data entry, conducting descriptive and inferential statistics through the SPSS); and examines also their ability to read the tables and deduce conclusions. It is worth mentioning here that we are only going to compare only the first part with the pre-tests as the first part is the one which deals with decision making skill (see appendix 5).

V.5.3. Tests' results

The test scores are measured on a scale of 10 points. We consider the marks of less than 5 as low on a decreasing scale and more than 5 as good marks on an increasing scale.

a. ***Tests' Results for theData Collection Phase***:

Table 78: Tests' results for the data collection phase

	N	Min.	Max.	Mean	SD
Data collection (pre-test)	25	.00	2.50	1.08	.66
Data collection (posttest)	25	3.00	9.50	6.24	1.68
Valid N	25				

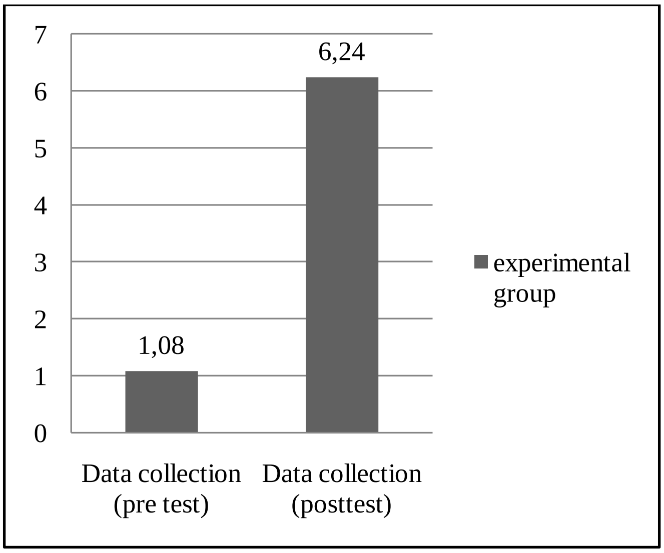


Figure 67: Tests' results for the data collection phase

The above table demonstrates the mean score of the decision-making tests in pre and post-phases of 25 students (N=25). We observe the students mean score in the post-study (M=6.24, SD =1.68) is higher than the mean score of the pre-tests (M=1.08, SD =.66).

b. *Tests' Results for the Data Analysis and Conclusion Phase*:

Table 79: Pre and post-tests' results for the data analysis and conclusion phase

	N	Min.	Max.	Mean	SD
Data analysis (pre-test)	25	.00	4.75	1.95	1.31
Data analysis (posttest)	25	3.00	8.25	6.19	1.61
Valid N	25				

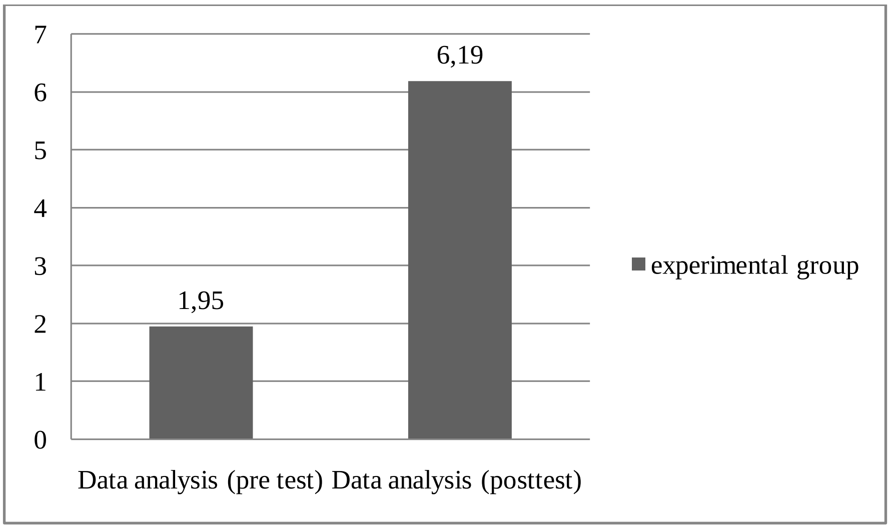


Figure 68: Tests' results for the data analysis and conclusion phase

For the data analysis tests, we can see in the above table that the Master's students' scores are higher in the post-tests (M=6.19, SD =1.61) than those in the pre-test (M= 1.95, SD= 1.31).

c. *Comparing the difference between the pre and post-tests (paired sample t-tests results)*:

In order to know whether the difference between the pre and post-tests is statistically significant, we run a paired sample t-test (results obtained from IBM SPSS Statistics 19). The results are then portrayed in the following table:

Table 80: Paired Sample t-tests Results for difference between the pre and post tests

	Pre-test		Post-test		N	95% CI For mean difference	T	Df	Sig. (2tailed)
	Mean	SD	Mean	SD					
Data collection test	1.08	.66	6.24	1.68	25	[-5.76, -4.55]	-17.55	24	.000
Data analysis test	1.95	1.31	6.19	1.61	25	[-5.20, -3.27]	-9.085	24	.000

The above table shows a significant difference between the pre (M=1.08, SD=.66) and post (M=6.24, SD=1.68) data collection tests: as we can see: $t(24)= -17.55$, $p= .000$; $p< .05$.Moreover, we observe that there is a significant difference between the pre (M=1.95, SD=1.31) and post (M=6.19, SD=1.61) data analysis tests: $t(24)= -6.085$, $p= .000$; $p< .05$.

d. Summary of the students' errors and problems in pre and post Tests

The test aims not only to know the students' decision-making level in the data collection and data analysis and interpretation phases but also to determine the different errors and the problems they face when making the decisions. Therefore, we opted for an error analysis method of the students' tests in order to find out these challenges and errors. The most frequent problems and errors are illustrated in the following table:

- ***Errors detected via the pre data collection test***:

Table 81: Errors and challenges faced in the data collection pre test

Students' Errors and Challenges	F	%
1. Mixing between the research design, methods and tools	23	92
2. Errors at the level of justification and argumentation for the chosen decisions (random choices)	18	72
3. Errors at the level of Hypothesis	22	88
4. Mixing between different research aims	5	20
5. Errors at the level of sample and sampling	8	32
6. Making a difference between research variables and types of data	23	92

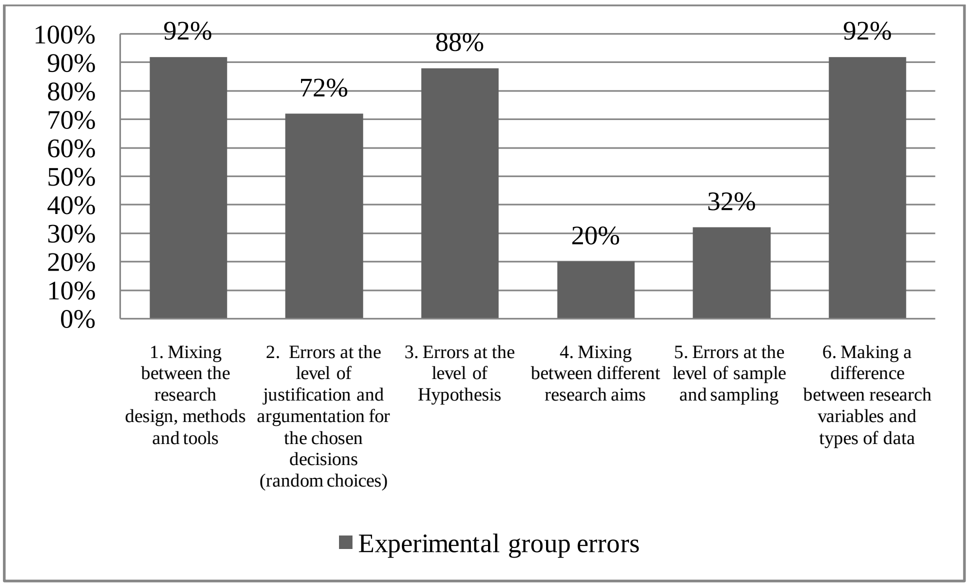


Figure 69: Errors and challenges faced in the data collection pre test

The above table demonstrates the most frequent problems and errors that the participants have committed or have faced when answering the data collection-related questions. As we may see the majority of the students (92%) make errors at the level of research design, methods, and tools. Moreover, 92% of them do not make a difference between research variables and data analysis. Furthermore, 88% of the students make errors at the level of the hypothesis. 72% do not provide arguments to their choices, if they provide they are not appropriate. We found also that 32% make errors at the level of sample and sampling and 20% at the level of research aims. More details about these errors are provided here:

a) *The lack of understanding about the research design, methods and tools:*

Concerning the first type of errors, students mingle between the three concepts. When we ask them what is the appropriate design the majority of the students give answers such as a questionnaire design or observation design. In addition, they give answers like descriptive method, experimental method, and so on.

Moreover, the students are inconsistent in their answers, for example: when they say that they choose a mixed-method, they claim that they choose an interview as a research tool or other qualitative tools. Furthermore, the students can explain that they will make pre and post studies; however, they tend to use different tools to measure the development of the same variable.

b) *The lack of justification and argumentation for the chosen decisions (random choices)*:

When the participants make a choice, they usually skip making justifications or give argumentations for their choices; when they make these justifications they are not appropriate. For example, they tend to use a questionnaire to measure a cause and effect relationship between two variables because it is easy and does not consume much time.

c) *Problems at the level of Hypothesis*

According to the tests, the students do not know when the study needs a hypothesis and when it does not need it. Furthermore, the students do not differentiate between the research aim and research hypothesis.

d) *Mixing between different research aims*:

Because of the lack of understanding about the research aims, students mingle between the different aims like finding the cause and effect relationship, finding a correlation, and exploring a given phenomenon. Moreover, they claim at the very beginning that the aims is a cause and effect (for example); yet when justifying the decision concerning the research tools, they choose only a questionnaire as a basic tool to explore the students' opinion about the variable.

e) *Lack of understanding of sample and sampling:*

The word sample is known to the students as being a group of participants who are taken from the population. There is a big lack in the understanding of why and how to and what to the importance of choosing a sample instead of working with the whole population. Most importantly, how to deal with the data obtained from the sample.

f) *Making a difference between research variables and types of data*

The students cannot make a difference between the variables and the data they obtain and the role that each one has in the research process.

- ***Errors detected in the post data collection test***

Table 82: Errors and challenges faced in the data collection post test

Students' Errors and Challenges	**F**	**%**
1. The disagreement in research tools choices in relation the research method	3	12
2. Errors in writing a cause and effect hypothesis statement	2	8
3. The errors at the level of research variables	2	8

4. The structure of the title	3	12
5. The justification & argumentation	5	20

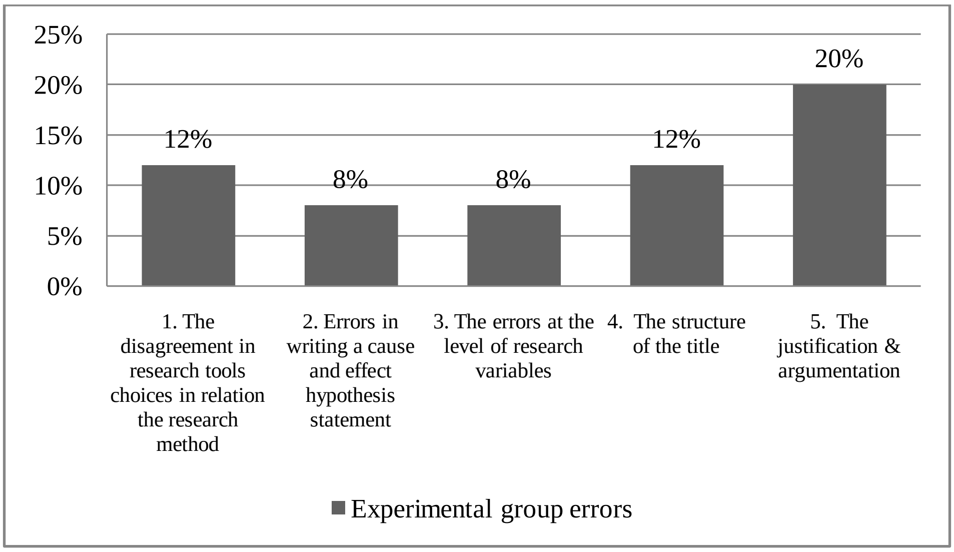


Figure 70: Errors and challenges faced in the data collection post test

It is shown in the above table and figure that 20% of the students make errors at the level of argumentations and explanations of the provided decisions (the most frequent error is that they provide non-complete or non-clear arguments); 12% of the students make errors at the level of research tools (when the students choose a mixed-method, they tend to cite only the quantitative tools like questionnaires or tests). 12% make errors in the title (they do not mention the aim-word and/or the case study), 8% of the students make errors when writing down a cause and effect hypothesis statement. Finally, 8% commit errors at the level of research variables (here the students either use large variables or they are not technical words; moreover, the students mingle between variables for example when the dependent variable in the title is the willingness to communicate, students say in the research aim that they want to develop the students' motivation).

- ***Errors detected in the pre data analysis test:***

Table 83: Errors and challenges faced in the pre data analysis test

Students' Errors and Challenges	F	%
1. Lack of knowledge about data analysis methods	22	88
2. Lack of knowledge about types of data	20	80
3. no arguments	2	8
4. No appropriate arguments	21	84

5. They do not know when and why to use frequencies, scores and percentages	23	92
6. They do not know how to read the tables	22	88
7. They do not know how to evaluate decisions made in previous research works	22	88
8. They cannot make a right conclusion from the data in the tables	22	88

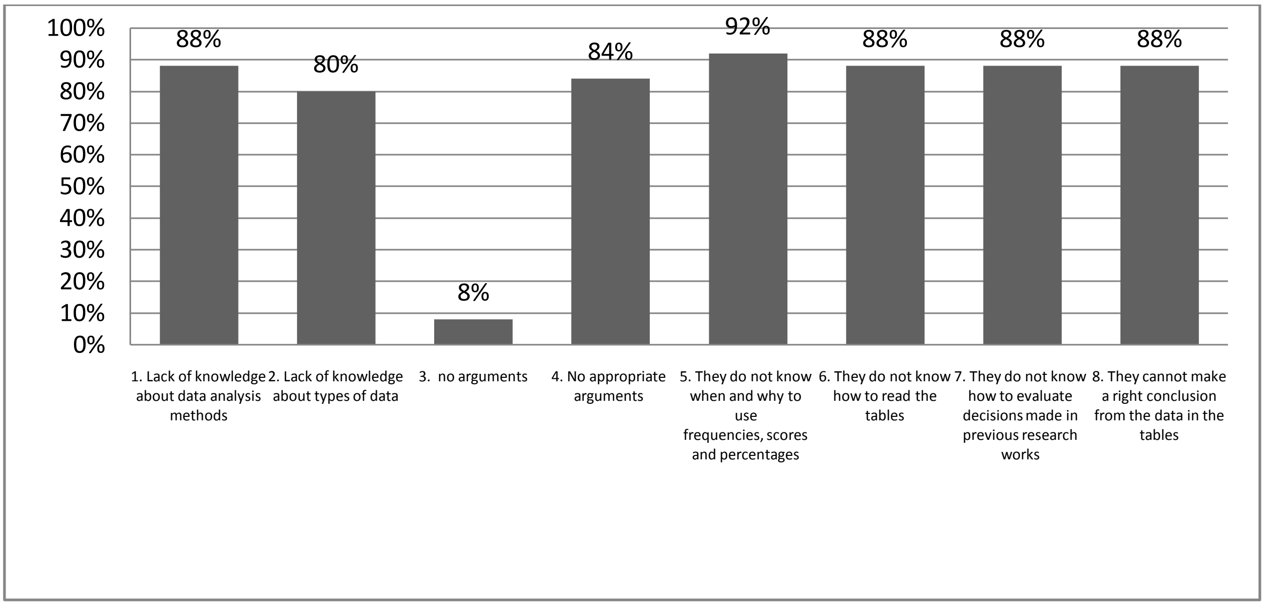


Figure 71: Errors and challenges faced in the pre data analysis test

The table above portrays the most frequent errors that the Master student committed in the data analysis pre-test. As we can observe, 92% of the students do not know when and why to use frequencies, scores, and percentages; then, 88% of them have a lack of knowledge about data analysis methods (we say lack of knowledge because they responded by I do not know). Moreover, 88% of them do not know how to read the tables, 88% of them do not know how to evaluate decisions made in previous research works, 88% cannot make a conclusion from the data in the tables. In addition to these, 84% did not provide an appropriate argument to their choices and 8% did not provide any argument.

- ***Errors detected in the post data analysis test:***

Table 84: Errors and challenges faced in the post data analysis test

Students' Errors and Challenges	**F**	**%**
1. Typing errors (including the font times new roman, font size and so on)	5	20
2. Typing the statistical abbreviations (spelling mistakes, italics when needed)	9	36
3. Mixing between the null and alternative hypothesis	4	16
4. Title of the tables are missing	5	20
5. Entering the data into the SPSS (including the place where to put variables and	4	16

the data)		
6. Reading Pearson product Moments' tables	1	4
7. Number of decimals to take	2	8
8. Proving and disapproving the null and alternative hypothesis (they accept both hypotheses).	2	8

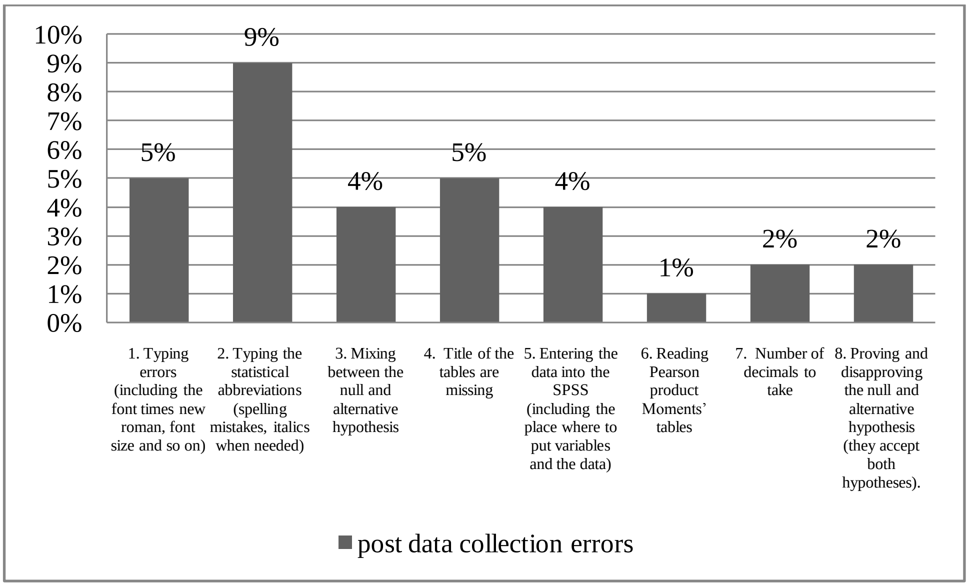


Figure 72: Errors and challenges faced in the post data analysis test

As it is demonstrated in the above table, 36% of the students have typed the statistical abbreviations in a wrong way (spelling mistakes, italics when needed), 20% of them made typing errors (including the font times new roman, font size, and so on). Moreover, 20% of the students did not include titles for the tables. 16% of them mix between the null and alternative hypotheses. 16% made errors when entering the data into the SPSS (including the place where to put variables and the data in the appropriate cases, how to name the variables, and so on). 8% do not know how to decide about the number of decimals when the SPSS output SPSS provides more than two decimals (how to round numbers) and 8% of the students do not know how to prove and disapprove the null and alternative hypotheses (they accept both hypotheses). 4% of the students did not read Pearson product Moments' tables appropriately.

V.6. NEEDS EVALUATION QUESTIONNAIRE

V.6.1. Description of the Questionnaire

For the sake of exploring Master's students' needs at the level of statistics and statistics' education from the teachers' perspectives, we address a questionnaire to the 13 teachers -at the department of English, the University of BEJAIA- who supervise Master's students.

The questionnaire consists of three sections: the first section explores the teachers' perspectives from general points of view; we mainly focus on the teachers' experiences in supervising students and their attitudes towards their levels and towards the research methodology syllabi and so on. The second section evaluates the students' needs in statistics and statistics education. Finally, the last section provides space for the teachers to add their own suggestions concerning statistics and statistics education.

V.6.2. Results of the questionnaire

Section One: General Information

1. ***How long have you been supervising Master's students***?

Table 85: Teachers' experience in supervising Master's students:

Age	Frequency	Percentage
Less than 5 years	2	15.4
Between 5 and 10 years	9	69.2
More than 10 years	2	15.4
Total	**13**	**100.0**

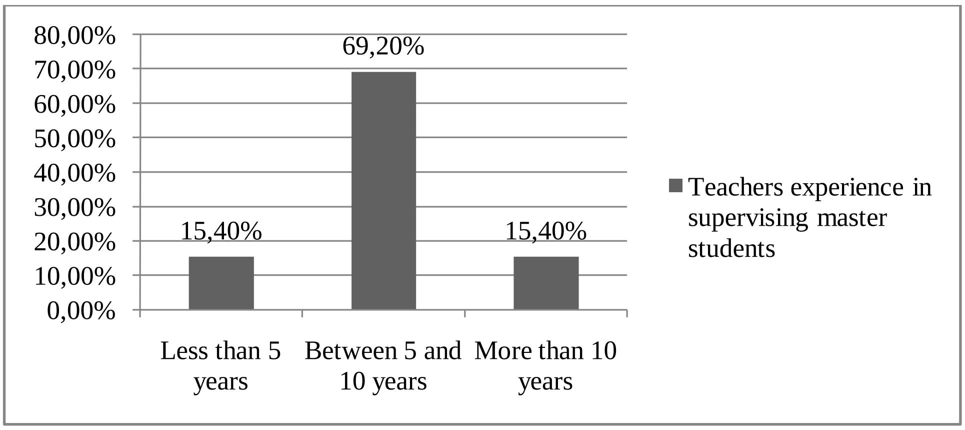


Figure 73: Teachers' experience in supervising Master's students

The above table describes the teachers' experience in supervising Master's students; we can see that most of the teachers (69.2%) have between 5 to 10 years of experience in supervising while 15.4% have less than 5 years and the same percentage (15.4%) for those who have more than 10 years of experience.

2. ***How do you feel when supervising EFL Master's students?***

Table 86: Teachers attitudes towards Master's students

Suggestions	F	%
1. Students are sufficiently and appropriately acquainted with theoretical research notions.	00	00.0
2. Students show mastery of research principles but still need more applications related to some important research issues.	13	100.0
3. Students show appreciated commands through their research projects and papers?	00	00.0
TOTAL	13	100.0

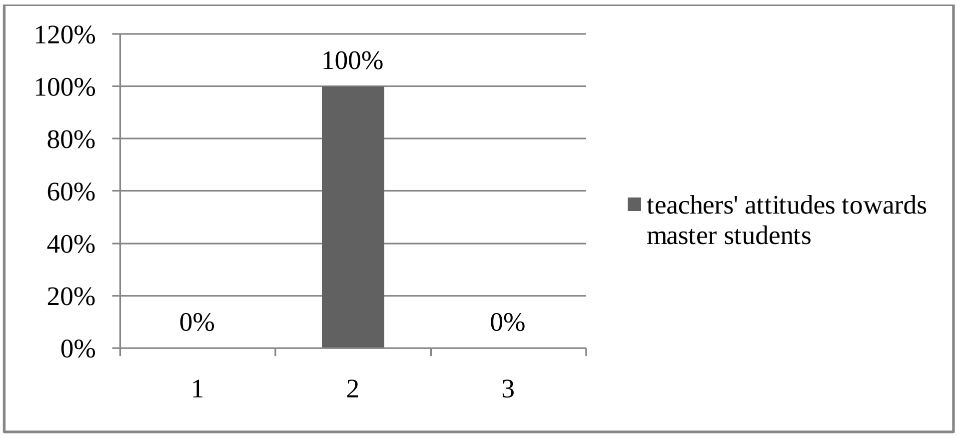


Figure 74: Teachers attitudes towards Master's students

The above table demonstrates the teachers' perspective concerning the students' level and abilities when conducting research. The totality of the teachers (100%) claim that the students show mastery of research principles but they still need more applications related to important research issues.

3. According to the different Master's fields at the department of English, University of BEJAIA, are the syllabi -designed to teaching research as a Unit- homogeneous?

Table 87: whether the syllabi -designed to teaching research as a Unit- are homogeneous

	Frequency	**Percentage**
Yes	5	38.5
No	7	53.8

I do not know	1	7.7
Total	13	100.0

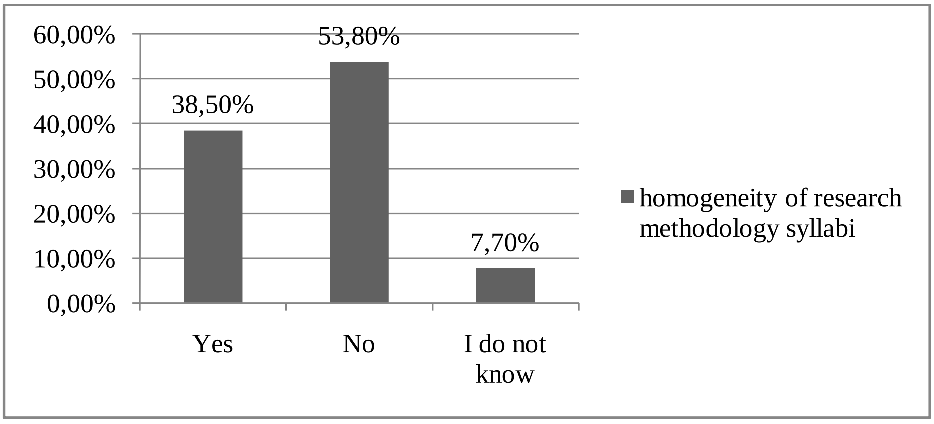


Figure 75: whether the syllabi -designed to teaching research as a Unit- are homogeneous

As it is shown in the above table, most of the teachers (53.8%) claim that the syllabi designed to teaching research are NOT unit homogeneous whereas 38.5% claim that the syllabi are not homogeneous. Finally, as it is shown in the above table 7.7% do not know whether they are homogeneous or not.

The above question is tagged along with follow-up questions that clarify more the teachers' attitudes towards research methodology syllabi's homogeneity and Master specialties at the department of English, university of BEJAIA. The teachers' answers are summarized in the following section:

If "Yes", what can the syllabi's contents provide the novice researchers with?

The teachers, whose answer to the above question was yes, justified their answers that:

- ✓ The syllabus is rich in terms of the diversified subjects devoted to research. They are designed to fit international standards.
- ✓ It can provide them with necessary tools to conduct a research as how to look for information on the net, how to write references etc.

If "No", make the difference between the research studies Master EFL students acquire in applied linguistics and in Didactics specialties at the department of English, University of BEJAIA?

The teachers, whose answer was no, have justified their answers by saying that:

- They believe that methodology teachers have to sit for annual meetings to decide on the relevant issues to be taught before and after. Moreover, they think that students have a first attempt to writing a research proposal too late, there is much theory left without practice in the very first years of teaching methodology. Therefore, when they reach Master studies they are abruptly supposed to write a research work and they usually misuse the theory.
- They claim that there is no difference between these two fields. They say that: “they are originated from and for the same field of study; whether we design the DLE or the ELT fields. Aren’t they focused on language teaching and learning, linguistics, or applied linguistics? We have to stop this massacre because if we point at the whole modules taught and learned in both fields; most of them revisit the same notions: linguistics and applied linguistics.” This is from a general point of view, from the research point of view, the teachers state that: “undertaking a research in both fields must agree on teaching and learning the same basic elements and principles related to research; they are scientific before being a matter of specific fields DLE /ELT”. In addition, they think that any difference between scientific fields related to teaching and learning languages should be banned. It’s totally not a matter of prestige nor is it a matter of “know better than the other”. The only difference that has to appear in research for both fields is this ability to “know how to approach given problems and related research statements”.
- The syllabi should emphasize application rather than theory through project work, mini-research assignments, and autonomous works (home works).
- When supervising Master’s students, they notice the differences in note taking, referencing, thesis structure, research strategies, questionnaire analysis, and interpretation of the results.
- Teaching, in general, requires coordination between teachers of the same module, but concerning research methodology, the syllabi (of AL and Did.) are quite easy to be elaborated, since they depend on the APA manual. But still, some inconsistencies are observed from one teacher to another.
- “The syllabi are well designed. However, the application of the programs and the tasks assigned to students need to be the subject of debate and coordination.
- There are different angles to envision research problems, and this depends on the type of course and the Master’s type (professional and academic).

4. Do you think Statistics Education should be taught at the level of:

Table 88: The best time to teach Statistics Education

The degree	Frequency	Percentage
Master 1	1	7.7
Master 2	0	0.0
Both	12	92.3
Total	**13**	**100.0**

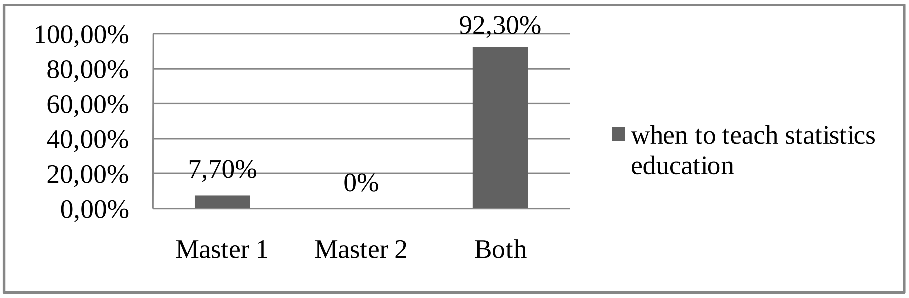


Figure 76: The best time to teach Statistics Education

We can see that most of the teachers (92.3%) think that statistics education should be taught at both Master one and Master two levels whereas only 7.7% claim that it should be taught at only Master 1 level. The teachers justified their answers by stating that:

- ✓ The students should be taught at Master one level about the different statistical concepts and at Master 2 they should practice them.
- ✓ It should be taught at both levels to ensure a better understanding of both theory and practice in the field.
- ✓ It is important to teach Master one students about statistics notions and concepts and to prepare them to practice what they have learned on their topics of research.
- ✓ Students should have a full mastery of quantitative analysis. Three semesters are better than two.
- ✓ In Master 1, students would learn the theoretical basis of research studies and in M2 since they are in an application situation of this theory, they need reinforcement besides the real context they are in. thus theory would go hand in hand with practice but this is feasible only with sufficient previous knowledge as a starting basis.
- ✓ The more time students have to learn the better it is. The students need more time to master not only the basics of statistics but also what is needed for their future research.
- ✓ They believe that having a piece of knowledge in Statistics and a command of the Statistics tools are of great importance for any researcher in socials sciences (including

language research) because the questionnaire is the primary data collection tool we use in this domain and the latter requires a correct valid statistical analysis in order to guarantee valid findings and plausible interpretation.

- ✓ Actually, it is never enough; at the same time, we cannot teach about everything too. It is good to teach about the basics and guide students to choose what is most suitable for their research studies.
- ✓ To equip learners with a critical command of decision-making skills.
- ✓ Ideally early in the Licence (Bashlor) level. There must be a continuum and incremental planning of the most important aspects in statistics from a year to another (of course, this is done according to the number of hours/week and the competent staff).
- ✓ Statistics studies as any other research skill cannot be mastered in one year. It is not pouring knowledge into the minds of the students who have never been required to or initiated to conduct any research; therefore, considering students as containers kept far away from any practicality which needs time, engagement and devotion is a critical way of discrimination. – Statistics studies which by the end of the syllabus cemented by both theories and practices will determine the abilities for any researcher to know how to read results, do calculations for sustainable results, analyze and interpret results from the data gathered to be able to validate or reject any statement of research.

5. What is (are) the type (s) of methodology-based research that is (are) mostly conducted by Master EFL Students?

Table 89: The type (s) of methodology-based research that is (are) mostly conducted by Master EFL Students.

Research types	**Frequency**	**Percentage**
Descriptive & diagnostic	7	53.84
Exploratory	2	15.38
Hypothesis-testing	3	23.07
all above	2	15.38
Total	/	/

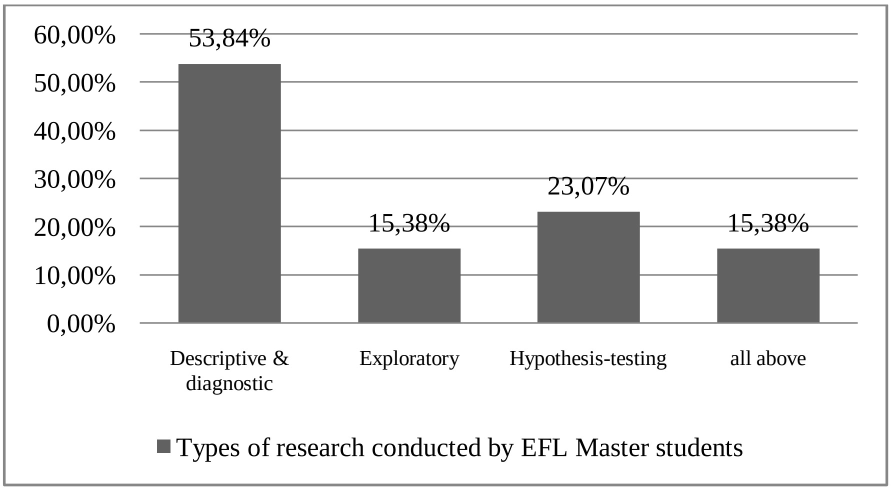


Figure 77: The type (s) of methodology-based research (are) mostly conducted by Master EFL Students

The above table shows that most teachers (53.8%) agree that Master's students usually conduct diagnostic and descriptive studies, whereas only 23.07 of the teachers see that students conduct hypothesis-testing studies and 15.38% of the teachers claim that student conduct exploratory studies. Finally, 15.38 claim that Master's students conduct all the above-mentioned types of research.

6. When testing a hypothesis, do students:

Table 90: Testing hypothesis Cases

Options	**F**	**%**
1. Estimate the population parameter (characteristics) from the selected sample statistics (data calculated from the sample)	5	38.5
2. They do not care whether the sample data represent the population characteristics	8	61.5
Total	**13**	**100.0**

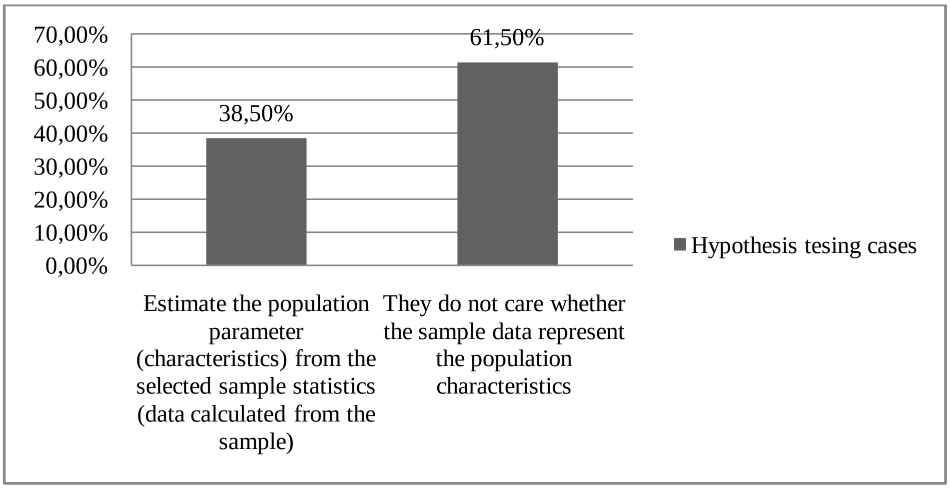


Figure 78: Testing hypothesis Cases

We observe that 61.5% of the teachers think that most students when conducting a hypothesis-based research; students do not assume that the sample data represent the population characteristics whereas 38.5% of them think that students assume and estimate that sample data represent the population data.

7. What type (s) of data is (are) being usually measured in the field of EFL research?

Table 91: type (s) of data being usually measured in the field of EFL research

	Frequency	**Percent**
Categorical data	3	23.1
Numerical data	3	23.1
Both	7	538
Total	**13**	**100.0**

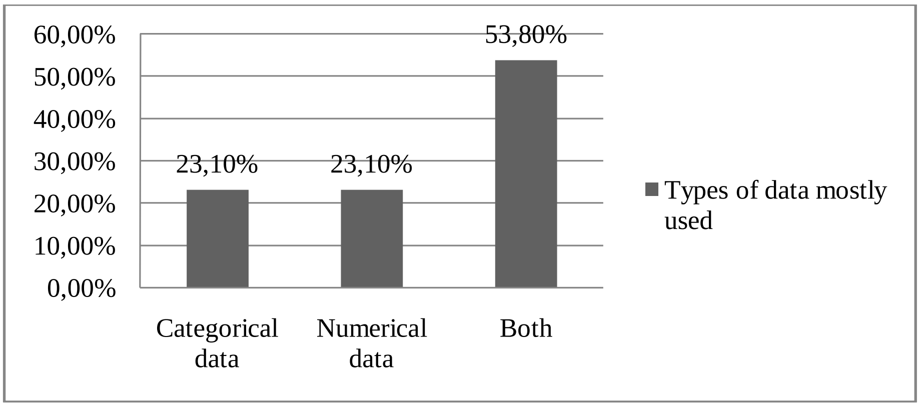


Figure 79: type (s) of data is (are) being usually measured in the field of EFL research

The above table and figure show that most students (53.8%) usually measure and work on both numerical and categorical data. On another side, 23.1% of the teachers think that students work only on numerical data and 23.1% of the teachers think that their students work only on categorical data.

Section One: **Statistics Educations**

1. ***Please express how important the following aims are to be taught to Maser students of English in "Statistics Education" Unit:***

1	2	3	4	5
Not at all important	Slightly Important	Important	Fairly Important	Very Important

Table 92: Different aims to be taught at Master Level in Statistics Education

AIMS	NAI		SI		I		FI		VI	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
1. How to decide about "what, where, how much, by what means" a research study is conducted	1	7.7	0	0	1	7.7	0	0	11	84.6
2. How data collection designs relate to data analysis designs	1	7.7	0	0	2	15.4	0	0	10	76.9
3. Research designs in exploratory studies	0	0	0	0	3	23.1	1	7.7	9	69.2
4. Research designs in case of descriptive and diagnostic research studies	0	0	1	7.7	1	7.7	1	7.7	10	76.9
5. Research designs in case of hypothesis testing research	0	0	1	7.7	2	15.4	1	7.7	9	69.2
6. Sampling designs and techniques and Sampling errors	1	7.7	0	0	2	15.4	2	15.4	8	61.5
7. The types of the data and the levels of measurements (types of data obtained from the different research tools: nominal, ordinal, discrete and continuous)	0	0	3	23.1	1	7.7	1	7.7	8	61.5
8. How to describe, organize, classify and present the data	1	7.7	0	0	0	0	4	30.8	8	61.5
9. How to make inferences and drawing conclusions from the different types of the data	1	7.7	0	0	0	0	1	7.7	11	84.6
10. The different APPROPRIATE ways of checking validity. reliability and practicality of the research study	0	0	0	0	4	30.8	0	0	9	69.2
11. How to apply the statistical and	0	0	2	15.4	4	30.8	0	0	7	53.8

mathematical calculations										
12. How to use technological aids including the SPSS	1	7.7	1	7.7	1	7.7	3	23.1	7	53.8
13. The figures that fit each type of data and research aim	1	7.7	1	7.7	0	0	2	15.4	9	69.2

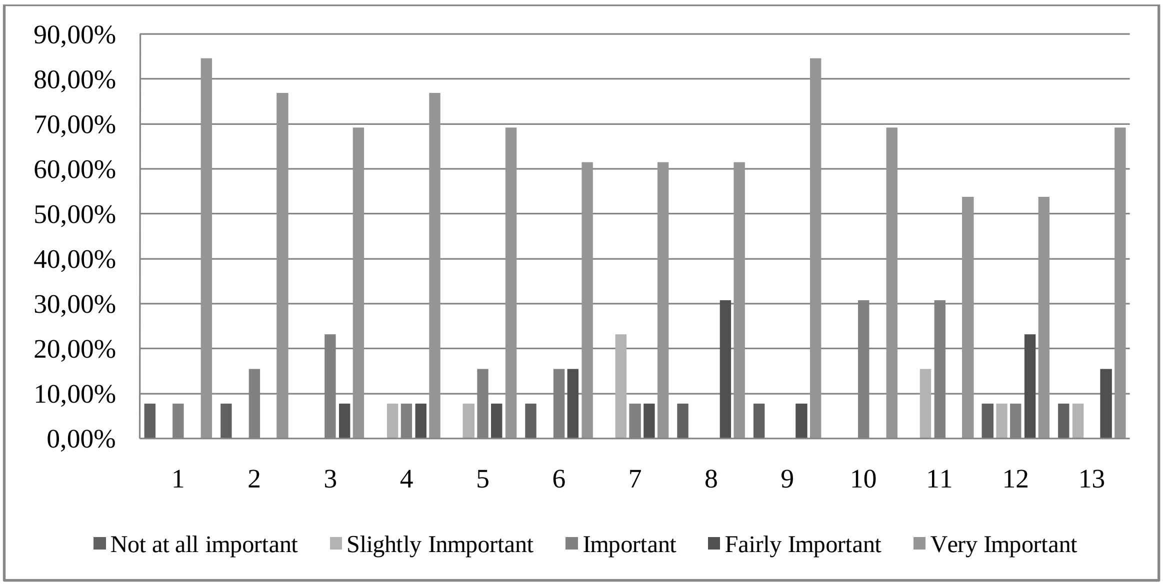


Figure 80: Different aims to be taught at Master Level in Statistics Education

The above table demonstrates the teachers' attitudes towards the provided propositions and whether they are important to be taught to Master's students in the Statistics Education Unit or not. The results are explained below.

We notice that the majority of the respondents (84.6%) claim that it is very important to teach the students about research design mainly about how to decide about "what, where, how much, by what means" a research study is conducted. However, 7.7% claimed that it is not important at all, and 7.7% claim that it is important.

Furthermore, the majority of the teachers (76.9%) claim that it is very important to teach to the students the logical relation between data collection and data analysis phases and mainly how data collection designs relate to data analysis designs. Moreover, 15.4% of the respondents claim that it is important and 7.7% claim that it is not at all important.

In addition, we asked the teachers whether it is important to teach the students about the Research designs in exploratory studies, we can notice that the majority of the teachers

(69.2%) claim that it is very important, 23.1% claim that it is important and 7.7% claim that it is fairly important.

Concerning the research designs in case of descriptive and diagnostic research studies, we observe that the majority of the teachers (76.9) agree that it is very important to teach them, 7.7% find it fairly important and 7.7% claim that is important, and finally, 7.7% find it slightly important.

Regarding the research designs in the case of hypothesis-testing research, the majority of the teachers (69.2%) find it very important, 15.4% claim that it is important. Moreover, we notice that 7.7% of the respondents assert that this point is fairly important and 7.7% claim that it is not important at all.

Furthermore, studying the sampling designs and techniques and sampling errors is seen as very important by the majority of the teachers (61.5%). Moreover, 15.4% find it fairly important and 15.4% find it important. Only 7.7% of the respondents find that teaching about these is not important at all.

The majority of the teachers (61.5%) see that it is very important to teach about the types of data and the levels of measurements. 23.1% of the participants claim that it is slightly important and 7.7% claim that it is important and finally, 7.7% claim that it is fairly important.

The majority of the teachers (61.5%) also think that it is very important to teach students about how to describe, organize, classify and present the data; whereas 30.8% claim that it is fairly important and finally 7.7% claim that it is not important at all.

In addition, we asked the teachers whether it is important to teach students how to make inferences and drawing conclusions from the different types of data, the majority of the teachers (84.6%) claim that it is very important, 7.7% claim that it is fairly important and finally 77.7% claim that it not important at all.

Additionally, the majority of the teachers (69.2%) assert that it is very important to teach Master's students about the different APPROPRIATE ways of checking the validity, reliability, and practicality of the research study. Moreover, 30.8% of the respondents think that it is important to teach how to check the study's reliability and validity, and practicality.

Moreover, most of the teachers (53.8%) think that it is very important to teach the students How to apply statistical and mathematical calculations. Besides, 30.8% claim that it is important and 15.4% claim that it is slightly important.

Concerning teaching students how to use technological aids including the SPSS, most the teachers (53.8%) claim that it is very important, 23.1% of the teachers think that it is fairly important, 7.7% of them think that it is important, and finally, 7.7% think that it is not important at all.

At last, the majority of the teachers (69.2%) see that teaching Master's students about the figures that fit each type of data and research aim is very important, while 15.4% of them claim that it is fairly important and 7.7% of them is slightly important; finally, 7.7% of the respondents are not important at all.

2. ***How often are the following cases treated in EFL Master Research works (applied and didactics):***

[1] Very Frequently	**[2] Frequently**	**[3] Occasionally**	**[4] Rarely**	**[5] Never**	**[6] No Answer**

A/ EFL students conduct studies to test/asses/ or to study:

Table 93: the aims that EFL students conduct studies to test/asses/ or to study them

	VF		F		O		R		N		NA	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
One variable	5	38.5	1	7.7	2	15.4	3	23.1	1	7.7	1	7.7
whether an association exists between two variables	7	53.8	3	23.1	2	15.4	1	7.7	0	0	0	0
whether an association exists between more than two variables	1	7.7	4	30.8	1	7.7	4	30.8	3	23.1	0	0
whether a cause and effect relationship exists between two variables	6	46.2	4	30.8	1	7.7	2	15.4	0	0	0	0
whether a cause and effect relationship exists between more than two variables	0	0	3	23.1	1	7.7	5	38.5	4	30.8	0	0
Whether change in one variable forecasts (predicts) change in another variable (for	3	23.1	1	7.7	2	15.4	5	38.5	1	7.7	0	0

example through scores in a learning unit, the researcher predicts the success or the failure of the sample)												

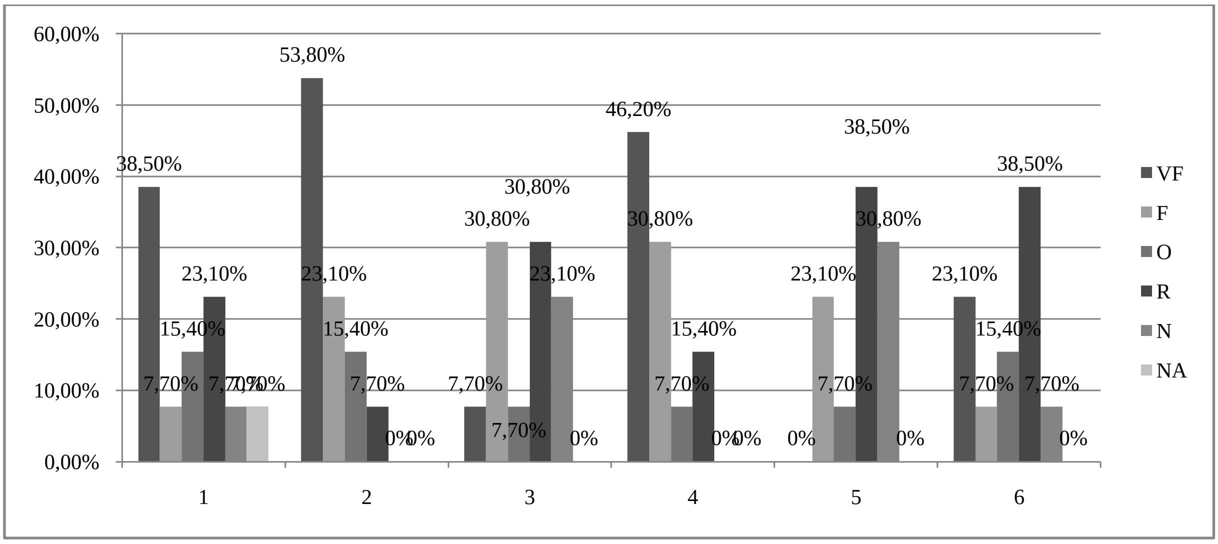


Figure 81: the aims that EFL students conduct studies to test/asses/ or to study them

This table and the figure portray the teachers' opinions about the general aims and the number of variables that are usually targeted in Master research works. The results are described below:

According to most of the teachers (38.5%), studying one variable is very frequent among Master's students. 23.1% of the teachers claim that this is very rare and 15.4% state that the students occasionally work on one variable. Finally, 7.7% think that it is frequent. The left 7.7% of the teachers did not express their opinions.

On another side, we asked the teachers whether EFL Master's students work on finding out whether there is an association between two variables, we observe that most of the teachers claim that students investigate this very frequently, whereas 23.1% claim that this aim is frequent. Other teachers 15.4% claim that this is occasionally investigated and we find only 7.7% of the teachers who claim that this aim is rarely investigated.

In addition to the above aim, we asked the teachers whether Master's students examine whether an association exists between more than two variables. The table demonstrates 30.8% of the teachers' state that students frequently work on this aim, while 30.8% of the teachers claim that it is rarely investigated. We can see also that 23.1% of the teachers claim that students never investigate whether there is an association between more than two variables. Finally, 7.7% claim that this aim is very frequent and 7.7% claim that this is occasionally investigated.

As far as the fourth aim is concerned, we observe that most of the teachers (46.2%) claim that Master's students work on investigating whether a cause and effect relationship exists between two variables very frequently. Moreover, 30.8% claim that this aim is frequent, 15.4% claim that this is rare, and finally 7.7% assert that this is occasionally studied.

On the other side, most of the respondents claim that Master student rarely investigated whether a cause and effect relationship exists between more than two variables. Furthermore, 30.8% claim that this aim is never studied by Master's students. Subsequently, 23.1% of the respondents claim that this aim is frequent and 7.7% claim that this aim is occasional.

Finally, we asked the teachers to say whether EFL Master's students investigate whether a change in one variable forecast (predicts) a change in another variable. The results demonstrate that most teachers (38.5%) claim that this aim is rarely investigated; while 23.1% claim that this aim is very frequent. Moreover, 15.4% claim that students occasionally work on this aim, and 7.7% see that this is frequent. Finally, 7.7% did not express their opinion.

B/ When analyzing relationships, students:

Table 94: The statistical aims when analyzing relationships

	VF		F		O		R		N		NA	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
1. Want simply to present the data and express the variable in form on numbers and percentages.	11	84.6	0	0	2	15.4	0	0	0	0	0	0
2.Want to determine the degree of correlation between two variables in case of ordinal data (data that are ranked from lower to higher or vice versa-like data coming from scales-)	1	7.7	4	30.8	4	30.8	4	30.8	4	30.8	0	0
3.Want to measure the degree of a linear relationship between two continuous Variables (it means if one variable increases or decreases. the other increases/or decreases respectively: the two	1	7.7	2	15.4	3	23.1	2	15.4	5	38.5	0	0

variables go in the <u>same</u> direction).												
4.Want to test the strength of the association (whether the relationship is strong or not) between two categorical variables (categorical means the data that can be put into categories like gender (male & female) or nationalities (English, Rusian, Algerian ...and so on) … etc),	1	7.7	2	15.4	2	15.4	4	30.8	4	30.8	0	0
5.Determine whether a sample matches the population (the sample statistics estimate really the population characteristics).	0	0	2	15.4	2	15.4	3	23.1	6	46.2	0	0

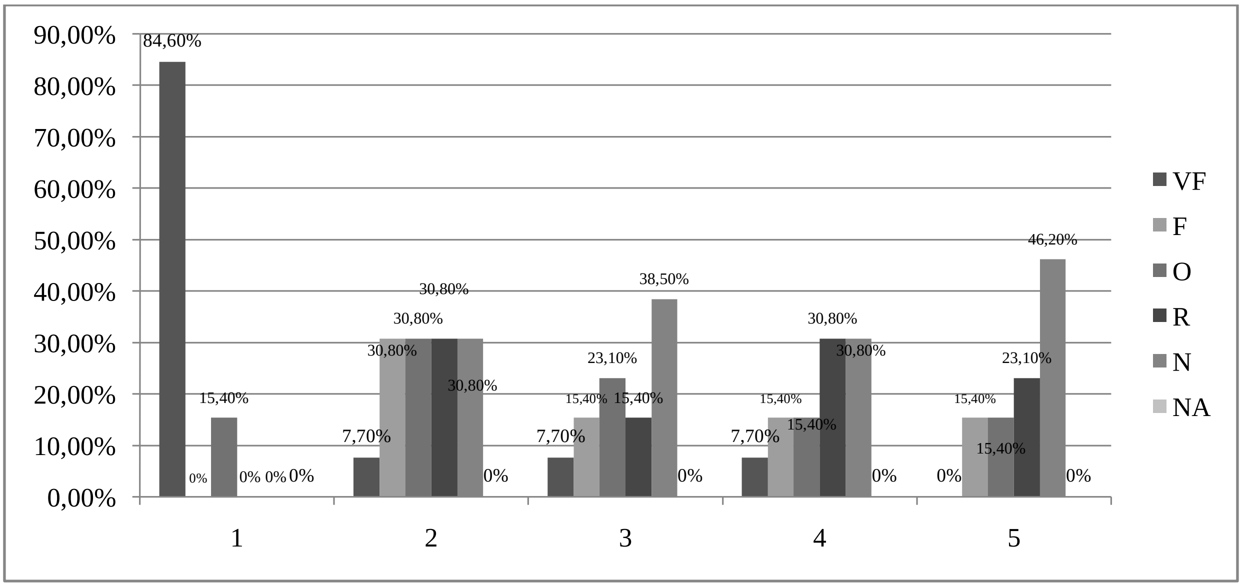


Figure 82: The statistical aims when analyzing relationships

The above table and figure show teachers’ opinions about the different aims targeted by EFL Master’s students when investigating relationships. The results are explained below:

According to most of the teachers (84.6%), students very frequently aim simply at presenting the data and express the variable in the form of numbers and percentages, whereas; 15.2% of the teachers state that students occasionally target this aim.

Moreover, we can see that some of the teachers (30.8%) think that Master's students frequently want to determine the degree of correlation between two variables in case of ordinal data; while other 30.8% of the teachers state that they occasionally investigate this aim; and subsequently, the same percentage of the teachers (30.8%) claim that Master's students rarely investigate it; then, 30.8% claim that students never target this aim. Finally, 7.7% of the teachers claim that students target the degree of correlation between two variables in case of ordinal data very frequently.

As far as the third aim is concerned, we can observe that most of the teachers (38.5%) claim that the students rarely want to measure the degree of a linear relationship between two continuous variables; while 23.1% of them think that students occasionally do. Moreover, 15.4% think that the students rarely investigate this aim while 15.4% think that the students are frequently targeting this goal. Finally, 7.7% of the teachers do not state their opinion.

The fourth aim refers to whether students want to test the strength of the association or not (whether the relationship is strong or not). According to 30.8% of the teachers, this aim is never investigated by Master's students; while the other 30.8% think that students rarely do. Moreover, 15.4% of the teachers see that students frequently target this aim, whereas the other 15.4% of them think that the students occasionally do. Finally, 7.7% claim that this aim is very frequently investigated among Master's students.

The fifth aim is whether Master's students determine whether a sample matches the population (the sample statistics estimate the population characteristics). Most of the teachers (46.2%) claim that this aim is never investigated by the students whereas 23.1% state that students rarely investigate it. Moreover, 15.4% of the respondents claim that the aim is frequently investigated by maser students while 15.4% of them mention that it is occasionally investigated.

C/ When analyzing the difference between the means of variables/ groups, Students want to:

Table 95: Statistical aims when analyzing differences

	VF		F		O		R		N		NA	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
1.Test the significance of difference between <u>tworelated</u> means/ averages (of same group	3	23.1	5	38.5	1	7.7	1	7.7	2	15.4	0	0

in pre and post tests for example)												
2.Test the significance of the difference between two independent group of means/ averages (of different groups; for example: comparing between group 1 and group 2's scores)	5	38.5	3	23.1	1	7.7	0	0	4	30.8	0	0
3.Determine whether there are any significant differences between the means of more than two independent (unrelated) groups (like the above statement but here we have more than two variables)	0	0	2	15.4	1	7.7	2	15.4	7	53.8	0	0
4.Test the effect of one or more independent variable on two or more dependent variables.	1	7.7	2	15.4	2	15.4	2	15.4	5	38.5	1	7.7
5.Find out whether the means of a dependent variable are equal across of a treatment. while trying to control for the effects of other variables (extraneous) that are not of primary interest (for example: studying the effect of Anxiety on Test Performance but at the same time trying to control) the effect that another variable –say like intelligence- may have on the test performance).	0	0	2	15.4	2	15.4	2	15.4	6	46.2	1	7.7

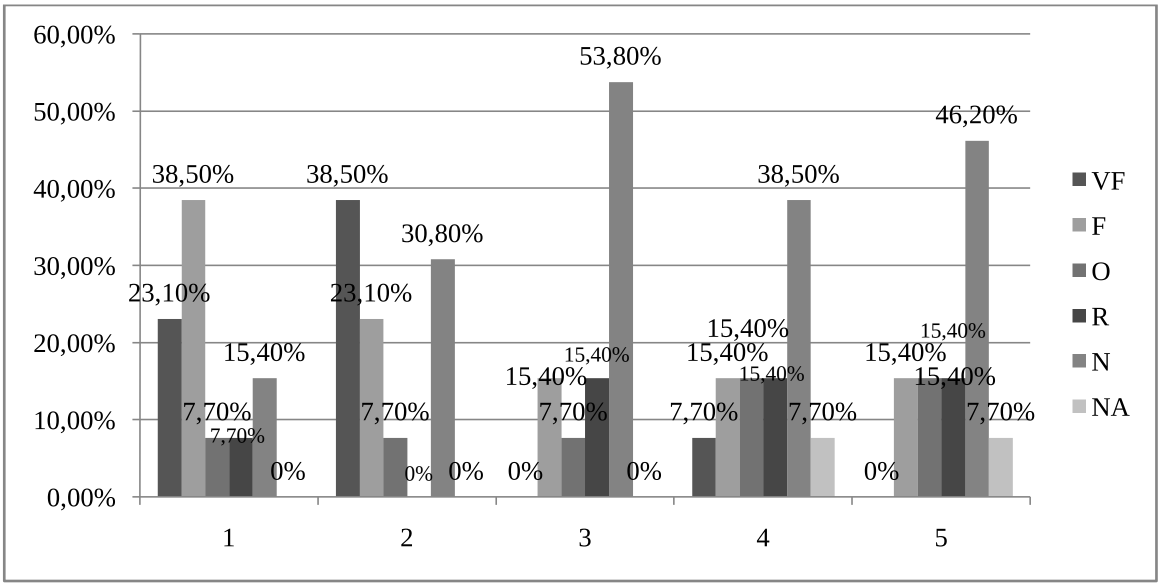


Figure 83: Statistical aims when analyzing differences

We asked the teachers to identify the aims that are targeted by Master's students in their research works when comparing differences between groups or variables. The results show that 38.5% of the teachers agree that Master's students *frequently* test the significance of the difference between two related means/ averages whereas 23.1% of the teachers this aims is *very frequently* targeted by the students. 15.4% of the teachers claim that it is *never* employed by the students and 7.7% say that it is *occasionally* tackled at Master level and 7.7% maintain that it is *rarely* employed.

Concerning the second aim which is "testing the significance of the difference between two independent groups of means/ averages", most the teachers (38.5%) claim that it is *very frequent* in Master research works; whereas, 30.8% of the teachers state that it is *never* targeted, and 23.1% of them claim that it is *frequent* in the student research studies. Finally, 7.78% of the teachers argue that it is *occasionally* found in Master research works.

As far as the third aim is concerned, most teachers (53.8%) claim that student *never* tries to determine whether there is any significant difference between the means of more than two independent (unrelated) groups; while 15.4% of the teachers claim that the aim is *rarely* found in Master research works. However, 15.4% of the teachers state that this aim is *frequently* found within the research works conducted at the Master level. Finally, 7.7% of the teachers claim that the students *occasionally* work on this aim.

In addition to these aims, most of the teachers (38.5%) assert that the students *never* test the effect of one or more independent variable (s) on two or more dependent variables; while, 15.4% claim that this aim is *rarely* targeted. 15.4% of the teachers state that students *occasionally* examine this aim and 15.4% of them claim that this is *frequent* among Master research works. Finally, 7.7% argue that the aim is *very frequent* and 7.7% did not state their opinion.

Lastly, the aim of "finding out whether the means of a dependent variable are equal across of a treatment while trying to control for the effects of other variables (extraneous) that are not of primary interest" is *never* investigated by Master's students according to 46.2% of the teachers. Moreover, 15.4% of the teachers claim that this aim is *rarely* targeted by Master's students and the same percentage (15.4%) of the teachers claim that it is *occasionally* researched in Master studies. Finally, 15.4% claim that this aim is *frequently* investigated and 7.7% of the teachers did not state their opinions.

D/ When analyzing prediction relationships, students want to

Table 96: Statistical aims when analyzing prediction

	VF		**F**		**O**		**R**		**N**		**NA**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Test how a change in the independent variable (predictor) predicts the level of change in the outcome (independent) variable (for example: increasing motivation (predictor variable) at a certain level predicts the same level of development in speaking performance).	0	0	4	30.8	5	38.5	1	7.7	2	15.4	1	7.7
Test how a change in a combination of two or more independent variables predicts the level of change in the outcome variable (the same as above, but here we have <u>more</u> predictors and <u>one</u> dependent variable)	0	0	0	0	3	23.1	0	0	9	69.2	1	7.7

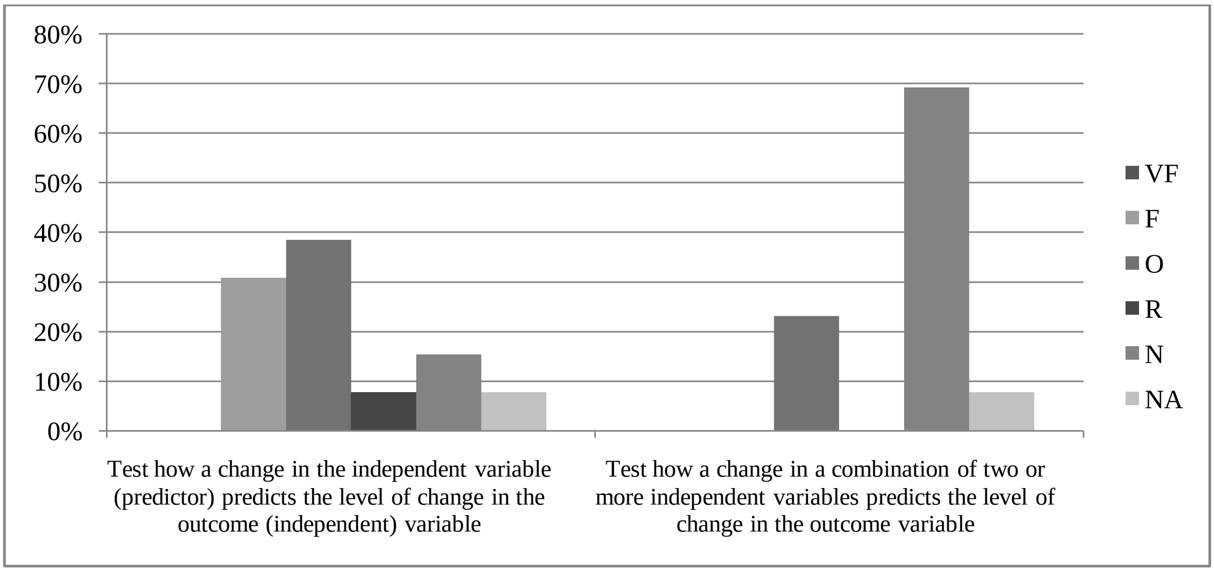


Figure 84: Statistical aims when analyzing prediction

According to most teachers' opinions (38.5), Master's students *occasionally* test how a change in the independent variable (predictor) predicts the level of change in the outcome (independent) variable. Whereas 30.8 claims that this aim is *frequently* targeted by Master's students. In addition, 15.4% of the teachers claim that it is *never* targeted by the students while 7.7% of them say that this aim is *rarely* employed at the Master level. Finally, 7.7% of the teachers claim that they have no opinion.

The last aim which is "testing how a change in a combination of two or more independent variables predicts the level of change in the outcome variable" is *never* targeted by Master's students according to 69.2% of the teachers. However, 23.1% of the teachers claim that this aim is *occasionally* targeted. Finally, 7.7% of the teachers claim that they do not know whether it is targeted or not.

3. ***According to your readings of different EFL research studies (related to applied linguistics and didactics), could you say which of the following statistical tests are needed/ or not needed to be taught to EFL Master's students? 4***

We asked the teachers to evaluate the need for the provided tests on a 5 point scale: (1: for not needed, 2: lowly needed, 3: moderately needed, 4: needed, and finally, 5: highly needed. The results are shown in the following tables:

Table 97: Teachers' opinions towards the most needed statistical tests' descriptive statistics

	N	Mean	Std. Deviation
1. Comparing difference tests	13	3.93	1.35
2. One sample tests	13	4.23	1.11
3. Survival analysis tests	13	3.92	2.25

4. Reliability tests	13	4.03	2.03
5. Predicting scores tests	13	3.98	1.81
6. Association tests	13	3.81	1.90
7. Data reduction tests	13	3.61	2.06
8. Assumptions tests	13	3.73	1.96
9. Moderation tests	13	3.54	2.29
Valid N	13		

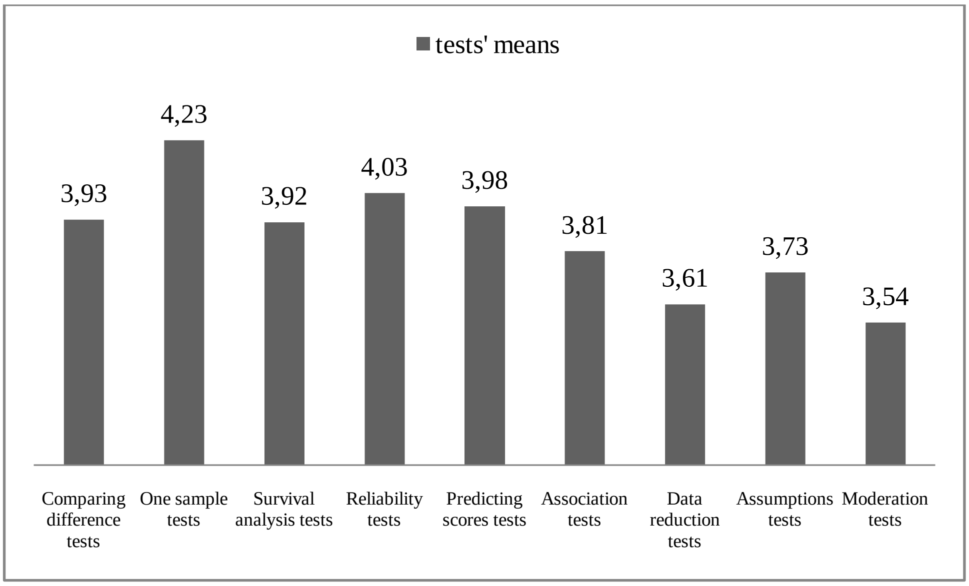


Figure 85: Teachers' opinions towards the most needed statistical tests' descriptive statistics

The table and the figure demonstrate the different data analysis aims that cover the provided tests. We see that they range from moderately needed to highly needed (based on the scale provided). More specifically, the teachers claim that one-sample test (M=4.23; SD=11.11) and reliability tests (M=4.03; SD=2.003) are raging from needed to highly needed. From another side, comparing differences tests (M= 3.93; SD=1.35), the survival analysis tests (M=3.922; SD=2.25), prediction score tests (M= 3.98; SD =1.81), association tests (M=3.81; SD=1.90), data reduction tests (3.61; SD =2.06), Assumption tests (M=3.73; SD =1.96), Moderation tests (M=3.54; SD=2.29) range from moderately needed to needed according to the respondents.

The bellow tables demonstrate the tests included inside each of the above cited aims:

Comparing difference Tests:

Table 98: Comparing differences tests' Descriptive statistics

Statistical Tests	**M**	**SD**	**Statistical Tests**	**M**	**SD**

Independent-samples t-test	4.53	.66	One-way ANCOVA	4.07	1.89
Paired-samples t-test	4.38	.76	Two-way ANCOVA	4.07	1.89
One-way ANOVA	4.61	1.04	Mann-Whitney U test	3.84	1.90
Repeated measures ANOVA	4.15	1.34	Wilcoxon signed-rank test	4.23	1.96
Two-way ANOVA	4.53	1.39	Kruskal-Wallis H test	3.77	2.12
Factorial (three-way) ANOVA	3.76	1.83	Jonckheere-Terpstra test	3.69	2.21
Within-within-subjects ANOVA	3.84	1.86	Friedman test	3.69	1.93
Three-way repeated measures	3.84	1.86	McNemar's test	3.76	2.24
Three-way mixed ANOVA	3.92	1.84	Cochran's Q test	3.77	2.00
Mixed ANOVA	4.23	1.64	Sign test	3.77	2.08
Hotelling's T2	3.76	2.16	Test of two proportions	3.77	1.87
One-way MANOVA	4.38	1.44	Chi-square test of homogeneity (2 x C)	4.61	1.60
Two-way MANOVA	4.23	1.69	Chi-square test of homogeneity (R x 2)	4.69	1.38
One-way MANCOVA	4.07	1.89			

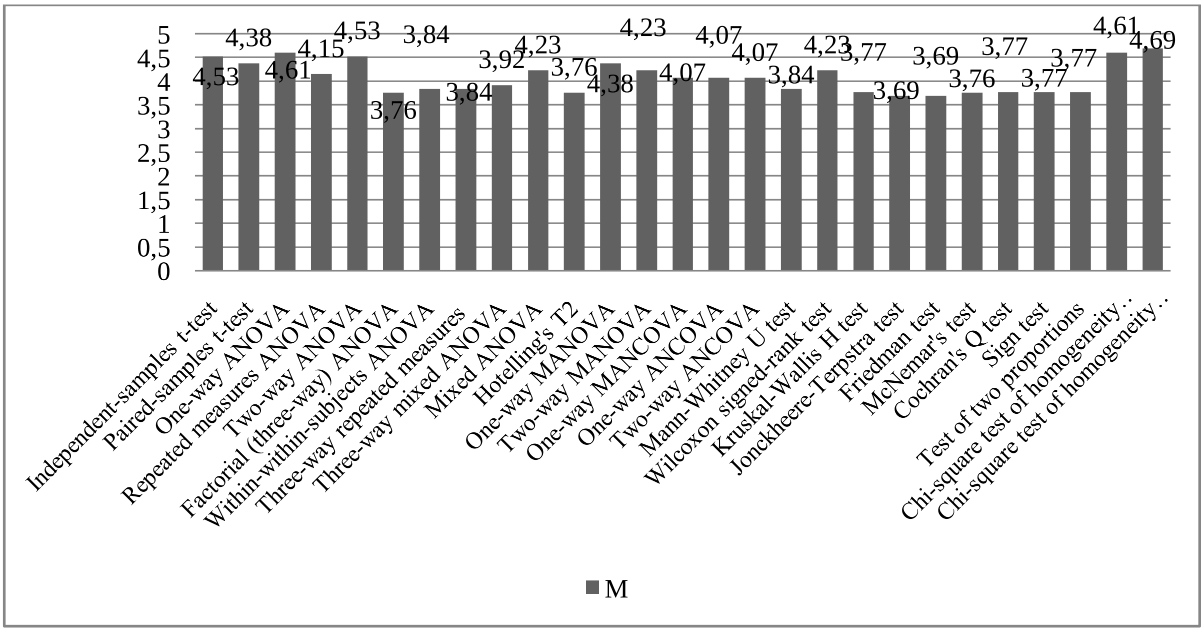


Figure 86: Comparing differences tests' Descriptive statistics

The above table and figure demonstrates the tests that help in analyzing the difference between groups or between means. As we may see, it includes twenty seven (27) tests that all rage from moderately needed to highly needed. The tests are: Independent-samples t-test (M= 4.53; SD=.66), One-way ANCOVA (M=4.07; SD=1.89), Paired-samples t-test (M= 4.38; SD= .76), Two-way ANCOVA (M=4.07; SD= 1.89), One-way ANOVA (M=4.61; SD=1.04), Mann-Whitney U test (M=3.84; SD= 1.90), Repeated measures ANOVA (M= 4.15; SD= 1.34), Wilcoxon signed-rank test (M= 4.23; SD= 1.96), Two-way ANOVA (M= 4.53; SD= 1.39), Kruskal-Wallis H test (M= 3.77; SD= 2.12), Factorial (three-way) ANOVA (M= 3.76; SD=1.83), Jonckheere-Terpstra test (M=3.69; SD= 2.21), Within-within-subjects ANOVA (M= 3.84; SD= 1.86), Friedman test (M= 3.69; SD=1.93), Three-way repeated measures (M= 3.84; SD= 1.86), McNemar's test (M= 3.76; SD=2.24), Three-way mixed ANOVA (M=3.92; SD=1.84), Cochran's Q test (M=3.77; SD= 2.00), Mixed ANOVA (M=4.23; SD=1.64), Sign test (M=3.77; SD=2.08), Hotelling's T2 (M=3.76; SD=2.16), Test of two proportions (M=3.77; SD=1.87), One-way MANOVA (M=4.38; SD=1.44), Chi-square test of homogeneity (2 x C) (M= 4.61; SD=1.60), Two-way MANOVA (M= 4.23; SD= 1.69), Chi-square test of homogeneity (R x 2) (M=4.69; SD=1.38), One-way MANCOVA (M= 4.07; SD=1.89)

One sample tests

Table 99: One sample tests' descriptive statistics

Statistical Tests	M	SD
One-sample t-test	4.23	1.30
Chi-square goodness-of-fit	4.23	1.78

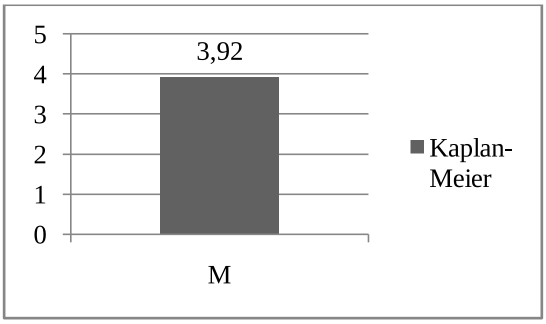
Figure 87: One sample tests' descriptive statistics

This table and figure demonstrate the tests used to analyze one sample. This category includes: One-sample t-test (M= 4.23, SD= 1.30) and Chi-square goodness-of-fit (M= 4.23, SD= 1.78). These tests range from being needed to highly needed according to the teachers' points' of view.

Survival analysis

Table 100: Survival Analysis test's descriptive statistics

Statistical Tests	M	SD
Kaplan-Meier	3.92	2.25



Graph 88: Survival Analysis test's descriptive statistics

The survival analysis category involves the Kaplan Meier tests (M=3.92; SD=2.25). The teachers claim that this test ranges from moderately needed to needed.

Reliability Tests:

Table 101: Reliability tests' descriptive statistics

Statistical Tests	M	SD	Statistical Tests	M	SD
Cronbach's Alpha	4.46	1.56	Fleiss' kappa	3.92	2.25
Cohen's kappa	3.92	2.25	Weighted kappa	3.92	2.25
Kendall's *W*	3.92	2.25			

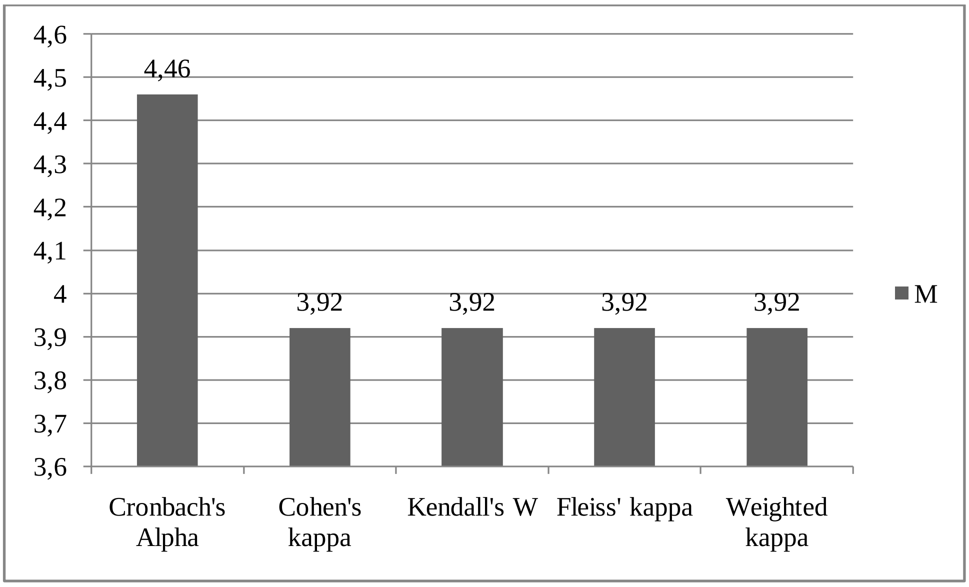


Figure 89: Reliability tests' descriptive statistics

The above table and figure demonstrates the reliability tests that include: Cronbach's Alpha (M= 4.46, SD= 1.56), Cohen's kappa (M= 3.92, SD= 2.25), Fleiss' kappa (M= 3.92, SD= 2.25), Weighted kappa (M= 3.92, SD= 2.25), Kendall's W (M= 3.92, SD= 2.25). These tests according to the teachers range from moderately needed to highly needed.

Predicting Scores Tests:

Table 102: Predicting scores tests descriptive statistics

Statistical Tests	M	SD
Linear regression	3.92	2.01
Multiple regression	3.69	1.97
Hierarchical multiple regression	4.23	1.87
Ordinal regression	4.15	1.90
Logistic regression	3.92	1.84

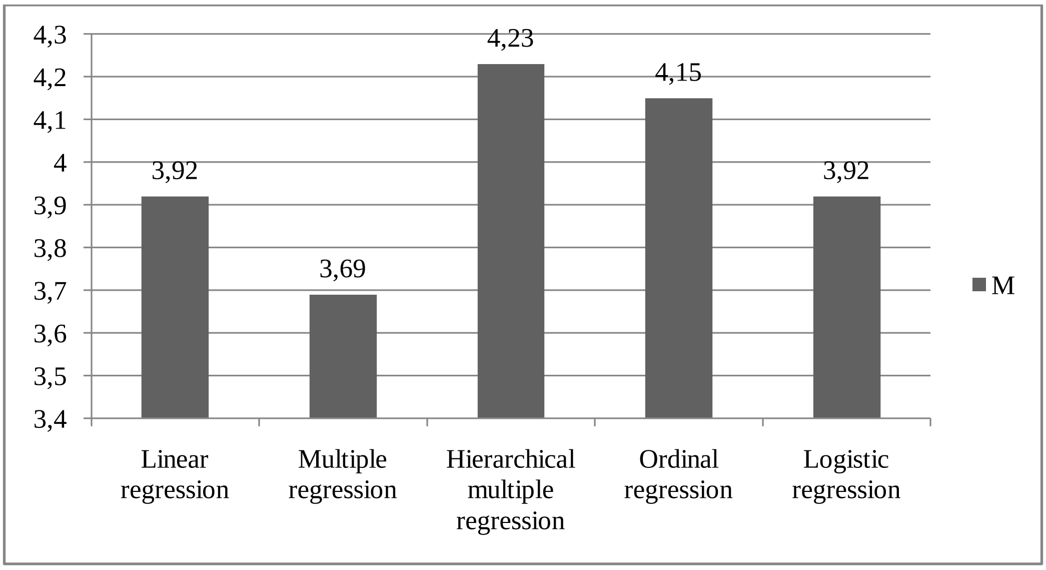


Figure 90: Predicting scores tests descriptive statistics

The above table shows the descriptive statistics of the Predicting scores tests. These tests mainly include: Hierarchical multiple regression (M= 4.23, SD= 1.87), Ordinal regression (M= 4.15, SD=1.90), regression (M=3.92, SD= 2.01), Multiple regression (M= 3.69, SD= 1.97) and Logistic regression (M=3.92; SD=1.84). These tests are said to be moderately needed to highly needed.

Associations Tests:

Table 103: Association tests' descriptive statistics

Statistical Tests	M	SD	Statistical Tests	M	SD
Pearson's correlation	4.00	1.87	Chi-square test for association (2x2)	4.07	1.4
Point-biserial correlation	3.76	2.20	Chi-square test of independence (RxC)	4.53	1.33
Pearson's partial correlation	4.07	2.01	Fisher's exact test (2x2) for independence	3.76	1.92
Spearman's correlation	3.92	1.97	Relative risk (2 x 2)	3.84	2.15
Kendall's τ_b (tau-b)	3.69	2.25	Odds ratio (2 x 2)	3.46	2.33
Goodman and Kruskal's γ (gamma)	3.69	2.25	Goodman and Kruskal's λ (lambda)	3.69	2.17
Somers' *d*	3.61	2.29	Loglinear analysis	3.53	2.18
Mantel-Haenszel test of trend	3.61	2.29	Cochran-Armitage test of trend	3.61	2.29

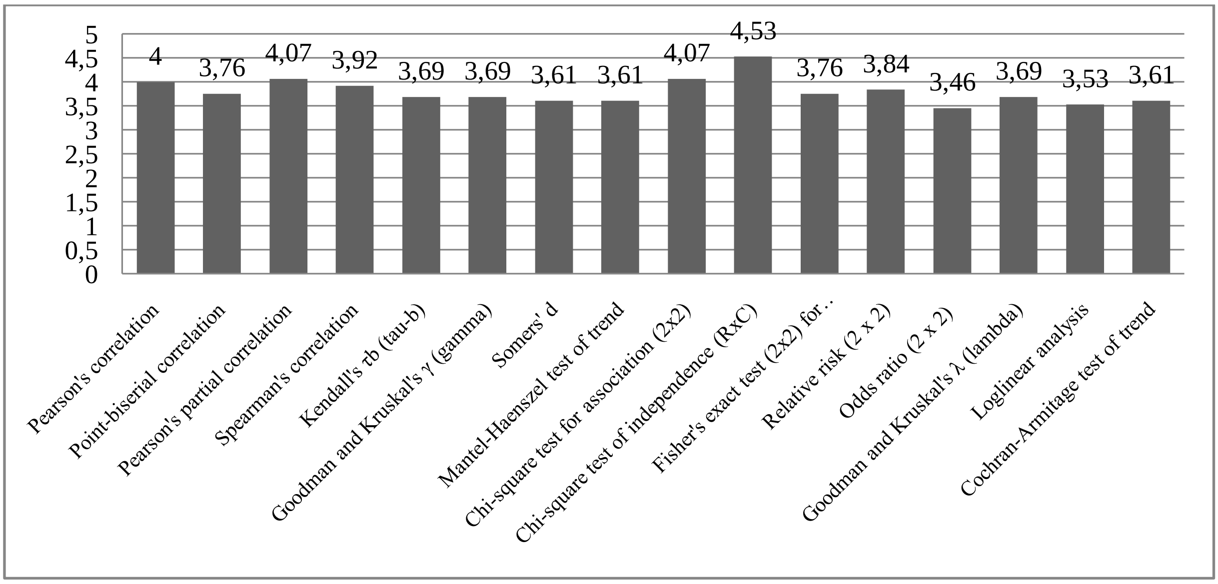


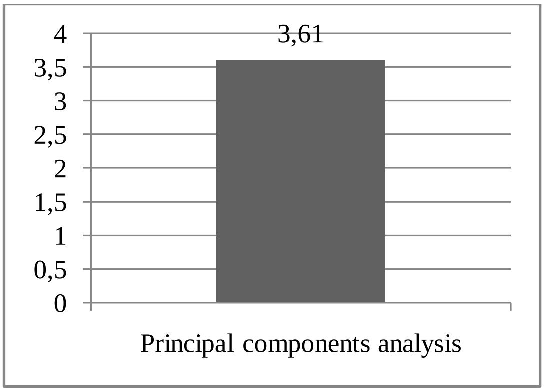
Figure 91: Association tests' descriptive statistics

According to the teachers, the association tests are said to be needed to highly needed. These tests include: Pearson's correlation (M= 4.00; SD= 1.87), Chi-square test for association (2x2) (M= 4.07; SD=1.4), Chi-square test of independence (RxC) (M=4.53, SD=1.33), Point-biserial correlation (M= 3.76; SD= 2.20), Pearson's partial correlation (4.07; SD =2.01), Fisher's exact test (2x2) for independence (M= 3.76; SD=1.92), Spearman's correlation (M= 3.92; SD=1.97), Relative risk (2 x 2) 'M= 3.84; SD= 2.15), Kendall's τ_b (tau-b) (M= 3.69; SD=2.25), Odds ratio (2 x 2) (M= 3.46; SD= 2.33), Goodman and Kruskal's γ (gamma) (M= 3.69; SD=2.25), Goodman and Kruskal's λ (lambda) (M= 3.69; SD= 2.17), Somers' *d* (M= 3.61; SD= 2.29), Loglinear analysis (M= 3.53; SD= 2.18), Mantel-Haenszel test of trend (M= 3.61; SD= 2.29), Cochran-Armitage test of trend (M= 3.61; SD=2.29).

Data Reduction tests:

Table 104: Data reduction tests' descriptive statistics

Statistical Tests	M	SD
Principal components analysis	3.61	2.06



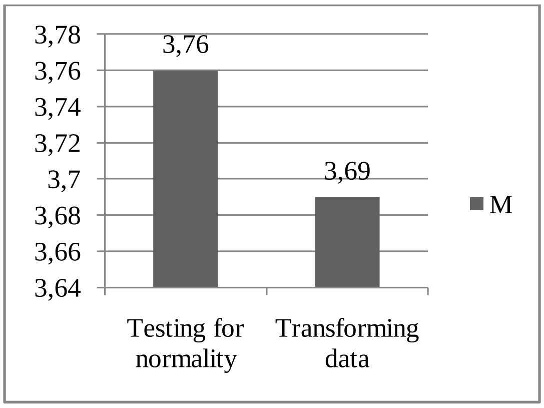
Graph 92: Data reduction tests' descriptive statistics

The data reduction test includes the Principal Components Analysis (M=3.61; SD= 2.06). This test is said to range from moderately needed to highly needed.

Assumptions Tests:

Table 105: Assumption tests' descriptive statistics

Statistical Tests	M	SD
Testing for normality	3,76	,92
Transforming data	3,69	2,05



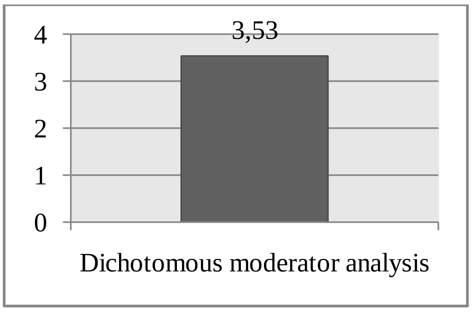
Graph 93: Assumption tests' descriptive statistics

This table demonstrates assumption tests that are declared to be moderately needed to needed. These tests include Testing for normality (M=3.76; SD= .92) and the Transforming data test (M=3.69; SD= 2.05).

Moderation tests:

Table 106: Moderation tests' descriptive statistics

Statistical Tests	M	SD
Dichotomous moderator analysis	3,53	2,29



Graph 94 : Moderation tests' descriptive statistics

The last category demonstrated in the above tables shows the Dichotomous moderator analysis which is said to range from moderately needed to needed (M=3.53; SD=2.29).

FURTHER SUGGESTION

We asked the teachers to add any further suggestions according to the aims of this questionnaire to enable cover legibly and validly the different points that might have or may cause areas of troublesome to our research students (they are free to express their beliefs, ideas, expectations to better topics, methodologies, teaching contents and designs related to Research as a Unit). The teachers' suggestions are summarized in the following points:

1. Teaching Research as a Unit through case studies. The teaching of research methodology should follow the following chronological and logical sequence:

   - Teaching this unit should be gradually covered giving due care to rudimentary notions at first levels (L1),
   - L2 is the reinforcement of the acquired knowledge and introduction to research needed skills (reading, analysis, interpretation, writing, statistics, figures and tabular presentations) through case sample studies,
   - L3 reinforcement of the acquired knowledge and introduction to research projects still through case studies (joining theory to practice),
   - M1 implementing research tools and research analytical and interpretative designs through case studies through the student is required to work on the data gathered results, with teacher/ Peer guidance to manipulate the different results presentations,
   - M2 reinforcements on reading and writing results using the appropriate analysis and interpretation tools as statistics, figures, tables. Wrap up with the final production of a studied case through 5 years of experimentation.

2. The teachers think that it would be of great importance for both teachers and students to understand when, how, and why to use statistics in their research.

3. Statistical analysis is an important part of research; it should be integrated early in the syllabus of Master's students and displayed all along the two years since there is a lot to say. And why not some practice integrated. The content should be targeted according to the students' needs. The teachers think that only specialists in the field should be allowed to teach such content; and not research methodology teachers, since their knowledge is superficial, and quite general unless they undertake some training in the domain.

4. The mastery of Statistics' basics and the different tools of analysis (mainly SPSS) are of paramount importance for any researcher in language studies. Thus, they strongly recommend the integration of Statistics (Theoretical Basics & Data Analysis using SPSS) in the Methodology Course at all levels.

5. They think that this module of “Statistics Education” would be very important because, according to their experiences, unfortunately, they did not have the opportunity when we were preparing our Magister or Ph.D., and thus they face difficulties when conducting any research. Furthermore, more time should be allotted for this module because of its importance in students’ academic career.

6. They believe that students’ competence in research is very limited, let alone their statistical ability in doing research. The points mentioned above, most of them, are not systematically used even by statisticians and expert researchers in prestigious institutions. In addition, researchers spend long years be satisfied with some quantitative principles and methods, and are happy to equip their tool cases with some of the statistical tools and techniques they find trustworthy and efficient in their work. In this questionnaire, it seems that too much is expected from students in a relatively short period. Mixed-methodology designs are also preferred by the students (qualitative research is also important). Research colleges, committees, and institutions would favor one test/technique/method over another and often make it clear in their general policy. This is not the case in Algeria (even the so-called ONS adopt shallow and surface-level and descriptive statistics in such sensitive areas as demofigurey, education, commerce, health, banking, etc.)! Numbers in our Algerian culture and attitudes are abstractions with no utility in real life. This point is very important in my thinking: what’s behind numbers? Some tests above are the same and fulfill the same function; others are far beyond students' and even teachers’ intelligence! (TheSome specialized statisticians offering advice even for advanced researchers). Teachers’ continuous training and learning are needed, ideally with more practice and authenticity

V.7. THE RESUTLS OF THE INTERVIEW

We conducted an experimental study with Master 1 students to test whether statistics education fosters the learners’ decisions making skills in the academic research process. To support the findings of the experimental study, we design an interview with 6 randomly chosen students from our sample (who became Master two) at the end of their research process (after defending their theses); it is worth mentioning here that each student is answering for a work done by two students which makes 12 students for 6 works.

V.7.1. Description of the interview

The interview is designed to be a mediated structured interview. We transmitted the interview guide to the participants in order to make them acquainted with the main points that we are going to discuss and in order to give them space to answer honestly in the absence of the researcher and then discussed some points through messenger. The interview is guided by 10 questions which are conducted with 6 randomly selected students from the sample, and it aims at exploring the students' experience with their academic research and the effect of the lectures of statistics they had in Master 1 on preparing them to the academic research. We based our analysis on a thematic analysis in which each theme contains some related questions.

V.7.2.The results of the interview

The interview is constructed by 12 questions that we divided in the analysis into nine (9) themes. In this section, we, present the analysis of the interview.

Theme* 1**: ***the choice between making training and conducting the research?

As an introduction to the discussions, we wanted to investigate the students' willingness to conduct research and whether the research was by choice or by obligation. The majority of the respondents agreed that their specialty imposes them to conduct research at their Master two-level, therefore, it was a decision under obligation. The first participant states: “No, I didn't because in linguistics we have only research and it is obligatory”, the other claims: “I have not a choice, for our branch it is obligatory”. Some of the participants maintain that they prefer the training than research: “I hadn't the choice since my specialty deals with research only, but I prefer to make training”, “We didn't have choice, we were obliged to do research. If I had [a] choice I would opt for training”, Moreover, another respondent says: “I wanted to [have] training but my specialty obliged me to make a research, So it is not my choice to choose research”. Only one student claim that she has chosen research because she is motivated to explore the research field she claims: “I have chosen research because I would like to explore the field of studies and research methodologies. It is a great experience to plunge in”.

Although the students claim that the research was imposed by the studied specialty; however, students had the choice to choose between Master in linguistics and Master in didactics where they have the chance to choose training in the Master of didactics.

Theme 2: Students' research titles and their motivation towards their topics

For the sake of reminding the students of their works, we asked them to explain their research topics and their motivation towards their topics. From the answers of the students, the majority of the respondents has chosen their topics and is motivated to work on them except one student. For instance, one of the students claims that she works on "Global war on terror, A speech by George W. Bush: A critical discourse Analysis" she claims that she has chosen the topic because she is interested in the field of discourse analysis and mainly in the field of critical discourse analysis. Moreover, another student claims she worked on "Sociolinguistic Study of Impoliteness in the Second Presidential Debate Between Donald Trump and Hillary Clinton on October 9th, 2016" she asserts that she is interested in the topic because it has a relation with her studies and her branch which is applied linguistics.

In addition, the third participant worked on "The importance of critical teacher-training for the development of the EFL teaching competence", she maintains that she is very interested in this topic because of the lack of the practical phase at the end of the study. Furthermore, another respondent claims that she worked on "Investigating intercultural awareness of bilingual and multilingual students: the case of the third year social sciences students". The participant is motivated and maintains that she has always loved linguistics and sociolinguistic phenomena; she says "Since our community is multilingual we investigated students' cultural awareness of the languages they speak".

Finally, one of the last two students is very interested in her research work which is "Language Planning in Algeria, case of Berber movements" because it is related to her study and as she says "…because I find linguistic complexity in Algeria a very interesting topic to study"; whereas the last one is not motivated and her topic "The conflict between languages and identity in Algeria: Arabic and Tamazighth" (t)because she is not motivated to research and the topic was imposed by her supervisor.

***Theme 3: description of the preparation phase of the students' research proposal: (the general difficulties and the decision making difficulties they faced*)**

The questions aim at pushing the students to share their experiences about the preparation for their research phase including the difficulties they had in making the different decisions. The respondents mentioned that they faced difficulties mostly in decisions about references and literature review (what to take in the literature and what to leave) and two of them mentioned methodology problems as it is declared by the first participant "It was not bad, me and my binominate [i.e. her partner in the research] started to work earlier in the summer. And the main difficulties we faced are in the methodology and references. We were not sure which method we should apply for our analysis". The motivation towards the work did not cease them to carry on the work even though it was a new topic. Moreover, the second participant claims: "At the beginning [,] it was [a] little bit easy but once I arrived at references it was difficult and it is the most problem [hardest] that I faced. For the decision making, I tried to make researches and ask for help from some teachers and classmates".

The third participant claims that the hardest problem she faced was finding related literature to her topic; she says: "during the preparation to my research proposal I met a difficulty on [in] the literature review I didn't find easily a similar [similar] previous studies". Similarly, the fourth participant argues that the problem she faced was in searching for the literature and their inability to find appropriate sources; she says: "Yes, we encountered numerous difficulties especially in the literature review we had problems in choosing the elements to work on and also in finding books and articles for free, but later on we found some websites where we could download literature for free".

Furthermore, the fifth participant also faced difficulties in the theoretical part as she argues: "The preparation was not easy, I lost [a] lot of time in the theoretical part because I did not have a complete plan…" she adds that she had also faced other difficulties "in choosen [when choosing] the data collection, methodology, design, etc". However, the sixth participant mentions the problem in the formulation of the topic, she says: "First and for most, the formulation of the topic was very tricky because we were not sure about real variables we would likely to study".

Theme 4: the problems the students met during the research steps:

Under this theme, we want to cover the difficulties the students face during the different phases of research. Therefore, we divide the theme into four (4) questions: difficulties in making decisions for the topic, for the data collection phase, for the data analysis phase, interpretation, and discussion phase, and the choice of appropriate figures. The answers are described below:

1. *The difficulties faced when making decision about the topic and title:*

The first problem is related to narrowing down the topic and choosing a limited field of study as the first participant describes their [with her partner] experience when deciding about the topic and the titles she says "we have decided first to work on discourse analysis, then [and then] we have chosen one filed in DA which is CDA. After that, we don't have a good idea of which speech to choose to analyze. We were lost at first [at the beginning]". Moreover, the second difficulty was when adjusting the title, the second participant claims "I have modified the title many times because each time I add a new part I feel that the title doesn't cover it, thus I adjusted it when I finished my research". Then, the third participant claims that: "We were confused when choosing the population and sample". In addition, the fourth participant claims that it was hard to formulate the title, decide on the variables and find the appropriate relationship between the research variables "yes, it was difficult to choose the right title and [to] find the appropriate variables and the relation between them". The fifth student claims that she had not a problem because the title was formulated by her supervisor "the topic was formulated with [by] my supervisor". The last participant said that she had not any problem with the title.

2. *For the data collection phase*

The problem that the first participant faced was the choice of a suitable speech to be analyzed "The only problem is which speech is more suitable from another according to our analysis. We need really to choose an appropriate one". Moreover, the second participant states "For my data, I chose the video of the debate" because her analysis was from a video recorded speech and that was difficult to collect the data according to her. Moreover, the third student mentions her problem with the research tool, she states that she decided about the observation and she was uncertain whether it is enough or not; she says "I used the observation as a tool to collect data, at the beginning I thought that it wasn't sufficient but when I met my supervisor we decided to observe more and no need to add another tool". This means that her decision was accurate but she was uncertain and she needed someone else's advice. The fourth participant claims that she did not have any problem with the data collection "no [I did not meet] difficulties since my topic is dealing with text analysis and discourse analysis". The fifth participant claims that she found problems in the choice of the research tools: "yes, I do not know which tools (data) [she means data collection tools] to collect [to use] for the research (questionnaire, or test or text analysis)". Finally, the last participant claims that she had not a problem with the data collection [she did not give detailed information].

3. *For the data analysis, interpretation and discussion of the data:*

For the data analysis phase, the students explained that most difficulties are faced when they come to start the analysis as they could not understand what to do first with the data, but when launched and understood the principles of the works they could manage to do the analysis. More specifically, the first participant claims that she does not know how to analyze the data and this had caused her many problems, she says: “yes, I do not know the correct method to analyze the data; I have a real problem with methodology”. Moreover, another student states that she did not face a problem because they did not employ the qualitative analysis: “no! My research is not qualitative”.

The student who worked on the critical discourse analysis could not start because they did not know what to analyze in the speech they had chosen, she states that she found the solution by consulting other works in the field “In this phase, we were not sure what exactly to analyze but after having the model things started to be clear”. Another student claims that: “In the analysis, I adopted a model of impoliteness which consists of five strategies”, from her answer we understood that the analysis was not very hard and it did not cause a problem. The analysis was clear for her. The other student claims that the analysis was a bit complicated at the very beginning and she has taken a long time in accomplishing it “for the analysis, it took a long duration of time because each point we analyze it showed well explained and followed by other examples”, this means that they made use of different examples to conduct their analysis. Finally, the last student claims that the data analysis was “… so vague we didn't know how to start the analysis of the gathered data”.

From a general a point of view the students had an idea about how the analysis of data is; yet, when they come to practice within their own research work, they felt confused at the beginning. For example, the first student claims: “at the beginning, we have an idea what CDA is from the literature review. But, we still [were] not sure what we need to analyze. That's why we need a model to follow. Hence, we had successfully applied the model through analyzing each step on it”. The other student said “I analyzed the video based on the model of impoliteness, by applying the model the analysis were [was] somehow easy”. It was clear from her speech that the analysis of the data was easier once she understood the impoliteness model and with an example she could be able to perform her analysis in an easier way. The analysis of the data was a bit tiring but successful for the third participant, the analysis was new and it was something she did not do before, she claims “Yes we were a bit lost after gathering data, we had first to translate because it was in French and analyze [then to] it, but we made research and asked for help and we finally succeeded to get valid data". Moreover, the fourth participant said the analysis and interpretation were not very hard: "Yes, our study is descriptive and observation and we will interpret what we have read and saw from different documents". Finally, the two last students claim that the data analysis and interpretation were very hard: "I did not have any idea about how to interpret the data", and the other states that because they did not know what to do they asked advice from others: "I couldn't analyze the data alone, I usually asked for help".

Concerning the use of the figures and tables in their studies, we asked the students about the difficulties they met since we did not have the time to study the chapter (due to time constraints we had just seen an overview about tabulation and figures). The students expressed their confusion in this section and that they had face problems. One of the participants said: "Yes [she faced problems at the level of figures], this has a relation with statistics and I hate this credit [unit]". The other participant claims that at first she was confused about what to do "since our analysis is based on CDA [Critical Discourse Analysis] perspective, we had a problem of deciding which figures to use. If there is [are] or not [appropriate figures in this field]. So, in our analysis it need [s] more tables according to the model". Moreover, two other students claimed that they did not use figures as their study did not impose figures "I did not use figures", "No [she did not have a problem], I did not use figures ...", and another participant did not use figures because her study was qualitative "My research was not quantitative, I did not deal with figures". Finally, the last participant claims that they faced problems at the level of the figures in their study and it was their supervisor who has shown them what types and how to include them: "we didn't have [a] problem in choosing figures our supervisor told us what to do". In short, the phase was difficult for the students at the start because of the new topics; however, when they have been acquainted with the principle of their studies, the analysis and interpretation were easy for them.

Theme 5: whether the statistics lectures last year helped you to decide about the above phases:

The participants' attitudes were positive towards the role that statistics lectures played in their research, though the negative attitude of some students towards statistics in person (not statistics lecture), the learning unit according to the majority of the respondents was helpful, this view is expressed by one of the participants when stating "… yes, it helped me a lot, but I mentioned already [see the third theme], I hate statistics so I did not take the lectures seriously". Another student states that she did not employ statistics in her study "I did not use statistics in my research because the method that I followed was [qualitative] discourse analysis method", the other says it did not help her at all "Statistics' lectures didn't help me at all" the participants did not explain in depth her opinion.

In addition to the above opinions, the rest of the participants expressed that the learning unit was very helpful to them. One of them says that: "yes, it helped me a lot. In statistics, there are many things to know. In my opinion, this module is good for us especially in our research works, from the beginning till the end. It helped us to know about how to write a good title. It helped us in methodology which method to follow, which data analysis to choose how to use them, [and] how to use SPSS. Statistics is so good". The same attitude is stated by the fifth student who says: "… that module was helpful; for instance I could decide whether my research was qualitative or quantitative" and the same with the sixth student who claimed: "Yes, they helped me to decide the nature of my research (descriptive) and which data collection tools I am going to use".

To conclude, the attitudes towards whether the success and the helpfulness of statistics education's lecture is related to the ability to practice them in real activities; however, their success is governed by their attitudes towards statistics themselves because they see it as mathematics (see questionnaire's results pp.190, 218 & 220).

Theme 6: the benefits and the disadvantages of the statistics lectures that they discovered during their Master two research process:

In order to get more details about the benefits of statistics education, we asked the questions what are advantages and the disadvantages of statistics of education that they discovered through their graduation project. The answers talk more about the advantages rather than disadvantages. About the disadvantages, one of the participants says that the module's content was hard to follow and to understand, she says: "Honestly, statistics' lecture is a very hard module, since I wasn't able to understand it well. It stills [it is till now] a very difficult module for me". The other disadvantage was the lack of necessary time to practice sufficiently. The student states: "statistics are [is] benific [beneficial] for all students not just Master one, it should be taken from second year. There is [was] no [not] enough time to practice the theoretical lectures".

In contrast, other participants argue that the module was very beneficial; their opinions did not change from Master 1 to Master 2. Among the advantages cited by the students is that the module teaches them about research and what to accurately choose between the different research tools. One of the participants says: “I think it is always beneficial to study statistics because the students will learn how to conduct research both qualitative ad qualitatively”; she includes qualitative because we had few comparisons between quantitative and qualitative research principles. Besides, the fourth participant mentions that statistics education helped them more in the research methodology, she explains: “for me I have no complain [complaints] about disadvantages. They are all benefits. For me, it is a guide that shows us the right path mainly in our research work, especially in methodology. We knew exactly what are the main purposes of each method [are]”. Furthermore, the fifth participant also maintains the importance of scheduling more time to practice the learned theoretical aspects: “There are many advantages, thanks to it I could know which tool is useful for each research .., I don't think that there is any disadvantage just if they can program [schedule] more than one lecture for a week because it is not sufficient since it is the preparation for Master 2 students”. Finally, the last student claims that the module was beneficial as they have learned everything about the SPSS “the statistics lectures were very helpful because we knew how to use SPSS”.

In conclusion, we can see that the module was beneficial according to the students. However, the program that we have introduced needs more time for the accurate application of the acquired aspects and to ensure that the students have benefited most from the lessons.

Theme 7:The students’meetings and discussions with the supervisors:

In order to investigate the way in which the students deal with their decisions, we asked the following question: when you meet your supervisors, do you list your decisions and then discuss them or you ask the teachers for their final decisions just to apply them?

The participants’ meetings with their supervisors turn around having a discussion more than asking for a decision.

The meetings –as explained by the students- are planned after making a part of the work and then discuss with their teachers the decisions they have made. One of the participants says: “After doing our research work. Our supervisor noticed what is our aim [what our aim is] and what exactly [we] wanted to reach. So [then], we had a discussion with our supervisor to know if our decisions are good or not”. Moreover, another participant claims that “Yes… I list [give] first my opinion concerning something then we try to discuss them [it] together if my supervisor finds that I suggested a good idea I continue my work if not he/she tries to suggest something else". That means that the students make their choices before going to see their supervisor and then meet them to make a certain decision.

In addition to this, the students prepare questions and collect the different decision they have collected and ask the teachers to guide them to make a certain decision; this is what the third participant claimed: "before we meet our supervisor we make a list of questions and decisions we discuss, she answers the questions and advises us what to do… we do it either via internet or face to face". The same idea is expressed by the fourth participant who claimed "when I met my supervisor we used to explore all the decisions than we choose the one which has more advantages". The two last participants claim that when the meeting is decided they prepare a list of questions to ask about the coming parts of the work; for instance, the fifth participant argues: "I ask the supervisor questions like how to proceed [in the work] to find results? What is the right methodology that will fit my research topic…" and as the sixth student says: "When I meet my supervisor the first question was about methodology, data collection, study design, how to analyze the data also how to make references and avoid plagiarism".

Therefore, and as we can see, the students try to make sure of the decisions they made and whether the decisions are equivalent to what the supervisors suggest. Moreover, they try to fill in the gaps about the things they did not manage to accomplish.

Theme 8: the role of statistics education in developing their thoroughness and logical thinking when conducting research:

We have asked two main questions that concern this theme; whether statistics education helped their decision-making process to be thorough and methodical. And the second question asks whether the lectures of statistics helped them develop a kind of logical thinking when making decisions even though when the logic is costly (either time or effort).

The majority of participants' answers have shown kind of satisfaction concerning how their decision-making has been developed due to what they have learned and practiced at their Master one level.

The first participant claims that "yes… I feel I became more accurate due to statistics because it shows us the most important point [s] that we need in methodology. Thus, [the] methodology is important in research work". Due to the lectures of statistics, it became easier for the students to know quickly the justification of a given decision because they had already seen these in their Master two; the second participant states: "yes, because we don't [do not] need to lose time to look for the explanation of everything since we saw them in Master 1 in statistics' module". Additionally, the third student explains that she and her partner had learned a lot from the previous research they conducted in their previous year, she states: "the decision I make became more accurate thanks to research that I did previously I [me] and my binomial [research partner]". Moreover, the fourth participant talked about logic; she says "Logic is always better. So yes... For me statistics taught us to be more logic (logical) even though [it] is hard to attain". The fifth claims that "yes, in statistics everything is done with logic" and as a result, they have also learned how to be logical. The last student who has a problem with statistics confirms that she did not benefit from the lectures, she says: "No, as I said before I'm really bad at statistics, I couldn't get it I couldn't understand so it didn't really help me".

Therefore, we can see that the students think that they developed a logical and methodical way of making decisions. The module according to the respondents facilitates understanding when they read about methodology and this shortens the time they lose in looking for justifications and explanations.

Theme 9: sufficient argumentation when defending the research projects and their suggestions about learning statistics in Master

We ask the student the following question: "when you defended your dissertations, did you feel that you have enough arguments to defend your methodology (design tools and so on) choices?" And we asked them whether the arguments are taken from what they have studied in statistics.The students argued they were confident about their choices; they worked hard and searched and they could defend their dissertations. Some participants mention that statistics was beneficial "because thanks to statistics lectures I know which tools are preferable to use". Moreover, the other participant says: "Yes I did. Because after studying our research work [i.e. after diving into the work and understanding the topic well] we have worked deeply about methodology since it is so important to reach our aim. And this is related to what we had in statistics of course". The other participants claim that they did not receive a lot of questions about methodology and the questions were more about their literature review:

"we actually had questions concerning literature, for the methodology, the members of the examining committee didn't had [have] any question".

The other question was about the participants' opinions about continuing the lectures of statistics in their second year of Master and what they suggest for better lectures. The students agreed on the importance of carrying on the lectures of statistics in their Master 2 "I think it is better to study statistics in Master one and two" because they are guiding them in the research where the students may forget some rules, concepts, or methods; this is claimed by one of the participants "It is better to study it in Master 2 because students need what they learn from it". One of the students says "in my opinion, studying statistics is so important and have [studying] it in Master one only is not sufficient. Hence, I think it is better to have it Master two too". Another participant explains "yes [it is important to study it in Master two]… I think it is important because we sometimes forget some rules…" because statistics contains different tests for the analysis in which the students should pay attention to the tests' assumption to see when and how to use it; therefore, more time needs to be provided to the students to practice with the chosen tests. Besides, another respondent claims that "Yes [it is important to study it in Master two]… I think that it is more important than the other modules". Finally, the last participant says: "Yes [it is important to study it in Master two]… I think it is important because the first question in the research is what is your method? And why you choose to analyze this data? Also for the figures and tables and so on…" therefore we can see that all the respondents agree that it will be very important and beneficial to continue the lectures we started in Master two.

For the suggestions of the students for better lectures, the students agree that the modules need to be supported with more time for practice; one of the participants states that the module should be taught in more than one session per week, two sessions to cover both the theoretical and practical knowledge of the module and ensure the well understanding among the learners; she says: "I think for better lecture, it is preferable to have two lectures per week, one will be theoretical, and the second practical to put into practice what the students have learnt [learned]."; the same idea is shared by the second student who said: "I suggest also not to program statistics lecture [s] just once a week, it is not sufficient". Moreover, the other student asserts that it is very important to plan for activities of practice with efficient material that enable the students to grasp both theoretical and especially practical knowledge: "I suggest managing [to manage] a lot of time [schedule for more time] for the lectures to practice what was learnt with the teacher and use data show for an easy and effective learning process.”. From another point of view, one of the respondents suggests that the module should be introduced starting from the second or the third year; she justifies her opinion by saying “to have clear ideas about what you want to do, how and where concerning conducting research.

Moreover, the SPSS is one of the pillars of statistical data analysis in social sciences research. Therefore, it is required that students have a good base in the use of this software. One of the participants claims that it is important to “push the student to decide about his own topic from Master one” this will enable the students to practice more and have time to study the title from different angles. More importantly, the student carries on that it is very crucial to “put into practice his [the students’ data analysis especially how to use SPSS for QUANTITATIVE RESEARCH”

To conclude, the interview has been conducted with Master two students (who were previously our sample for the experimental study on decision making). The students expressed different opinions and explained the variety of experiences they lived during the research process. In an attempt to make sure that the statistics’ lectures they attended in their previous year could prepare them for making research-related decisions during the research process. The majority of respondents’ answers showed that the module was helpful in raising their awareness about the different aspects of the research process and facilitating them an understanding lot of notions they needed in Master two research projects; however, due to the lack of practice students forget what they have studied and thus face difficulties in making decisions. For this reason, all the students suggest providing this unit more time by having two sessions per week and scheduling this module to be taught in the second of the Master level.

CONCLUSION

This chapter has presented the different results obtained from the different tools employed throughout this study. the dissertation analysis and diagnosis tests have shown different problems and challenges students face when conducting research work and more specifically when making decisions. More precisely, the diagnostic tests had shown the development in the students' decision-making accuracy among students, and the reduction of the different errors made before the introduction to statistics. Moreover, the questionnaire has revealed students' anxiety and negative attitudes towards studying statistics education; it has also shown their good expectations for studying statistics. However, the post questionnaire has attested that the students' fear and anxiety towards statistics had been lessened and the students had earned different advantages from studying statistics in their Master 1.

Furthermore, the decision-making questionnaire had noted development in the overall decision-making skills for the experimental group; they mainly developed principled and thoroughness' decision-making styles. Besides, the needs evaluation questionnaire has demonstrated the importance of teaching statistics to Master’s students. it also has displayed the different point that needs to be taught. Finally, the interview has shown the importance of the statistics module in helping the students to accomplish the students' graduation projects.

CONCLUSION

This study aims at finding out whether statistics education helps in fostering the EFL learners' decision-making skills when conducting academic research. In pursuance of this aim, we adopted different research tools to test the hypotheses and explore different aspects of our research area.

In this part we presented the methodology followed throughout the study to answer the research questions and prove the aforementioned hypothesis; moreover, the different results that we have obtained from the different tools used are reported in the second chapter of this part. The dissertations' error analysis technique demonstrated the different problems and errors Master's students commit when making a research project; the questionnaires provided the participants' opinions concerning the difficulties in decision making, the factors and their attitudes toward statistics lectures in the research process in both pre and post phases of our study. The teachers' questionnaire helped in evaluating the students' needs at the level of statistics education. Furthermore, the decision-making scale evaluated the students' decision-making and decision-making styles in the pre and post-treatment periods. Finally, the interview provided more supportive data to the finding of our experiment. Therefore, discussion of the results is discussed in the following part.

PART III: DISCUSSION OF THE RESULTS AND IMPLICATIONS OF THE STUDY

INTRODUCTION

The study in hand investigates the effect of statistics education on EFL learners' decision-making skills. Different other aims have been targeted like the decision-making styles of the students, learners' attitudes towards statistics education before and after the study. Furthermore, the study aims at enclosing a statistics syllabus designed for Master EFL students. Therefore, in pursuance of these aims, we opted for an experimental design where a variety of research tools is used: questionnaires, tests, scales, errors analysis, and so on.

For that reason, in this part of our research, we present two main chapters: the first is the discussion of the results where we discuss tour findings obtained in the second part in relation to the previous research works in order to respond to the basic research questions which are set at the beginning of our study. In the second chapter, we present the different suggestions and recommendations we concluded through all the aspects of this study; this includes mainly implications recommended to teachers and learners of statistics, recommendations to how to develop research related decision making skill through statistics education, implications towards further research in this domain, and finally; the study entails a suggested statistics syllabus which bases on the finding of our results. Finally, this part reports the different challenges and the limitations we have met throughout the study.

CHAPTER VI: DISCUSSION OF THE RESULTS

INTRODUCTION

The present study is an attempt to examine the effect of statistics' education on EFL Master's students' decision-making skills during the academic research process. The experimental study is conducted with a sample of 25 Master 1 students as an experimental group (and 25 students for the control group), and several research tools have been employed in order to achieve the research aims. More specifically, we have conducted an error analysis of Master two research projects in order to detect the students' errors committed when making research and making decisions in the research steps.

Moreover, we have administered (for both control and experimental groups) a pre questionnaire to measure the students' opinions and attitudes towards research methodology, to explore the research difficulties they are aware of, and finally investigate their prediction and attitudes towards learning statistics. At the same time, we have attached the Decision Making Questionnaire with the students questionnaire in order to evaluate their decision-making skills. Furthermore, to analyze more specifically our samples' needs and spot the errors they make when conducting research especially when they are in form of decisions, we have performed pre-diagnostic tests (for both the data collection phase and data analysis, interpretation, and conclusion phase). After performing the treatment phase of our experiment study, we distributed a post questionnaire to know whether the students have resolved some of the problems stated in the pre questionnaire or not; moreover, the questionnaire also aims at investigating the students' attitudes towards the sessions and the module of statistics' education. We have attached a post scale to assess the students' decision-making after the performed treatment (experiment) and the same procedure has been done with the control group. Moreover, a post-diagnostic test (for both phases) has been conducted.

The results of the pre-study are compared with the results of the post-study to know whether there is any development at the level of decision making and to explore the other sub aims of the study. To conclude the results and to support our conclusion from the experimental study, we have made a mediated structured interview with six randomly selected master two students (who were our experiment's sample in their master one) after defending their graduation research projects. The interview aims to know whether the lectures of statistics that the students have been introduced to during their master one helped them in making the different decisions during the research process, to share their experiences and challenges they met; and more importantly to give their suggestions in order to refine the syllabus of statistics education and make it conform with the needs of master two students.

From a general perspective, the findings of the study revealed the development of the decision-making skills and more specifically the thoroughness and the principled decision-making styles. The majority of the students' attitudes towards statistics were positive in pre and post questionnaire, although there was a minority of the students who expressed their fear and anxiety towards this module. However, they expressed their gratitude towards the lectures in the post questionnaire. Concerning the appropriate syllabus for statistics education, the results indicate that the statistics lectures should be based on the students' needs in order to overcome the errors they commit in the research process; however, it should be supported with enough time for better application. The results of our study are discussed more specifically and in relation to our research questions in the bellow sections:

VI.1.THEPROBLEMS AND ERRORS FACED BY THE EFL STUDENTS WHEN MAKING AN ACADEMIC RESEARCH:

Making research is a complex process that requires high thinking and practical capacities. For this reason, many students find a variety of difficulties and challenges during the research process. When trying to design a syllabus for students, detecting the students' errors and challenges are the most crucial step. Accordingly, we opted for different research tools as an attempt to explore different errors and difficulties faced by Master's students at the department of English, University of Bejaia.

We have seen through the literature reviewed in the first part that this researches that errors in research are the pitfalls and the difficulties that the researchers face when making research (Jupp, 2006). According to the findings of the errors analysis, students commit different errors in the research process, mainly when making decisions at the levels of the title, the research variables, the research questions, hypothesis, sample and population, the research design, research methods, and tools, the data analysis, interpretations, presentation of the results, and finally at the level of discussions and conclusions. On another side, the pre questionnaires revealed that there are changes in the students' opinions towards methodology and the methodology difficulties they meet when engaged in research activity, task, or research work. Besides, the pre questionnaire's results show that most students (for both control and experimental groups) show similar experiences concerning the research process (the different research tasks and activities they performed are similar); these experiences mainly are making decisions about the topics and how to represent it, research problems statement, data analysis, interpretation and data collection. When we asked the students about their most successful decisions, the majority of the students (for both control and experimental students) mentioned that they were successful in their decisions about topics, some other students mentioned other research phases like hypothesis, research aims, and the research tools. Although the students could make these decisions, they maintain that they were hesitant and that they accomplish the research works and activities assigned to them basing on the classmates, peers, and teachers' help. Moreover, in the pre questionnaire, the students evaluated their knowledge in research methodology as being average.

In addition, according to the results of the pre questionnaire, the most difficult research phase is the decision about the topic and the decision of the data analysis methods. The control group thinks that the most difficult phase is the data interpretation and conclusions and the problem definition and presentation. Different students reported problems in the accomplishment of the literature part and reported their negative attitudes toward research and research methodology lectures. When asking about the challenges they meet in making the research in the pre questionnaire, the students state that they are not knowledgeable about the research and research decisions concerning the research tools, methods, and designs. On the other side, the control group maintains that the most challenging research phase is that they do not know how to get conclusions from the data obtained. Besides, other students claimed that they do not know how to interpret and critically evaluate the obtained data; they do not have knowledge about how to use the data sources, and they do not know how to present tables and graphs and how to read them. Concerning the students' confidence in the decisions they make in research, the control group expressed their confidence, where the experimental group argued their hesitancy in the research. It is worth mentioning that the control group said that they are hesitant about their decisions in question 13 of the pre questionnaire (p. 177). The students also expressed that they are hesitant when we asked them about the way they make decisions, the students of the experimental group claim that it is randomly; whereas, the students of the control group gave different answers that range between making argumentations and making random choices in addition to the group of those who did not express their opinions. Furthermore, when making a decision, the experimental group's students claim that they rely on others (be it a teacher or a classmate, or some other experienced students). The control group again had responded equally to relying on others and relying on their own selves and those who did not give an answer.

In addition to the results of the pre questionnaire, the diagnosis tests revealed the same problems and errors. The diagnoses tests have been conducted to evaluate the students' ability to make decisions and make choices in the research process. In the pre-data collection tests, we see that students have big problems at different levels including problems with research designs, methods, and tools, providing wrong justifications and argumentations to their choices, difficulties at the level of hypothesis and research aims, problems in sampling; and finally, making difference between research variables and types of data. Concerning the different problems and errors committed by the students in the pre-data analysis test, students show a lack of knowledge about the data analysis methods, lack of knowledge about types of data and consequently their roles, they do not know when and why to use frequencies and scores, averages and so on. Moreover, the students do not know how to read tables and cannot make the right conclusions from data in the tables. Finally, the students cannot evaluate decisions made in previous research works. In the post-tests, the majority of problems have been reduced and few problems or errors have been detected. In the data collection phase, students had problems in providing justifications, the structure of the title, stating a cause and effect hypothesis, research variables, disagreement in the choice of methods and tools. As we have already said these errors are in low frequencies (see results of the error analysis of both Master 1 and master 2 research works). Regarding the data analysis errors in the post-tests, we find some errors with low frequencies; most of them are related to typing errors including the APA formatting, typing statistical abbreviations, mixing between null and alternative hypotheses, and conclusion about these two hypotheses. Some students could not enter data into SPSS (dealing with the variable view and data view); finally, the titles of the tables are missing.

Similarly, researchers in the field found the same results. Jupp (2006) has reported different errors and problems including getting started in the research (in our study the students reported a problem (in the questionnaire) in which they know the research steps but they cannot start the research as they do not know how to apply them). The author also found difficulties in the research questions and that researchers could not match the obtained data with the questions set at the beginning of the research. Moreover, our results conform to the findings of Reardon (2006) who reported that students make mistakes in the selection of methods, drawing conclusions based on insufficient data, making generalizations without enough evidence; they usually make generalizations based on subjective assessments, interpretations, and preconceptions. Finally, the author claims that students do not select samples that represent the population. Likewise, Kothari (2004) reported that the major problems with researchers results from the sampling methods and/or the data collection procedures (when tools are not reliable or not valid for the wished aim), mistakes in reporting the data by the researchers, wrong or inexact answers provided by the respondents. Furthermore, Akyürek & Afacan (2018) classified the problems faced by their participants into lack of scientific knowledge (this refer to theoretical lectures, courses which have insufficient content ad research stage), problems related to supervisors (the topic is imposed by the teachers, the supervisors' fails in guiding the students and so on), problems related to methodology (including problems related to methods, planning, research problem, data collection tools, data analysis and so on), and finally, the authors reported problems with sources and legal procedures. Moreover, Qasem & Zayid (2019) have reported problems encountered by undergraduate students. They claim that the students have a lack of knowledge in research methodology, in the format of the research projects and proposal, they do not know how to select research tools and methods for the collection and analysis of data, and finally have problems in reporting results. Correspondingly, Bocar (2013) stated different problems including the respondents' cooperation with the researchers, managing the time available for the project, managing psychological and affective side (like stress and drive and so on), formatting of the text, and so on. Most importantly, the decision-making problems stated by this author are similar to our findings; these include identification of the research problem and the construction of the research title; besides, the author mentioned problems at the levels of interpretation analysis, findings, conclusions, and recommendations. More specifically, the author stated also problems at the level of data collection related to studies and the choice of the literature; finally, she reported statistical analysis of data and the choice of statistical tools' problems.

As it is obvious, our study's results conform to the finding of these authors and other authors (Qasem & M. Zayid, 2019; Akyürek & Afacan, 2018; Yalçin & Altun Yalçin, 2017; Taskeen, Shehzadi, Khan, Saleem, 2014; Bocar, 2013 and other studies) especially those related to methodology and the research process as we did not dive into other problems faced by the students, but we were more interested in the selection and decision problems the students encounter. Therefore, based on our findings and the available literature, we conclude a list of the decision-making problems that are faced by EFL students; we cite the following problems:

- ***Getting Started Decisions:*** these include decisions about the research variables, research problems, research aims, decisions about Hypothesis (es), and construction of the title, and so on.
- ***Data Collection Decisions:*** these decisions include the selection of the sample and population, decisions about the research design, decisions about the research methods and tools.
- ***Data Analysis, Interpretations, and Presentations of the Data Decisions:*** these decisions include the selection of data analysis methods, making conclusions, decisions about tables**.**
- ***Conclusion Decisions:*** this has to do with making decisions and conclusions from the data obtained from the study.

In addition to these decisions' problems, other challenges- that could be cited in association with research-related decision problems- mainly include hesitancy, lack of confidence, and lack of motivation as is demonstrated by our results and in other research work selected for the literature. Consequently, regarding the importance of decision-making skills in the research process, it is very important to be aware of these problems and challenges that face students in order to find different ways to overcome them. More importantly, teachers and students should be aware of the factors that affect the decision-making in the research so as to be able to solve these problems.

VI.2. THE FACTORS THAT HINDER MASTER EFL STUDENTS' DECISION MAKING SKILL DURING ACADEMIC RESEARCH:

Decision-making problems cited above may be caused by different factors. In the pre questionnaire, the students justified their hesitancy in making decisions by arguing that they do not trust their understanding of the acquired theoretical knowledge and claim that no or not sufficient experiences were offered to them to gain the needed confidence. Moreover, they said that there was not enough guidance during the research process. In addition, the students think that the methodology lectures they were introduced to previously, provide good knowledge that helps them accomplish the research process decision; however, the majority claims that the lectures are theoretical; they are deficient and they neglect the practical skills that are needed, a lot of details are missing and the students cannot connect the different parts on the lectures to each other. Moreover, the students in the pre questionnaire claimed the major reason is the lack of practice with the authentic material, the lack of scientific reasoning, and the lack of statistical knowledge.

In the post questionnaire, we asked the students different questions to understand better their research decision-making skills and to understand the factors that affect negatively their knowledge. From the experimental group's point of view, we found that the lack of information is the factor that mostly affects decision making. In addition, some students included at some low rates the factors of having much information and when asking so many people. These two factors may lead them to get confused. From the control group's point of view, the students claim that the lack of information affects negatively their decision-making skills.

Accordingly, Qasem & Zayid (2019) maintain that the problems that hinder the students are caused by the short time provided to writing a research proposal; for this reason, we suggest that teaching statistics should start from master one level to have much time to prepare themselves to their graduation projects. In addition, the authors claim that the supervisors play an important role in causing the difficulties because they do not provide good guidance for the discussion of the research proposal before starting the research. In addition, motivation is a major factor that affects writing research projects and therefore decision making too. From Bahçekapil, Bahçekapili, Fiş Erümit, Göktaş & Sözbilir's (2013) point of view, the students' inability to define the research problem can be one of the major factors that lead to decision-making problems in the academic research. The authors claim "It is underlined that defining of the research problem is influential on the whole study; in this way, decision can be made on how to carry out the research and what method will be used then". We think (based on our experiment) that many methodology-based decision problems raise from the fact that they could not understand the basic aim or the basic relationship between the variables under study; for this reason, students could not select appropriate tools for the basic aim for their research works. Moreover, Mahmood (2011) finds that the research-related courses and lectures do not lead to quality research in education because the lectures are not up-to-date and do not provide the needed knowledge to make good research works. In addition to this, the author talked about the factor of supervisors who are seen by the participants of their study as a barrier to quality research.

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The above-mentioned factors are related to the research findings in general; however, in the literature part of our work, we reviewed the factors that affect the decision making skill (Greenback, 2010; Guthrie, 1997; Placet & Pearson, 1987; Woodman, 1997; Chandrasekhar Pammi & Srinivasan, 2013; Vartanian & Mandal, 2012; Miyapuram & Chandrasekhar Pammi, 2013; Clemen & Gregory, 1995 and so on). If we compare our findings with the literature (see pp. 102-105), we find that our findings match with what Greenbank (2010) who cited about the confidence factor (which is one of the individual's personality), the social context (the people with whom a person interacts) and the person's cognitive style (including the ability to think logically). These factors are found in our study; the students expressed in the pre questionnaire about being unconfident and in the post questionnaire they claimed that asking too many people may be confusing. Moreover, students claimed that logical thinking helps them in making sound decisions. Besides, Chandrasekhar Pammi and Srinivasan (2013) mentioned the factors of the affective side of the decision-maker. Affect plays an important role in pushing the researchers forward or retreating back.

Consequently, based on the reviewed literature and the findings of our study, we summarize the factors that can affect the decision making in the research process in the following points:

- ***Theoretical knowledge***: this involves either lack or much knowledge. When the students have a lack knowledge, they cannot advance in their decisions; and when they have much information, this makes them confused about which information to take and which to leave. This factor may create a high level of hesitancy and confusion in the researchers' minds.
- ***Practical knowledge***: practice is very important in achieving good experience and acquiring practical skills and acquiring good confidence. Therefore, when students are not having enough practical knowledge, they cannot make sound decisions.
- ***Methodology lectures***: the methodology lectures which are designed to teach only theory and neglect practice can cause the students to face different difficulties and may affect the students' attitudes towards research.

- ***Lack of authentic material*** that may lead to insufficient practice and the lack of understanding of the provided information,
- ***Lack of scientific knowledge*** (reasoning and statistical knowledge): this is one of the important factors that affect the researchers' decisions because they should know about the scientific evidence to each decision and how to get this evidence through statistical procedures (as we see in the pre questionnaire, students claim that learning about how to reason and present evidence would be helpful).
- ***Researchers' affective side***: we found through our study that motivation is important in making decisions. Moreover, students claim that they do not trust themselves and their understanding (low self-confidence) and this may affect negatively the students' decision-making skills.

Other factors are not mentioned through the research tools, but the students repeatedly mentioned them through lectures which are stress, fear, and anxiety of making research and making their own decisions. All the factors that are mentioned can result in different decision-making problems that hinder the students from carrying on their research works; therefore, it highly important to the research-based-lectures to take into consideration these factors in order to reduce the decision-making problems.

VI.3. STATISTICS EDUCATION IN THE EFL SETTINGS

Our study aims also at describing the status of teaching and learning statistics in the EFL context, reporting the students' attitudes towards the lectures, demonstrating the different difficulties and challenges they met through the lectures, and presenting the advantages. Therefore, in this section, we try to discuss our results with the existing literature in this area.

The majority of the EFL students at the University of BEJAIA come from literary and foreign languages fields in the secondary schools; their interest is based on literature and foreign languages and only a few students performed well in science subjects like physics, natural sciences, and mathematics especially. Regarding the importance of Statistics in scientific research, this field is integrated very recently into the research-related curricula and syllabi. In an attempt to investigate the EFL students' expectations about the benefits of statistics in helping them get rid of the different challenges and problems they meet when making research, we asked them in the pre questionnaire about their opinions and expectations. The experimental group students state that learning about how to reason and present evidence would be helpful; whereas, the control group claims that what could help them will be through consulting new resources for enhancement and asking help from others. Concerning the pre-expectations of the students concerning learning statistics, most of the experimental group felt anxious but they thought it will be helpful. From the control group's point of view, the students also feel anxious about studying statistics but they think they will appreciate it. Those who expect that statistics is challenging and anxious about learning it justified their answers through relating statistics to mathematics and that they have no idea about it at all. Although the students claim that they did not study it at all, the syllabi of mathematics of secondary school in Algeria of all streams include a chapter called statistics. We may justify the students' answers by the fact that the students took it as part of mathematics and they understand it as being a mathematical process and that they do not know the relationship between studying statistics and Foreign Language Learning (FLL). From another point of view, the students who claim that statistics will be enjoyable and helpful and will appreciate it justified their answers that this will help them in the research and it will add a lot of things to their research capacities. Moreover, they think that it will be a change in the learning routine as it is different from studying linguistics and didactics, and finally, it helps in developing logical thinking. To conclude, the students expressed their anticipations towards learning statistics in the EFL context, the students mentioned that statistics will be beneficial if they are taught how to reason when making research. Moreover, they think that learning statistics will reduce their difficulties they meet during the research process. And finally, it will help them make autonomous decisions.

The above opinions were just the students' attitudes before introducing statistics, after the experiment, we distributed a post questionnaire in which we asked for the students' opinions about the lectures of statistics and the advantages they earned from studying this module. From a general point of view, their attitudes did not change towards learning statistics; the students claimed that the lectures on statistics were beneficial and they have learned different things. Mostly, they have learned: how to choose a sample, how to decide upon the type of relationships between variables, deciding about the data collection methods and procedures, deciding about the data analysis methods, drawing conclusions from the data, and presenting the data in tables and graphs. Yet, in the study of Gonulal, Loewen, and Plonsky (2017), their subjects have acquired higher literacy at the level of degrees of freedom, statistical power, post hoc tests, ANOVA, and effect size. The difference between our study and theirs is that we have focused through our courses on different research phases including data collection, data analysis, interpretation and conclusion, and finally data communication, while the authors focused on data analysis. Furthermore, our students like most using technological aids in the lectures (including computers, internet, software and so on). Besides, they think that the lectures were enjoyable, working with reason and logic to make the different choices. Despite this, the majority of the students think that statistics are hard to be understood; similarly, the same results are reported by Ernesto whose students find that statistics is a hard subject (cited in Joliffe, 2002). Some students find working on SPSS hard because it is new software to them and there are lots of similar procedures when practicing with it; whereas approximately the same rate of the students maintain that it is easy because they dealt with enough practice and because this software is organized, the students have just to follow the procedures and apply them carefully.

If we look back to the literature, statistics educations aim to prepare the students to understand and make use of statistical data for their studies (Gal, Gingsburg & Schau, 1997). Moreover, according to Garfield and Ben Zvi (2004), statistics education should aim at developing their statistical literacy (ability to understand statistical knowledge), statistical reasoning (ability to explain statistical situations), and develop their statistical thinking (how and why to use a particular method, measure, design, statistical model ..etc). We may say that through our experiment, we could achieve to some extents these three aims as is mentioned by the students in the questionnaire's results, students acquired theoretical notions and they can understand them, through the tests and the exams students could score good levels in explaining statistical situations where they were not able in the pre-study; and finally, students are able to give thorough and sound arguments for their selections and decisions they made concerning the research design, methods and tools and so on. Correspondingly, Gonulal, Loewen, and Plonsky (2017) claim that due to statistics education lectures, their subjects developed significantly the ability to interpret and use descriptive statistics and the most usual inferential statistics but there was an insignificant ability to use advanced statistics. Moreover, the subjects due to the lectures developed their statistical self-efficacy. Additionally, the authors' subjects have been able to attend the lectures that they have already taken in the quantitative methods lectures.

On another side, Perry (2005) claims that two factors may affect the students' willingness to study statistics: the technical notions or the mathematical formulas, operation, and calculations. Through our experiments, we introduced the students to the technical notions in relation to their field of interest and in the context of what they already know about research in order to facilitate the acquisition of these notions. Moreover, we introduced the students to the SPSS software that it takes in charge of making complicated calculations. Besides, we have seen only together basic calculations like the Rule of Three, calculating the mean and standard deviation, median, selecting the mode, and so on. Therefore, our lectures in statistics education target the above-mentioned abilities to ensure a good environment and good learning of statistics. Moreover, Varalakshmi, Suseela, Sundaram, Ezhilarasi, and Indrani (2004) stated five aims of statistics: condensation of the data, comparison, forecasting, estimation, and tests of hypothesis. Through our experiment, we targeted these aims in relation to the students' levels. We have seen through this experiment how to condense data, how to compare the data, and how to test the hypothesis. We were not able to dive into estimation and forecasting because these two are rarely targeted in the EFL research (as is mentioned in the teachers questionnaire). Furthermore, Kothari (2004), Garfield and Ben Zvi (2008), and Garfield (1995) stated the importance of technology in helping researchers and statisticians and developing statistical skills. Through our experiments, we have been working with the use of technological aids including computers, the internet, and mainly the use of SPSS. These technological aids helped the lectures to be more enjoyable and motivating the students to learn statistics.

Concerning the challenges in the pedagogical implementations, the students –as we have seen above- see that the content is hard to be understood and working with the SPSS is also hard since it is the first time to work with such software. Many difficulties are found in installing the SPSS in the students' personal computers for external tasks. Moreover, the lack of time assigned to more practice causes students to be unconfident about the knowledge they acquired. In the interview, which is conducted with a sample from our experimental group, the students in their Master two-level and after graduation suggest that the module should be taught at master two levels too to provide more time to understand and most importantly to practice more with the acquired notions. Besides, students emphasized the importance of supporting this module with helpful materials (like computers and data shows and SPSS, and so on). Some other students find difficulties in recalling some technical words or differentiating between statistical terms like mean, median, and mode. Finally, the last challenge we met during our lecture, is some of the students' negative attitudes towards statistics. These challenges conform with what authors like: Da Ponte (2011), Francis & Lipson, (2010), Tishkovskaya & Lancaster (2012), Garfield & Ben Zvi (2008), and others cited in their works. Therefore, in order to motivate and reduce these challenges, we opted for some strategies like working with authentic material, technological aids, and authentic data that has relation with their research studies. The students like working with authentic material because they can learn the statistical knowledge in their context and relation to the EFL research studies. Moreover, we tried to establish some kind of equality between theory and practice and we make use of some external tasks (because due to some external factors (mainly strikes) students have less practice than needed inside the classroom) to ensure providing the required practice and foster active learning.

To summarize, statistics is very advantageous in the EFL context; however, teaching and learning statistics in this environment require careful implication due to the student's background knowledge and their specific interest. It is highly important to motivate students through different strategies and materials to ensure attracting the students' attention to what it is being taught. It is also important to raise the students' awareness about the importance of quantitative research and statistics in their future research works.

VI.4. THE ROLE OF STATISTICS EDUCATION IN FOSTERING EFL LEARNERS' DECISION MAKING AND DECISION MAKING STYLES:

We targeted two main aspects of decision-making skills through our study. The basic aim is to develop the overall decision-making skill of Master's students when conducting academic research, and the second is to know the decision-making style (s) that the students developed due to statistics education. In the following two sections, we discuss our results with the available literature concerning the role that statistics education plays in the development of the students' decision making:

VI.4. 1. The role of statistics education in research and decision making skill

The results of our study proved that statistics education helps them overcome the decision-making problems they had at the beginning because they acquired both theoretical and practical support throughout the experiment. As we might see from the post questionnaire's results, the students claim that they have two research-related modules in which even the modules are entitled differently (for the control and experimental groups) but they are teaching the same contents. The only difference between them is that the experimental group has been introduced into statistics education lectures where the control group did not. Furthermore, when asking them, in the post questionnaire, whether they developed the research-based knowledge, they answered by yes for both experimental and control (because they had other modules to teach research methodology). We asked the students to explain what they have benefited from each of the methodology-related modules. The control group claims that the module of research methodology aided them to enhance the research concepts and reinforce their understanding of research and research steps, and they mainly learned how to organize the research phases. From the experimental group's point of view, we see that the majority claim that their knowledge is developed mostly due to statistics lectures where they learned from the two other modules how to organize the research steps and how to write academically, they corrected different concepts, how to write a literature review and how to write a research proposal. Concerning the module of statistics education, the results revealed that have learned how to collect and analyze the data, how to conduct experiments, how to present tables, graphs and read them, using the SPSS, types of research, and how to conduct each of them (mainly experimental, exploratory and correlation), descriptive and inferential statistics, and to draw conclusions. We notice that the students in their answers focus on saying HOW TO DO THINGS which refers to the process and that we relate later into the thoroughness of their decisions.

Concerning the students' feelings about whether they are ready to conduct research or not, the experimental group expressed equality of the answers' quantity (of those who said they are ready and those who said they are not), in addition to those who feel ready but not totally. Despite the percentages, the students in their justifications expressed their readiness to conduct research with some doubt. They explained that they are aware of the research process and due to the statistics module; the students can plan easily for the research and what they think is difficult is the application of the research in reality. The control group claimed they are not ready as think there are lots of details they cannot understand and that are very important to the application of the research. This lack of knowledge is due to a lack of practice according to them as we have seen in the chapter of the results.

The post questionnaire also revealed that the experimental group shows better levels in the research process. We see that the experimental group has good data collection abilities (M= 2.04 which is considered as a good level). Moreover, the data analysis abilities of the experimental group revealed a good level (M = 2.48). Furthermore, at the data interpretation and conclusion level, results demonstrate the students' level is good (with a mean of 2.84). Finally, the student's level in the data communication is low (mean of 3.24). On another side, the control groups' results show low levels at all the research phases. We see that the students claimed that they have a low level at the data collection phase (M= 3.25) and the data analysis (M = 3.30). Besides, the students claimed that they have a low level in the data interpretation and conclusion level (M =3); and a low level at the data communication level (M =3.10). Although the primary results demonstrate a better level for the experimental group than the results of the control group, the independent t-test revealed that the difference between these two groups is statistically significant only at the phases of data collection and data analysis, where the difference between their levels of the data interpretation and data communication. If we compare these results with the results that we have obtained in the pre questionnaire, we may see that the students claimed that they have a problem at all the levels of the research process for both experimental and control groups. In contrast, the students of the experimental group show a good level in the data collection, analysis, interpretation, and conclusion; whereas, the levels of the control group are low at all the research phases in the post questionnaire. We may explain these differences (in the experimental group) by the application of the syllabus, where we afforded much of time to the data collection and data analysis phases; whereas due to external conditions (strikes mainly), we have lost too much time and thus we summarized the main points with enough practice in the two last phases. We think that it is worth mentioning here that when asking the control group about the data interpretation, students mainly talk about interpreting percentages and frequencies, and when asked about graphs, they talk about pie charts whereas the experimental group has more knowledge about how to interpret inferential data and how to present these data in different graphs. Therefore, we believe that the comparison (of the two last phases) is based on the students' knowledge –which we said is different- and this could be biasing without taking the context of the experiment and the details we got from the control group and from the experiment itself. This last point could be taken as a limitation of our study.

In order to prove this difference, we asked the students in the post questionnaire about their level of confidence when making choices in the academic research tasks. The majority of the experimental group argue that they are somehow confident and the majority of the control group claim that they are not confident about their choices. Then, if we compare the pre questionnaire's results, the majority of the control group claimed that they are hesitant about their choices. The majority of the experimental group also claimed that they are hesitant about their choices. From this point, we can conclude that the experimental group has gained confidence during the experimental period; however, with a degree of low attitude certainty. Nevertheless, what should be mentioned here is that the experimental students claimed they are hesitant about their decision but are somehow confident. This may be explained by inconsistent attitude certainty. This last refers to "the subjective sense of confidence or conviction one has about an attitude" (cited in Tormala, 2016) or can be defined as "a metacognitive tag reflecting the degree to which one feels that an attitude is correct and/or clear in one's mind" (cited in Tormala, 2016). This means that the students' problem is not with the decisions themselves but within their attitudes towards the decisions they make. The main factors that affect the attitude certainty are summarized by Tormala (2016) in the followings: 1) the completeness of the information, 2) the accurateness and consistency of the information, 3) the relevance, importance, and legitimacy of the information, 4) and finally, the subjective experience thinking about, retrieving, or using one's attitude. This attitude uncertainty is because of the lack of experience in the real research process; that is to say that they did not have real experience in making research and the real conditions of undertaking this research work; thus, this makes them question their readiness to conduct graduation research as they claimed that they have acquired good knowledge but they are not sure whether they need more. According to Tormala (2016), uncertainty is important because it pushed people to think of the details before taking any action in order to be certain. This is why; uncertainty in scientific research is usual and very normal. According to the literature, hesitancy and uncertainty in research is inevitable and happens at all level of the scientific research process; as Cordner & Brown (2013) claimed: "we argue instead that uncertainty occurs at various stages of the scientific process…" These stages mainly include: uncertainty when choosing research questions or methods, uncertainty when interpreting scientific results, uncertainty when communicating results to multiple publics, and uncertainty when applying results for policy-making (Cordner & Brown, 2013). However, and in spite of this attitude uncertainty, the students claimed that they are confident of the decisions they were able to make during the experiment. Similarly, the students of Gonulal, Loewen, and Plonsky (2017) claim that they have not significantly developed their statistical confidence. The students of Gonulal, Loewen, and Plonsky (2017) have not developed confidence since they claimed they were confident before starting the lectures, however, after, they find that they were not confident. In our study, as we have seen in the results, the experimental students claimed that they became somehow confident; yet, our control group claimed that they were confident at the beginning of the year but at the end, they claimed that they were not confident.

To get more details about their confidence, we asked the student about what boosted their confidence; the experimental students expressed their appreciation towards the modules of SAQR and WRP which helped them too much. Different things have been learned from both modules. In previous questions in the post questionnaire, we asked the students to specify what they have learned exactly from the research methodology modules. From the general perspective, they have learned from WRP how to write the research proposal and how to organize research steps (see p.199). Whereas in the SAQR (which is the module of statistics education) students claimed that they have learned a lot of practical abilities such as how to collect data, conducting experiments, and how to analyze them, they dealt with different kinds of research, appropriate data collection methods and data analysis ways (see pp. 199-200). Basing on the above results, we may see how both types of knowledge enhance the students' confidence in making decisions. The lectures on statistics provided both theoretical and practical knowledge and involved the students in active learning because we believe in what is mentioned by Wrenn & Wrenn (2009) who claimed that theory presents basic background which becomes refined by appropriate practice.

Furthermore, the interview results which has been conducted with six randomly selected students from our sample to inquire after the role that the statistics education lectures played in the development of their decision making skill during the real academic research and other benefits and advantages they have gained due to these lectures. The interview revealed that the students have chosen the domain of applied linguistics because they are motivated to this field of study even though this field is obliging them to conduct a graduation project. The students claimed that they were obliged to make research a requirement to follow this specialty. The participants talked about their starting problems in the research process where they had problems settling on the problem and the topic of the study. In further steps, the students claimed that the most difficult phase was the literature review as they had no idea about what to take and what to leave in the literature. We tried to dive into the specific problems met by the students at the level of each research step. At the level of the title, the students claimed that their problem is in the formulation of the research title so as to cover all the research parts. Even though students considered this as a problem, we can say this is a normal step in the research process because adjusting research titles to the final form can be done after accomplishing the research study. Furthermore, in the data collection phase, the interviewed students did not report a lot of problems except for the choice of corpus and the sample of the study; and very few students reported a problem in the choice of the tool. In the next step, the students felt confused at the very beginning about how to analyze speeches they choose to their study because they have not the habit of working on speeches.

Finally, the students expressed their confusion in the choice of the appropriate graphs. This would be seen as normal because we just had an overview of this chapter and we could not study all the details due to time limits. Additionally, the students' attitudes towards statistics lectures they had in their master 1 level did not change in their master two. We have seen in the results of the post questionnaire that students liked the module and found it advantageous at many levels; however, many of them have reported that the content is difficult. The interviewees declared that statistics lectures helped them to make different decisions concerning the research process, and it guided them and prepared them for the graduation projects. They claimed that due to the lecture, students are able to provide enough arguments to their choices as they knew how, when, and why to choose the research tools and methods. However, for the disadvantages, the students claimed that the content of the module was hard to be understood; and most importantly, there was not sufficient time to practice everything, Ernesto reported in his study also that the students he is supervising find that statistics as a hard subject (cited in Joliffe, 2002). Moreover, statistics education helped the students to be more careful when making decisions for the research; and due to it, they became more precise and systematic in making choices. According to them, the students started to think logically and to decide upon reasonable decision even though they are costly; they claim that they became accurate and have sufficient arguments for their choices. The interviewees maintained that their meetings with their supervisors were more about the discussion of their own decisions; instead of asking for a decision. This demonstrates that students show a kind of maturity in their decision-making.

To conclude this section, statistics education plays an important role in academic research and decision-making during the research process. The lectures if well prepared develop the students' knowledge (both theoretical and practical). These two types of knowledge help the students to overcome the different research problems and challenges (cited above). Moreover, the lectures if well-designed help to raise the students' confidence in their decisions. Students showed through the experiment a significant development in the decision-making skill in the phases of data collection and data analysis and a non-significant development at the level of data interpretation and conclusion and data communication. We have seen that the development in the two last phases was due to lack of time provided to the training in these two phases. Finally, statistics education does not reduce uncertainty and hesitation when making decisions; this uncertainty as we have seen through the literature is a normal and usual condition and it can help push the decision-maker to look for details before making the decision.

VI.4. 2. Statistics education and the development of decision making styles

The modified version of the Decision Making Questionnaire adopted from French, West, Elander, and Wilding (1993), revealed the development of the experimental group's overall decision-making skill, and the students' decision making became throughout the experiment more systematic or more thorough. According to French, West, Elander, and Wilding (1993): "Style of decision making involves those aspects of the decision process in which individuals may be presumed to adopt a common mode of operation across a wide range of decision domains". That is to say, these styles refer to the way people use usually in making decisions. The scale as mentioned above consists of seven decision-making styles: thoroughness, control, hesitancy, social resistance, optimizing, principled, and instinctiveness (see chapter IV, pp. 102-105).

When comparing the control and the experimental groups' decision-making before the experiment we see that the control group is having a higher decision-making skill more than the experimental group. We may explain this difference with the control groups' overconfidence in their research skills (based on the post results in which their decision making skill has declined). This is clear if we compare the pre and post means of the decision-making styles of the control group. We see that there is a decrease in all the means except for principled decision making which has a non-significant development and distinctiveness which is a significant development. Therefore, we conclude that the students have overconfidence where they learned during the whole year their real level. Concerning the experimental group, we see that there is an increase in their decision-making level. Consequently, we see that the difference between pre and post-experimental decision-making is significant development ($p<.05$), whereas the difference between the pre and post-scales of the control group is a non-significant decline ($p>.05$).

Contrary to the control group which has a non-significant difference between pre and post-decision-making styles, our experimental group has developed the majority of the styles: thoroughness, control, hesitancy, social resistance, optimizing, principled, but not instinctiveness. The results showed that there is a great development as all the differences are statistically significant ($p<.05$) except for instictiveness ($p> .05$). However, we might say that the decision-making styles that are developed due to "Statistics Education" are only thoroughness and principled styles. More specifically, the difference between the control and experimental group decision-making styles is not significant except for thoroughness and principled styles in the post-study. Concerning thoroughness, the results claimed that the control group has a higher level in the pre-study; however, in the post-study, the experimental group has a significant development (in pre-study M=3.08 and post-study M=3.70) whereas the control group has a significant decrease (in pre-study M=3.60 and the post-study: M= 3.26). Concerning the principled decision-making style, there is a significant difference between pre and post-levels of the experimental group where there is a non-significant difference between the pre and post-levels of the control group. The difference between the control and experimental groups' principled decision-making style in the pre-study, we see that the control group has a higher mean (M=2.78) than the experimental group (M=2.74). Nevertheless, in the post-study, we see that the experimental group has a significant development in their principled decision making in the post-study (M=3.50) comparing to the control group's level (M=3.04).

To summarize the decision-making questionnaire revealed the experimental group's development: either the general decision making or the specific decision-making styles. However, we assume –based on comparisons with the control group- that the statistics education module has developed only "thoroughness" and "principled" decision-making styles and other styles have not been developed (hesitancy, control, social resistance, instinctiveness, and optimizing). Both control and experimental groups were engaged into two other modules of research methodology in which they studied how to organize their research works and corrected so many research-related concepts; the only difference is that the experimental group has been introduced into statistics education that has reinforced more their thoroughness and the principled decision making. We see that in the control group students have a decrease in thoroughness and a non-significant development in the principled styles.

Additionally, the results of the decision-making diagnosis tests have revealed that the students' errors in decision-making have been reduced. The tests revealed a significant development in the accuracy of the research decisions, as we see that in the pre-tests, the students have a very low decision-making level (M=1.08; SD=.66) whereas, in the post-study, the students have a good level (M= 6.24; SD=1.68). Moreover, there was a significant decrease in the types of errors committed by the students as we see that the majority of the errors detected in the post-tests are found with very low frequencies (see chapter V, pp. 250&252). We can see that the majority of errors committed in the post-study are not related to the decision making, but with practical abilities.

In an attempt to explore the students' styles (way) of making decisions, we asked them about the basis of their decisions. The experimental group claim that they follow the reasoning and their knowledge when making choices; whereas, the control group claim that they base on their knowledge. These results support our finding of the decision-making questionnaire where we found that the experimental group developed their thoroughness decision-making style.

Moreover, the students maintain the role that statistics education plays in decision making. They claim that it helps them decide the right way because they can relate different research aspects with each other, they can provide sound arguments to their choices; and it helps them make decisions basing on logic rather than emotions. They learned that when making decisions, it is very important to look for details. This includes, according to them, analyzing the plan than taking action. Moreover, they think that sound decisions do not come from their own desire, but comes from a correct procedure (this is referred to in the literature as thoroughness style). Furthermore, the statistics lectures helped the students to have control over their decisions and to think carefully before making their choices; for example, when the students find that they like a specific tool over the others, they prefer following a correct procedure than choosing that decision. Furthermore, statistics taught them to make choices related to other aspects of research and not based on what they like or what they find easy (this is idealism/ principled style). In addition to these, statistics education helps them be more confident about their decisions because they have more knowledge and more arguments to provide. Finally, the students argued that statistics education taught them how to apply logic and reason when making research-related decisions and they became aware of the right meaning of being scientific in the research process.

Logical reasoning is an important part of decision making (Manna, 1992 as cited in Ong, Khaddaj & Bashroush (2011) as it leads to the accuracy of the process of decision making. Different research studies worked on the relationship between statistics and reasoning, among these works we cite Biehler's (2002, p.41) "Developing and Assessing Students' Reasoning in Comparing Statistical Distributions in Computer-Supported Statistics Courses". The study worked on the strategies and tools the students used when comparing data sets and how they employ the knowledge they obtained from the lectures. Moreover, another study has been conducted on "Statistical Reasoning Used By Elementary and Middle School Students When They Analyze and Interpret Data" conducted by Jones, Thornton, Langrall, Mooney, Perry & Putt (2002). The study revealed the importance of the context in shaping the kid's statistical reasoning. Furthermore, Delmas, R. Garfield, J.G. & Chance, B.L. (2002, p.44) worked on "A Framework for The Development of Students' Statistical Reasoning". Their study disclosed the following reasoning behaviors: first, fluency in which the students are able to use correct terms, concepts, and procedures. Second, rules in which students are able to use appropriate rules as cited by the authors to predict and explain. Third, consistency represents the use of contradictory sentences (exist or do not exist). The fourth reasoning component includes equilibrium which refers to the ability of the students to locate inconsistencies or contradictions. Finally, the last behavior includes confidence which refers to the level of certainty in the students' selections. Regarding these studies, there is a big effect of statistics on the students' reasoning. Similarly, our study revealed that EFL students have developed their reasoning when have been introduced to statistics lectures. More specifically, our students have learned different terms and concepts and different procedures to collect and analyze and interpret, and finally draw conclusions. This could show that the students acquired the fluency reasoning related behavior; in addition to confidence where have seen that our students expressed that they became somehow confident about their choices where they were not confident in the pre-study phase. Moreover, through tests, we emphasized during the lectures the ability of the students to detect errors through the use of tricks in the examination and activities and we focused on the importance of following the rules they learned when explaining their choices. These support the students' answers about them developing their reasoning through the statistical lectures.

Moreover, from Patrick, Steele & Spencer's (2013) point of view, two factors may affect the decision-making process: the amounts of the information searched and the strategic search (including compensatory and non-compensatory strategies). The information search plays an important role in reducing uncertainty (Clemen and Gregory, 1995) and leads to pleasing outcomes. Compensatory and non-compensatory strategies -as explained by Bandyopadhyay, Chandrasekhar Pammi & Srinivasan (2013), Peters & Bruine de Bruin (2012), and Patrick, Steele & Spencer (2013) - are information-based strategies used to make decisions. The compensatory strategies rely on different information, analyzed, evaluated, and combined in order to ensure that each part can get over the drawback (s) or the weakness (es) of the other part (s). On the other side, the non-compensatory strategies base on the most important piece of information and ignore others. Through our experiments, we tried to afford the students with the different needed knowledge and push them to look for and investigate more information. Furthermore, Crăciun (2016) in the study "correlates and Factors of Decision Making in Management" tested the relationship between decision making styles and some factors, namely: the level of information, the problems' difficulty, age, and finally, stress. The study concluded that the factors that have a relation with decision making are: the level of the information, the problem's difficulty, and stress. More specifically, the study found a significant correlation between the level of information and the optimizing decision style. The author explained that when the person makes a decision with less information, s/he may persuade ways to optimize the decision. Moreover, the author reported significant correlations between the problem's difficulty and Thoroughness, and between the problem's difficulty and hesitancy. Furthermore, in the same study, the author found that the correlation between decision-making styles and age is not significant. As a final point, the author found a significant correlation between perceived stress and hesitancy. In the study of French, West, Elander, and Wilding (1993) –entitled: Decision Making Style, Driving Style, and Self-Reported Involvement in Road Traffic Accidents-, the authors found that thoroughness style has been correlated with accident rates and explained that relation through the fact that when the driver is impatient this means that they employ low thoroughness.

Consequently, the students when making decisions follow a purposive and logical procedure, they take into consideration all of the implications of the decision through planning well ahead and working out all the pros and cons before making a decision. More specifically, they make use of the information they acquired to analyze the pros and cons of the decision they set, look into the details, relate it to different parts of the previously decided in the research process, and make the final decisions. Moreover, the students learned to make decisions that are said to be better in the outcome and not those which are easy or which they like, their decisions are governed by the principle not by the difficulties or the practicalities. Therefore, the student's decision-making became more systematic and more logical. They tend to use the knowledge acquired in the statistical lectures to analyze the research study before applying it, analyze the adequacy of data analysis tools with the research aim (s), and then the appropriateness of the data analysis tests with research aim (s) and the types of the variables and the data collection tools and the sampling methods. Finally, the students base their conclusions on the type of tests employed and the sampling method used. In the case of studies that we could study in the class, students became able to understand notions when making extra reading or extra research in the domain.

Therefore, regarding the results of our research work and the available literature in this area, we conclude that the decision making process during the research process includes these systematic questions:

1. What is the aim of the decision?
2. What are the alternatives we have?
3. What are the advantages and disadvantages of each?
4. What are the available materials that I have?
5. Which among the alternatives leads directly to the aim? if not directly, which alternative does lead me closer to the aims?
6. Apply the choice.
7. Evaluate the outcomes.

VI.5. THE MOST SUITABLE STATISTICS' SYLLABUS FOR EFL MASTER'S STUDENTS

Before diving into the content to be taught, we would like to mention here that contrary to the different methods of teaching statistics based on statistical calculations, our study targets the teaching of statistics in relation to the different parts of research in the EFL context. That is to say; statistics education should not be based only on data analysis but should elaborate on the logical ties that connect the data collection and data analysis, interpretation, and conclusion decisions. Similarly, Shaughnessy (2007) reported that statistics teaching focuses on teaching how to calculate and present the data and it ignores the data collection methods and the formulation of research questions (cited in Henriques & Oliveira, 2013). We also believe that the statistical lectures should be based on the needs of EFL Master's students. Likewise, Shulman (1986) maintained that the statistical content to be taught or the knowledge that is taught should be based on the discipline it is taught in (cited in Henriques & Oliveira, 2013). Accordingly, the questionnaire that is submitted to teachers revealed different important points in the teaching of statistics education to EFL Master's students. These results support in some ways the findings we obtained from the students (including the error analysis, the diagnostic tests, the questionnaires, the interview, and mainly from the experiment we conducted).

From a general point of view, the teachers provided their attitudes towards the modules of research methodology that are taught at the department of the English/ University of Bejaia and how the students always show mastery of research principles but still need more applications related to some important related issues. Moreover, another problem is stated by the teachers who claimed that the research methodology syllabi are not homogeneous as they focus on theory and neglect application. For this reason, we thought that there should be a statistics-based syllabus that is complementary to the research methodology syllabi and that is based on the students' needs. Therefore, in this section, we discuss the content which seems to be significant to be included in the statistics education from both the teachers' and the literature perspectives. The teachers suggested that statistics education should be taught at Master 1 and 2 levels to ensure sufficient time for the acquisition of all notions and practice within their own topics in Master 2.

VI.5.1.The content to be taught in statistics education

According to the teachers, the types of research that are mainly used in the EFL domain are descriptive, diagnosis, and hypothesis testing research studies; wherein hypothesis testing students do not estimate the population parameters. Moreover, the types of data Master's students use are both categorical and Numerical. We think that teaching about the types of the research study and the types of data are highly important because the type of the study facilitates the decisions to be made in the data collection and the data analysis phases, and the types of the data facilitate the data analysis methods' decisions. From a general point of view, the teachers maintain the importance of teaching both data collection and data analysis. The content to be taught according to the findings of the teachers questionnaire includes the following important points:

1) ***Content for the data collection phase***:

Even though statistics relate to data analysis, we believe that the students should have a sound background in the data collection phase because this last relates to the validity of the results in general and the validity of the data analysis procedures in specific. The teachers agreed on the importance of teaching the following points:

- Research Designs including data collection design and data analysis design (and how they are related to each other); the design should **MAINLY** include:
    - The research design in exploratory research
    - The research designs in descriptive and diagnosis research studies
    - The research design in hypothesis testing research
- Sampling Designs: including sampling techniques and sampling errors
- Types of data and levels of measurement

This part mainly bases on theoretical knowledge about the above titles and then the students are supported with activities and example to ensure that they have understood the content.

2) ***Content for the data analysis phase***:

From a general perspective, the data analysis phase, according to the teachers, should involve the following concepts:

- Descriptive Statistics
- Inferential Statistics
- Checking validity, reliability and practicality of the research studies
- How to apply statistical operations and calculations
- Using technological aids and mainly SPSS
- Teaching about different graphs that fit the research aims

Contrary to the data collection phase, the data analysis part is more practical, and it requires the students to be active. Teachers should engage the students in real data analysis activities to ensure acquiring fluency in the application.

Similar to our findings, Garfield (1995) claims that there are some central concepts to be taught to the student when teaching *introductory statistics*; these include:

> …the idea of variability of data and summary statistics, Normal distributions, the usefulness of sample characteristics (and inference made using these measures) depends critically on how sampling is conducted, a correlation between two variables does not imply cause and effect, statistics can prove very little conclusively although they may suggest things, and therefore statistical conclusions should not be blindly accepted.(Garfield, 1995, p.26)

In short, the author suggests the importance of teaching the students about the concepts of central tendency measures (mean, mode, median ...etc) and measures of variability (Standard deviation, range, percentiles …etc). Furthermore, teaching the students about normal distribution, teaching everything about sampling and sampling methods, teaching them about correlations and associations and the difference between these aims and cause and effect aim; and finally, studying concluding statistics-based data. Moreover, the author insists on the importance of teaching students some statistical skills. This last includes according to the author: the ability to understand and evaluate the information in the world, forming good statistics habits and working in pairs and groups, the ability to solve statistical problems, to communicate data using statistical language, the ability to solve statistical knowledge, draw conclusions and supporting the conclusions with explaining the reasoning behind it, and finally, knowing how to use statistical tests' assumptions in order to draw important and sound conclusions. Furthermore, Gonulal, Loewen, and Plonsky (2017, p.5) maintained the importance of developing the Applied linguistics' students' statistical literacy where they should be able to "choose, apply, carry out, and interpret the statistical methods that are most appropriate for their research". The authors emphasized the idea that not only the researchers should have this ability, but they also claimed that even readers, reviewers, and editors in the field should have this statistical literacy. The authors reported different research studies which have been done about statistics in the field of applied linguistics. They talked about the works of Larson-Hall's (2010) who made his manual about the SPSS, Lowie & Seton (2012) who worked on experimental research in the applied linguistics field, Loewen & Plonsky's (2015) who worked on the research method in the field of applied linguistics, Plonsky (2015) who worked on advance statistical procedures in the field of the second language (cited in Gonulal, Loewen & Plonsky, 2017). That is to say, these research studies emphasize some crucial statistical concepts and procedures to be taught to applied linguists including the SPSS, experiments in research, research methods, and the statistical procedure. Therefore, our results conform to these research works studies.

Concerning the sampling, different works on this area have been conducted; among these studies, we may find: The study of Watson (2000) which is entitled "Pre-service mathematics teachers' understanding of sampling: intuition or mathematics". Moreover, there is the work of Watson & Moritz (2000) which is about "Development of understanding of sampling for statistical literacy" and "Developing concepts of sampling" of Watson & Moritz (2000) (cited in Batanero & Jolliffe, 2002). Other studies include Thompson's "Conceptual Issues in Understanding Sampling Distributions and Margin of Error" (Thompson, 2002), "Methods For Assessing and Researching Student Reasoning about Sampling Distributions" of Earley (Early, 2002), Rubin, Bruce & Tenney's (1991) "Learning about sampling: trouble at the core of statistics", Hawkins' (1997) "Children's understanding of sampling in surveys, and finally, Metz's (1999) "Why sampling works or why it can't: Ideas of young children engaged in research of their own design" (cited in Meletiou, 2002). Therefore, we can understand the importance and the indispensability of teaching sampling and sampling methods to our students. In addition, Monteiro & Ainley (2007) reported different studies that emphasized the importance of including graphs' knowledge in syllabi and curricula like Meira (1997), Ainley (2000), Evans (2000) (as cited in Monteiro & Ainley, 2007). According to the authors, teaching about graphs should include not only the types of graphs but also reading, interpreting, and drawing conclusions from the graphs' data because learning about them is helpful even in real life like reading media graphs and so on (Monteiro & Ainley, 2007). Finally, Gonulal (2016) and Gonulal, Loewen & Plonsky (2017) reported that statistics education should target statistical literacy which should include three main components: understanding of descriptive statistics, understanding of inferential statistics, and interpretation of inferential statistics (cited in Gonulal, Loewen& Plonsky, 2017)

However, the teaching of statistics is not only related to the content, Joliffe (2002) summarized some important studies about statistics education and claimed that teaching statistics does not only require statistical knowledge and skills but also teaching or pedagogical skills. According to Ernesto Sánchez, and Michel Henry and Bernard Parzysz, the teachers in the field of statistics education need an academic background and should have training in didactics. Moreover, Susan Starkings claimed that teachers of statistics education should have knowledge in pedagogical issues (cited in Joliffe, 2002); likewise, Heaton and Mickelson (2002) asserted that there is a "need to focus on pedagogical content knowledge in teaching statistical investigation" (p.32). Consequently, teaching statistics does not only need the teachers to have a background in statistics but also to have teaching and pedagogical knowledge.

VI.5.2.Most Important Research Aims Employed in EFL Research

The above content covers the general lines to be taught; however, these lines include many details. Therefore, we gave the teachers a list of research aims that could be employed in EFL research. The respondents agreed on the following list of aims:

A. ***General Aims***:

From general perspective, the EFL students are:

1) Very frequently interested in exploring one variable in a given situation or context.
2) Very frequently interested in studying whether an association exists between two variables.
3) Studying whether an association exists between more than two variables (here the teachers' attitudes varied between those who said that this aim is frequent and those who said that this aim is rare among EFL research works).

4) Very frequently interested in studying whether a cause and effect relationship exists between two variables.
5) Rarely interested in studying whether a cause and effect relationship exists between more than two variables.
6) Rarely interested in studying whether a change in one variable predicts (forecasts) a change in another variable.

As it is clear, the EFL students' research works vary at the level of the number of variables and the relationship between them. The EFL research works, then, are made to investigate one, two, or rarely more than two variables. They frequently target the causal relationship between two variables, and rarely more than two variables. Moreover, the teachers claim that the students rarely make some studies on prediction aims.

B. Data Analysis andStatistical tests and their aims:

Concerning the aims that are related to data analysis, the teachers agreed on this list:

- The students simply present the data in form of numbers and percentages.

1) *Analysis of Relationships*:

- They want to determine the degree of correlation between two variables in case of ordinal data.
- They want to measure the degree of linear relationship between two continuous variables.
- The students test the strength of an association between categorical variables
- Concerning investigating whether a sample matches the population, the teachers claimed that this aim is neverinvestigated in the EFL context.

Therefore, when the students analyze their research works, and in order to achieve these above aims, they need to use the following tests respectively: descriptive statistics, Spearman Correlation, Pearson Product Moments Correlation, and finally, Chi-Square.

2) *Analysisof difference*:

The teachers claim that the following cases range from frequent to very frequent in the EFL research studies:

- The students test the significance of the difference between two related means.

- The students test the significance of the difference between two independent means/groups.

In the analysis of the difference between groups or variables, the teachers agreed that the students mainly target the above aim. These aims are pursued with these tests: dependent t-test (or paired t-test) and independent t-test respectively. From another perspective, the teachers claimed that the following aims are never used:

- Determine whether there are any significant differences between the means of more than two independent (unrelated) groups.
- Test the effect of one or more independent variables on two or more dependent variables.
- Find out whether the means of a dependent variable are equal across a treatment while trying to control for the effects of other variables (extraneous) that are not of primary interest.

The students in pursuance of the above aims make use of the following tests correspondingly: ANOVA, MANOVA and ANCOVA.

3) *Analyzing Prediction:* here the teachers claimed that the students occasionally test how a change in the independent variablepredicts the level of the change in an outcome variable. The other case that is declared by the teachers as being never employed is how a change in a combination of two or more independent variables predicts the level of change in the outcome variable. The first aim is pursued through the Simple Regression and the second is tested through Multiple Regression.

C. The Statistical Tests

The teachers questionnaires revealed that all the tests range from moderately needed to highly needed. The tests include: Comparing difference tests(M=3.93; SD=1.35), One sample tests (M=4.23; SD=1.11), Survival analysis tests (M=3.92; SD=2.25), Reliability tests (M=4.03; SD= 2.03), Predicting scores tests (M=3.98; SD=1.81), Association tests (M=3.81; SD= 1.90), Data reduction test (M=3.61; SD=2.06), Assumptions tests (M=3.73; SD=1.96), Moderation tests (M=3.54; SD=2.29). However, if we compare these results with the findings of the other parts of the questionnaire, we might see some differences. For example, the teachers claimed that the prediction tests range from moderately needed to needed; however, they declared in the aim of prediction is occasionally treated in EFL research studies.

According to Gonulal, Loewen, and Plonsky (2017), a variety of research works concluded that the students face a variety of difficulties when using statistical procedures; more specifically; the students do not respect the tests' assumptions, they omit the non-statistical results, and they have poor abilities in reporting statistical results (cited in Gonulal, Loewen and Plonsky, 2017); therefore, statistics lectures should aim at eliminating these challenges. The authors (2017) analyzed the statistical syllabi in which their participants were enrolled. these syllabi mainly include the following contents "basic statistical procedures (e.g., standard deviation, correlation, mean, median), graphic and tabular presentation of data, as well as common inferential statistics (e.g., t-tests, ANOVAs, regression, chi-square, and non-parametric tests)" (pp.11-12). Moreover, the authors mentioned that the program of the intermediate statistics in applied linguistics introduces the students to more advanced content. This mainly includes: "factor analysis, cluster analysis, discriminant function analysis, and logistic regression" (p.12), and they claimed that the syllabi did not include more advanced statistical procedures, namely "structural equation modeling (SEM), implicational scaling, and Rasch analysis" (p.12). Concerning the pedagogical implications of these syllabi, the researchers reported that the syllabi emphasize the importance of practice upon the research articles and practicing on scales and working with projects, and the practice is done using the SPSS.

Additionally, Gries (2015) summarized the main statistics that are used in the Corpus Linguistics Research (CLR). He cited that CLR employs both descriptive and inferential statistics. In descriptive statistics, the CL researchers use frequencies of occurrence of linguistic elements, frequencies of co-occurrence or association measures (which has no significance testing), measures of central tendencies, the dispersion measures, correlation measures (like Pearson's r or Kendall's τ). Concerning the inferential statistics, the author claims that CL researchers employ tests that look for statistical significance. The author cited: significance tests of two-dimensional frequency tables (this includes mainly the chi-square tests and Fisher-Yates are very rarely as mentioned by the author). Furthermore, the inferential statistics in CLR involves association measures that do involve significance tests, (including t-tests, z-tests, f-test, and so on), significance tests for differences between measures of central tendencies (this include t-tests, U -tests, Kruskal-Wallis tests), in addition to significance tests for correlations. According to the author, in addition to these basic statistical tests, other advanced ones are used. The author mentioned multifactorial regression modeling which is considered an inferential statistics method. Moreover, the multivariate exploratory tools (like hierarchical cluster analysis, principal components analysis, correspondence analysis, multidimensional scaling) are also found in the Corpus Linguistics Research.

Therefore, there is not any contradiction between our findings and those of the literature, However, the teachers who responded to our questionnaire claimed that all the tests (in the last section) are ranging from moderately needed to highly needed, where we did not find in the literature who used them in the field of applied linguistics or corpus linguistics. These tests mainly are: Survival analysis tests, Data reduction test, Moderation tests, and Data reduction test.

CONCLUSION

This study aims at proving that statistics education helps EFL Master's students to foster their decision-making skills during academic research. Through this chapter, we tried to establish a relationship between our results and the findings of other studies in the field or similar fields. The discussions revealed that our results conform to these studies' findings and proved that statistics education fostered the EFL students' decision-making skills during the research process, and more specifically, the students became more thorough and more principled when making decisions. Other decision-making styles have not been developed through our experiment, namely: social resistance, instinctiveness, optimizing, control and hesitancy. Moreover, our study concluded that statistics education lectures should base on different research process' steps and establishing a logical relationship between each step. More specifically, contrary to other research studies that focus in their syllabi on teaching statistical data analysis principles, we argue that statistics should also teach at first the ways to collect incorrect manner the needed data.

CHAPTER VII: PEDAGOGICAL IMPLICATION AND LIMITATIONS OF THE STUDY

INTRODUCTION

This study investigates the effect of statistics education on master EFL students' decision-making skills during the academic research process. Furthermore, we try through this study to suggest a statistics syllabus that is based on master EFL needs. Through the experiment, we have used different research tools in order to reduce at the maximum any research bias and to get more information about the investigated objectives. The study, therefore, has been conducted with 25 Master 1 students who have been introduced into statistics education lectures and have been tested to see their decision-making level before and after our suggested treatment. We have opted for other research tools to explore the other sub aims of our study; namely, investigating EFL Master's students' research difficulties, to explore the students' attitudes towards their levels' development, towards statistics and statistics' education, to test the accuracy of their decision making before and after the experiment and so on.

Through this chapter, we report the most important suggestions and implications we concluded from our study. These implications are divided into implications for teaching and learning statistics, the implications for developing the students' research decision-making skills and reducing decision-making difficulties of Master's students during the research process through statistics education; and finally recommendations for further research in this field. This section also provides a recommended Master's students' statistics syllabus which is based on the findings of our study; and finally, we present the limitations and challenges we met through this study.

VII.1. IMPLICATIONS FOR TEACHING AND LEARNING STATISTICS IN EFL CONTEXT

Teaching and learning statistics in the EFL context is advantageous as we have seen through this study; however, there are many situations and conditions that both teachers and learners should take into consideration before and during the learning and the teaching processes.

VII.1.1. Showing the difference between Research methodology and statistics education

The first thing that should be understood is the difference between research methodology and statistics education. The former represents the process of conducting research and how to organize the research steps; learning about research methodology helps the students learn different research-related concepts and notions and be aware of what is research in general. Yet, statistics education is more profound and deep; it is assumed that this field is related to data analysis; however, statistics education provides a backlink between the different research steps; this link is based on logic and reasoning. That is to say, through statistic education, the learners will be able to make a logical relationship between the different research steps and understand the effect of one step on the other and the validity and reliability of the research as a whole. Consequently, we strongly emphasize the importance of explaining this point especially to the students, in order to make them aware that statistics education is not a repetition of research methodology lectures neither a calculation lecture; it is yet, a continuity of the research methodology. Moreover, we recommend that the lectures on research methodology should emphasize how to employ the literature in the formulation of the research topics and the good definition of the research problems. Besides, statistics education lectures should provide an up to date knowledge about research and research methodology.

VII.1.2. Implication about Research and training at Master 2 level

Many students choose training because they think it is easy and does not require much effort. This is mainly related to the difference of efforts afforded to train and the efforts afforded to research works. In the training, students are said to attend the lectures with the trainer and take notes in a so-called “observation phase”; then the students are going to initiate some activities in an “initiation phase”; and finally present a whole lecture in the “presentation phase” under the control of the trainer (the trainees are evaluated); then the students are asked to write a training report to describe the three phases (which contain 20 pages at maximum); in addition to this, students are paid for their training. In dissertation writing, students are required to write 60 pages at a minimum where they are going to use different practical and thinking skills to resolve a problem or to find answers to the research questions and to complete the research works. Students meet different challenges and limitations and afford much effort to do this; besides, students waste so much time and money through the research process. Accordingly, the majority of the students prefer making training rather than undertaking research. Therefore, we strongly emphasize the importance of restructuring the training process to make it more purposeful and in order to be a decent project to be submitted for Master's graduation. In this concern, teachers should change and restructure the training process into action research, where the trainees are expected to use more cognitive and self-reflective skills. According to researchers, action research is very beneficial in the field of education because teachers can develop their teaching skills through it, the UK educational reform emphasized action research and its importance in the teaching process (see McKernan, 1991 as cited in Lesha, 2014). According to Burns (2015) "those engaged in AR experience self-reflection on their behavior, actions, and interactions with others". That is to say, action research, which is based on solving teaching problems and answering the question through practice, enables the teachers to reflect on their own behavior and discuss with other teachers in order to solve the problems they meet when teaching. Action research is active learning for both teachers and learners; this claimed by Lesha (2014) when said: "action research is a teaching, learning, and decision-making process that can be used in a myriad of ways to assist the learning process of students and teachers". Moreover, Burns (2015) claims: "within the action research process, educators study student learning related to their own teaching". Based on this, and because students aim through training at becoming good teachers through the training process, we strongly recommend including action research in their studies and conducting action research through their training period. This will make a balance between those students who will conduct academic research and those who choose to make training for professional purposes.

VII.1.3. What for and when to teach statistics

The teaching and learning statistics should not only be based on the statistical content, but also linguistic content. The students without statistical-related vocabulary and syntax (as mentioned by Wood, 1990) cannot transmit and explain their studies; mainly, the students cannot communicate their results and explain the sequence and the logic in the study. The statistical language principally includes the statistical vocabulary, grammar, syntax, symbols in the target language (Boughani & Maouche, 2017). Therefore, teaching statistics does not only need teaching statistical knowledge but statistical lectures should aim at developing the students' statistical language first to ensure the correct use and transmission of the statistical knowledge later on. However, the statistical lectures will need much time and much preparation in order to ensure a well understanding of the differences introduced issues and notions and acquire the needed statistical language. For this reason, we recommend that statistics education should be introduced at the Master one level. This will help both teachers and students be well prepared for the research process by reducing as much as possible the students' research challenges and problems. More specifically, Master one lectures should include initiative information and introduction to main concepts in the field to provide basic and enough information and the needed statistical language to enable the students to make a sound decision (based on the role of information in decision making through the literature review). In master two, the lectures should be more practical (if not merely practical) to enable students to integrate the acquired information in master one within their own works. The lectures should target the students' deficiencies when they come to make their decisions. Moreover, teaching statistics only for master one would reduce its effectiveness as the students will learn it for exams. Therefore, we suggest a mode of evaluation that bases not only on the final exam but on continuous evaluation which is made on research tasks.

VII. 1.4. Statistics' teachers' characteristics in the EFL context

Different researchers (like Henson, Hull, & Williams, 2010; Garfield and ben Zvi, 2008, Tishkovskaya and Lancaster, 2012, and others) maintained that teachers of statistics should have specific training in advanced statistics literacy. However, the teachers' are not only required to have knowledge of statistics but also should have good knowledge about the research area (in our case: teachers should have good knowledge in research methodology in the EFL research). Moreover, in addition to statistical knowledge -either general or specific-, teachers should have teaching and pedagogical knowledge to enable a good transmission of the information. Moreover, teachers of statistics should have good knowledge about teaching methods and strategies to ensure that the students have acquired the target knowledge in a good manner. More specifically, and as it is mentioned in the literature, namely by Da Ponte (2011), teachers should be able to plan, conduct, and reflect on statistics-based lectures. It means that the teachers should be flexible and active and evaluate their lectures each time to identify the strong points and weaknesses of their lectures. This will help them mainly develop themselves and ensure the students' development in statistics as well.

VII.1.5. Objectives of statistics lectures

When teaching statistics in the EFL context, teachers should focus on raising the students' awareness about the importance of research and teach them how to avoid the research problems. Then, the lectures should target first developing the students' statistical literacy and developing the statistical thinking and reasoning later on. Statistical literacy includes the students' ability to understand the statistical language. Therefore, the students should learn the statistical vocabulary, syntax, and symbols (as it is claimed by Wood; 1990) to use them correctly and to understand other researchers' works' reasoning (how they think). This last refers to statistical thinking. Furthermore, students should be able to know why to use the statistical procedures and to be able to read data and understand their significance and meaning; finally, they should be able to interpret them correctly and draw correct conclusions (statistical reasoning). Consequently, teachers should introduce the students to the study of articles to make them familiar with the statistical methods and concepts. This way, the students will be able to make extra efforts and study autonomously other articles that are not assigned by the teachers. We stress the importance of extra practice in raising the students' awareness about research and attract their attention towards different research areas that they could not study inside the classroom. The students, thus, should make extra readings to avoid the problem of time restrictions and widen their knowledge in both research and the field of study.

However, teachers should not only always introduce the students to the most common procedures; we stress the importance of introducing advanced statistics too. We believe that teaching about other statistical procedures that are not common in the EFL field (like prediction and so on) would open the field to other investigations; that is to say, teaching about the non-mentioned statistical aims (in this study) could help show students new domains to be tested and investigated instead of sticking to the existing aims and repeating research works which are already done by previous researchers.

VII.1.6. Strategies to motivate students in statistics' based lectures

The basic aim of statistics lectures, as we have seen above, is to develop the students' statistical literacy, thinking, and reasoning but not statistical rules and vocabulary memorization; therefore, when teaching statistics, lecturers are required to facilitate at maximum the learning process. One of the most challenging points about statistics to the EFL students is that they assume that statistics is a mathematical process that emphasizes heavy calculations and mathematical operations. Therefore, we recommend that teaching statistics in the EFL context should teach statistics in the context of EFL research to reduce students' statistical anxiety and their negative attitudes towards statistics. Moreover, we highly recommend using all the helpful technological tools and software (like SPSS) to lessen the students' fear of statistical calculations.

In this concern, and in order to reduce the students' negative attitudes towards research mainly and statistics specifically, we emphasize the importance of raising the students' awareness on the importance of research for their studies, for their career, and their own cognitive and affective abilities and skills. Hence, we highly recommend using different strategies that foster students' motivation, risk-taking, autonomy, and so on to promote their sense of responsibility towards their learning. Among these strategies, we cite the use of authentic data when dealing with research because the students lose their interest when they are introduced to imaginary or non-authentic data. In this concern, students may deal with two sources of authentic data: either through analysis of information obtained from published articles (since they are reviewed and corrected) or through their own data. This last could be achieved through research tasks assigned to the students at the beginning in order to help them learn by practice and train themselves to collect and analyze the data they obtained by themselves. Students can exchange their own data with other classmates through the different tasks to see the variability of different data sets collected through a variety of research tools and procedures.

The second strategy that fosters the students' motivation is the use of technological aids. Kothari (2004), Garfield and Ben Zvi (2008), and Garfield (1995) stated the importance of technology in helping researchers and statisticians and developing statistical skills. Therefore, we recommend that the lectures should take place in computing centers where students can work with computers. We stress mainly the importance of using the SPSS software to facilitate the calculation of mainly inferential statistics. It is worth mentioning here that students should be introduced to basic calculations mainly the calculation of central tendency measures and variability measures because we believe that this could help them better understand these notions and concepts. The technological tools raise the students' confidence about the process as it enables them to touch and visualize closely the data.

Both strategies (authentic data and technology) make the lectures enjoyable and motivating. It is very important to mention that statistics should be taught to the students who are motivated to conduct research; otherwise, there will be no benefits and the students will study just to get good grades. Students are worried about scoring good marks and grades in all subjects including research projects. To motivate the participants to do well in writing the research proposal and project in this stage, teachers should make them feel secured about grades (evaluation) because grades might increase and decrease students' anxiety in writing research in L2 and in learning in general.In this concern, Lekholm (2010) claimed:"

> The results from two previous studies (Klapp Lekholm & Cliffordson, 2008; 2009) show that grades are multidimensional in that they measure both cognitive and non-cognitive aspects of student knowledge, skills and characteristics. The cognitive dimension is primarily measured by student achievement in different subject areas whereas the non-cognitive dimension is primarily measured by student characteristics such as motivation and interest"

This shows that grades an important role in booting the students' motivation and changes their attitudes towards the learnt subject.

VII.1.7. Teachers Collaboration and Syllabi Design

Another important point in teaching and learning statistics and methodology-related subjects is the homogeneity of the syllabi of these subjects. This homogeneity can be achieved through the teachers' cooperation. That is to say, teachers should decide upon what should be taught in each subject in collaboration with other teachers so as not to fall into the problem of repetition of the content being taught, clarify the objective of each subject, and define the needed content for each subject. In addition to this, we recommend that statistics modules should collaborate with other modules' tasks (especially research tasks and projects) in order to gain time and help students avoid the time pressure. This means that teachers should agree on one research project (especially at Master 1 level) and then each teacher can ask the students to complete the part related to the assigned module. Finally, all the research-related subjects should aim at refining the students' attitudes towards academic research and research methodology.

Furthermore, because of time restrictions and the richness of the content to be taught in statistics, students and teachers face many difficulties in statistics lectures. More specifically, time pressure leads to the lack of practice inside and outside the classroom (if the students do not practice much inside the classroom, they will not be able to practice outside). Therefore, we recommend affording more than one session per week for this module to give more time for the acquisition of the basic notions in statistics in the EFL context. We strongly recommend this module to be taught at the Master two-level for more advanced and more specific statistical procedures which are related to the students' own research topics (for graduation projects). Moreover, due to the importance of practice in this field (as it is revealed throughout this study), we stress the importance of supporting the lectures with all needed materials; we mainly stress the availability of SPSS for classroom practice and extra activities. Therefore, the teachers -before working with this software- should help the students to install it and teach them how to use it.

VII.1.8. Students' role and student-teachers collaboration

Statistics education does not only require the teachers' efforts but also the students' willingness and attendance in the lectures. Students mainly face challenges at the level of their attitudes towards research in general and statistics in specific. Therefore, students should have responsibility for their learning, they should know that research is indispensable in their studies, and despite the different challenges they can meet, they have to face their fears and take the risk. Students should not be reluctant and try to make extra reading about research to widen their research-related culture. Most importantly, through extra reading, students can know the importance of quantitative research in the EFL context and can know how other researchers succeeded in using statistics even though they are not students of mathematics or statistics as a specialized field. In order to prevent students from being reluctant in the research process, we suggest the following strategies to help them play their roles as necessary:

- The students' works should be highly evaluated and severe grades should be attributed and different punishment procedures should be applied to plagiarized works (done intentionally or not intentionally). Since students fear failing in exams and having low grades, teachers should take advantage of this in order to raise the students' awareness about plagiarism and raising their awareness about the importance of putting effort into their studies to have good grades.
- Research methodology modules should aim at developing the students' willingness to make research and then develop the different research skills. The students need to find their own reason for making research in order to motivate themselves, and teachers should boost this reason through different ways and procedures.
- According to Gal and Ginsburg (1994), Garfield (1995) and Verhoeven (2006), Garfield & Ben-Zvi (2007), Tishkovskaya and Lancaster (2012), there are different problems met by students of statistics that prevent them from learning, among these they cited negative attitudes towards learning statistics, Math-phobia or Statistics Anxiety, having pre-dispositions against statistics, having no interest in this field, finding statistics a difficult subject and the content is hard. We highly stress the fact that students need to get rid of their prejudice against statistics in order to reduce their fear and their anxiety. Moreover, researchers like Gal, Ginsburg, and Schau (1997) emphasized the significance of refining students' attitudes by teachers; and Hulsizer and Woolf (2009) stressed the importance of the teachers' role in finding the suitable

methods and strategies to teaching statistics and developing the students' statistical performance and their self-efficacy.

- Students should try to use, at maximum, the technological aids and learn autonomously about them and how to use them in order to facilitate the research process and take advantage of their benefits. In this case, teachers may introduce these tools and guide them when using them. The research tools include mainly research bibliographic tools like Zotero for saving references and/or IDM downloader to facilitate downloading files and documents and saving their dates and links of access; moreover, students should learn about academic websites like SNDL and electronic journals and how to access them, anti-plagiarism tools and software like Endnote, for example, data analysis tools like SPSS and Excel. Typing tools and software mainly computers and Microsoft Word. All the cited tools and others facilitate the research process to the students and lead to valid and reliable research works.
- The students usually when acquiring new information feel that they have learned and added new knowledge to their background, but at the same time they feel not confident about this knowledge. In this case, the students have an attitude of uncertainty which is very important in motivation and pursuance. This is claimed by Tormala (2016): "there is a growing body of evidence suggesting that inducing uncertainty early in a message can increase people's engagement with that message and, ultimately, promote persuasion". Therefore, students should not take this uncertainty as a negative term but a motive to pursue and carry on their way. From another point, teachers can help the students base their attitudes and decisions on the completeness, accuracy, relevance, importance, and legitimacy of the information acquired and to base them on the experience that students had with this information (Tormala, 2016). This last point shows the importance of practice that provides enough experience to making decisions and refining attitudes. Practice should be planned by teachers to be done inside the classroom and students should extend it to extra practice.

Therefore, academic research is the students' task; however, it cannot be done without the teachers' assistance. Hence, both teachers and students should collaborate to achieve satisfying results. Consequently, teaching statistics in the EFL context is related to the field of research methodology and different conditions should be taken into consideration when introducing this subject. Teachers and learners should collaborate to take advantage of the benefits of statistics lectures; students should be responsible and risk-takers, and teachers should introduce the module using strategies and tools that motivate and make the students enjoy the learning environment. Syllabi designers should be careful in choosing the content that fits the EFL students' needs and provide enough time to the module in order to deal with all the aspects needed.

VII.2. IMPLICATION FOR IMPROVING THE STUDENTS DECISION MAKING THROUGH STATISTICS EDUCATION

The main aim of our study is to prove that statistics education improves and fosters the students' decision-making during the academic research process. Statistics education pushes the students to discover logical links between the research steps and follow reason and logic in planning for their research study.

We recommend statistics education to develop decision-making because statistics education bases on the logical link that relates to the research steps instead of based only on the chronological link. That is to say, statistics lectures help the students to understand well their study and then prepare an action plan. More specifically, the students should first decide on their variables, and then set up the relationship they want to prove within a given population. The relationship between the variables clarifies the basic aim of the study which in its turn limits to the students the sampling method and the research design. Then, the students will be able to choose appropriate methods of research and the research that will help them reach the aim. After collecting the data, the students will decide the data analysis methods based on the research design, aim, and type of the data. Finally, the latest decisions include proving or disapproving the hypotheses or making conclusions in general.

For statistics education to develop decision-making skills, different aspects and conditions should be taken into considerations. In the following section we discuss the main implications and recommendations we suggest for better decision making skill in the academic research process:

VII.2.1. The importance of the information in decision making

We have seen through this study the importance of the provided knowledge and information transmitted to the students in the research process. In teaching statistics lectures, we recommend that the information should be clear and at one level beyond the level of the students (*i+1*) as it is mentioned by Krashen (1985). Moreover, the information transmitted to the students should not be too much and should not be insufficient; because as we have seen throughout this study, the lack of information leads to the inability of the students to make decisions, and too much information leads the students to be confused. Moreover, theoretical information is dangling and foggy if not supported with enough practical knowledge. Therefore, we highly recommend focusing more on practice and supporting lectures with tasks and enough activities where students became active participants.

VII.2.2. The role of the supervisors in the students' decision making

One of the major problems that can happen during the decision-making process is the students' reliance on their supervisors to GIVE THEM THE FINAL DECISION. For this reason, many students do not put any effort in looking for sound decisions and they just sit and wait for the supervisor's recommendation. Therefore, we believe that the role of supervisors should be assisting and guiding the students to make decisions through providing information and boosting the students' reasoning through discussions. Moreover, the supervisors play an important role in changing the students' attitudes and boosting their motivation towards research. Feedback of the supervisors is important, based on the fact that students cannot avoid their hesitancy when making research.

VII.2.3. Strategies to foster decision making skill

Decision-making is a complex skill in which different factors may affect its process. Both teachers and students have to make use of different tools and strategies that help them develop their decision making in general and decision making styles.

- The affective side of the students is very important in the decision-making process. Negative affect like fear and anxiety influence negatively decision-making skills. Therefore, intrinsic and extrinsic strategies should be used where both teachers and students ought to work collaboratively to avoid these negative emotions. The best two factors that reduce anxiety and fear are having an interest in the research area and enjoying the learning environment. The students if interested in research will take risks and with time they reduce their fear while enjoying the environment reduces students' anxiety.
- Statistics lecture should push students to use their second cognitive system (system 1 bases on intuition; see more in Milkerman, Chugh and Bazerman, 2009. This system is a cognitive system that bases on reasoning and consciousness when making decisions;

the lectures, therefore, should help the students justify and argue the decisions they made.

- The amount and the quality of the information play a significant role in decision making; hence, teachers should provide the student with the needed information to make the decisions; and more importantly, students should put more effort into extra-readings.
- Appropriate decisions in the research process base on the understanding of the research variables and the research tools. Therefore, students should take much of their time in reading about their variables (this shows the importance of teaching statistics at master one in order to give much time to the students to think and read more profoundly about their variables).
- Lectures should emphasize more on the ways to better define a research problem because it is basic and raises students' motivation to make research. Moreover, statistics education should not only include data analysis methods, but also data collection, because the data collection phase influences the data obtained and if the data are not well gathered, data analysis results will not be valid. Moreover, most research decisions are taken when planning for research, therefore statistics should base on clarifying first this phase.

VII.2.4. Students' thoroughness style when making decisions

Statistics education fosters the students' thoroughness when making decisions. In order to develop thoroughness in decision making, statistics lectures should help the students to:

1) Consider all of the implications of the alternatives to be selected. Students should analyze all the details and results that can be produced from selecting one of the available alternatives. Then they will choose the one which leads to more advantages than disadvantages.
2) Learners should learn to make plans and schedules of what to do in order to avoid confusion or to avoid wasting time. Students should organize their list of alternatives and make an action plan of each in order to elaborate on the results of each choice.
3) Students should learn to analyze and look for other people's opinions to see those who are for the selection of one alternative over the other (the pros) and those who are against (the cons) before making a decision. This will help them make a clear plan of action.

4) Students should know that decision-making is a purposeful and logical process, therefore, they should set up the aims they want to achieve, and at the very beginning, it should be clear and well stated to avoid any confusion. Then students should follow valid principles and a systematic way when dealing with the alternative. Students should have enough argument when selecting over the other, and they should avoid random selections.

Therefore, statistics education helps the students to look into the details before making any decisions rather than making random selections. Students became able to justify and provide sound arguments to any decision they make. Consequently, the strategies and the classroom activities should target the decision-making peculiars.

VII.2.5. Students' principled when making decisions

Statistics education fosters principled decision-making through planting good principles that are related to research like the harmfulness and the unacceptability of plagiarism and the importance of affording efforts to reach personal results. According to Oxford Learners' Dictionaries (2019), the word "principle" is defined as "a moral rule or a strong belief that influences your actions" and it is also defined in the same dictionary as "a belief that is accepted as a reason for acting or thinking in a particular way". Therefore, since principles are highly important in making decisions, we recommend that statistics lectures should foster the students' research-related principles through raising their awareness about research principles. The principled decision-making style- according to French, West, Elander, and Wilding (1993) - claim that the students should understand that their decisions are governed by their ideals regardless of practical difficulties. That is to say, students should take risk of making a given decision even though they can meet many difficulties or even though the decision needs much effort to apply. Therefore, we highly recommend that teachers should plant good and ethical research related principles and raising their awareness about the importance of making good research regardless of the challenges or the efforts they afford in it.

VII.2.6. Assessment and evaluation modes under statistics education

When teaching a given subject, teachers always ask about how can they evaluate or assess the students. Statistics in the EFL context represents a crucial step of the EFL research process; therefore, evaluation should be made through the research process or research-based tasks.

More specifically, the statistics' evaluation is related to the ability of the researcher to make the accurate decision making. The evaluation mainly includes the assessment of statistical literacy, thinking, and reasoning. However, according to the literature, there is no valid and reliable approach to assessing the statistical reasoning of the students; therefore, the teachers may face problems while evaluating the students' outcome (Garfield, 1994); Gal & Garfield, 1997; Garfield & Gal, 1999; cited in Tishkovskaya and Lancaster, 2012). In spite of this; we suggest that the evaluation in the EFL context should be at these levels:

1. The ability of the students to understand the statistical terminology and symbols: at this level, the terminology should be taught in the context of EFL research to enable students better understand them.
2. The ability of students to use the above concepts in their appropriate places.
3. The ability of the students to read statistical tables and graphs and interpret statistical data correctly.
4. The ability of the students to resolve statistical problems and discover the research bias if any.
5. The ability of the students to read other researchers' studies and understand the way they conducted their research works and the decision-making processes they went through.
6. The student's ability to evaluate the quantitative research processes and situations of other researchers.
7. The ability of the students to make logical decisions when conducting research.

These levels are highly important in the research process. When the students show proficiency at these levels, they surely acquired a good level in statistical literacy, thinking, and reasoning.

VII.3. NEEDS-BASED STATISTICS SYLLABUS

Based on the fact that EFL students study research methodology since their first year at the university, we thought of making a statistics based syllabus which is complementary to the research methodology syllabi and that is based on the students needs. The syllabus should be applied for both Master 1 and Master 2 levels to give more and sufficient time for the acquisition of all notions and to practice with Master 2 students' own topics. Therefore in this section we present the syllabus we designed through our study and based on our students' needs. This syllabus should be always evaluated and updated based on the students' needs.

Ministry Of Higher Education and Scientific Research
University of Abdurrahman Mira/ Bejaia
Faculty of Arts and Languages
Department of English Language and Literature
Statistics Course Syllabus

Instructor (s): ……
Office &Office Hours: …..
Office Phone: …..
Email: ……..

Preamble:

Statistics is an important field in recent centuries; it has been integrated into different fields like natural sciences, geology, social sciences, education, and so on; especially with the emergence of quantification and quantitative research in the late centuries. In the field of education and mainly in the EFL context, statistics are integrated into academic research as the most important base in quantitative research. Statistics is not only seen as a science of calculation and numbers but recently it is seen as a guiding science that helps researchers collect and analyze and making sound decisions based upon the data collected logically. For this reason, students need to acquire different statistical skills in order to conduct valid research studies and to be able to support their works with logical arguments. Consequently, the teaching and learning of statistics in EFL context is crucial, and the elaboration of statistics' syllabus- which is based on the EFL learners' needs- is indispensable.

1) Course description

The course of statistics in the EFL context is said to teach students how to calculate and analyze data. In spite of this assumption assumed by many students and teachers, statistics education's aim deals not only with the data but also with how to collect the needed data. That is to say, when the students want to conduct a study, they should know how to link the data collection with the data analysis steps in order to avoid any research bias or any types of research errors.

Therefore, the course of statistics aims at developing the students' knowledge and skills of data collection and data analysis; this latter includes both processing the data and making decisions based on this data. Moreover, the subject of statistics also aims at helping the students to plan the whole study before starting the research; that mainly includes planning for the data collection and the data analysis and being able to make sound decisions based on justifications and arguments.

Furthermore, Statistics' aims trespass the classroom environment because one of the goals of statistics is to construct citizens who are able to read and understand data in all aspects of the society including business, traffics' data, importation, exportation, human resources, unemployment, and so on. This field is important because people should make their everyday decisions based on the data to avoid regret. More importantly, in the EFL context, the majority of students who graduate from this field become teachers in middle schools or secondary schools or carry on their post-graduation studies. In the three cases, statistics are indispensable as teachers should understand their students' outcomes and achievements to accurately assess their students' development. This will help them in making sound decisions for future methods and techniques to be used.

To summarize, teaching and learning statistics in the field of EFL aims at developing statistical skills amongst students to help them succeed in their research tasks and projects, nonetheless; these statistical skills can be employed outside the classroom and in everyday life. Therefore, statistics education in the EFL context aims at clarifying the assumption that claims that only students from the scientific field can understand data and statistics.

2) General Course Objectives:

Based on the importance of statistics in the students inside and outside the classroom, different skills should be developed. From a general perspective, the course of statistics targets Master's students who will be engaged in graduation projects. Therefore, it is highly recommended to prepare these students for these projects by developing the following skills:

a. *The ability to conduct quantitative research and conduct a graduation project:* As is mentioned before, quantitative research in social sciences and education is very crucial so that students should have enough knowledge about it. Statistics which is basic in quantitative research aims at raising the students' awareness about quantitative research and provides them with the needed knowledge. Therefore, at the end of the course, students should be able to conduct a graduation project with the employment of quantitative research.

b. *Developing the students' problem-solving abilities and critical thinking:* research process deals with solving problems that require both and creativity and analytical skills. Therefore, at the end of the statistics course, students are expected to develop at a -a good level- the most important solving problem skills.

c. *The ability to read and understand and use statistical concepts and terms:* the basic skill which is needed in statistics in the accuracy of statistical language. Students should be aware of the statistical notions and terms, they should be able to understand them and to use them accurately.

d. *The ability to understand and solve statistical problems:* research works may face different problems when using the statistical procedure. Therefore, the statistics course should enable the students to depict the statistical problem and understand it. Then, students should be aware of how to solve these problems through scientific procedures.

e. *The ability to understand and make sound decisions and conclusions based on the data:* statistics deals mainly with data, and students -through the course- should understand the types of the data and how to deal with them. Moreover, students should understand the reasons behind the statistical decisions which are made by others and be able to make decisions based on the data like drawing conclusions from inferential statistics and justifying the use of a specific statistical procedure over the other.

f. *The ability to provide strong arguments to their selections and choices:* research is based on making a selection, choices, and decisions. Through this course, students should be able to give strong reasons and arguments to their choices and decisions either in the data collection phase, data analysis, and/or interpretation phase.

g. *The ability of the students to work collaboratively and/or autonomously when needed*: research in the EFL field at the department of English at the University of BEJAIA gives the opportunity to students to work in pairs or individually. Therefore, one should be able to work collaboratively when needed in solving research problems and working individually when needed. Statistics lectures can enable the students to use these two competencies through the employment of different types of activities.

These seven goals are basic in statistics' course from a general perspective and that should be targeted by statistics lectures. Students and teachers should work collaboratively to achieve better results.

3) Specific Learning objectives:

The above objectives are general goals that should be targeted in each session. However, statistics targets more specific aims based on each phase of the research. These specific aims include mainly:

a) *At the data Collection Phase*:

- The students should have enough knowledge concerning the research designs including data collection design and data analysis design (and how they are related to each other); the designs should **MAINLY** include:
    - The research design in exploratory research
    - The research designs in descriptive and diagnosis research studies
    - The research design in hypothesis testing research
- The students should acquire enough knowledge about sampling designs: including sampling techniques and sampling errors
- The students should be able to differentiate between the different types of data and the levels of measurement.

b) *At the Data Analysis Phase*:

- The students should be able to define the different descriptive statistics measures and use them. Moreover, the students should be able to employ them in research projects.
- The students should be able to define inferential statistics methods and procedures, to be able to differentiate between the statistical tests. It is worth mentioning that each test is having assumptions, so students are expected to be able to read and understand these assumptions easily.
- The students should be able to check the validity, reliability, and practicality of the research studies: the students should have enough knowledge about the different methods to check whether their studies are reliable, valid, and practical, and should be able to practice them.
- The students should know how to apply statistical operations and calculations: here the students in the EFL context are expected to be aware of only descriptive statistics' calculations because it helps them understand the notions themselves and to differentiate between two closely related concepts (like median and mean).
- The students should be able to use technological aids and mainly SPSS: students are expected at the end of the course to be able to use research-related technological aids

like computers and personal computers in addition to using calculators and software like Excel and SPSS.

- Statistics should make students aware of the different graphs that fit the research aims: graphs and tables are one of the important aspects of statistics. There are different types of graphs and tables that students should differentiate and should know how and when and why to use them. Therefore, at the end of the course, students should be able to accurately use graphs and tables.

c) *Statistical competences and abilities to be developed*: at the end of statistics course, the EFL students should be able to do test the following aims:

- The ability to explore one variable in a given situation or context.
- The ability to study whether an association exists between two variables.
- The ability to study whether an association exists between more than two variables
- The ability to study whether a cause and effect relationship exists between two variables.
- The ability to study whether a cause and effect relationship exists between more than two variables.
- The ability to study whether a change in one variable predicts (forecasts) a change in another variable.

d. Data Analysis & Statistical tests- related competences:

- Ability to presenting the data in form of numbers and percentages.

When analyzing Relationships, students will be able:

- To determine the degree of correlation between two variables in the case of ordinal data.
- To measure the degree of the linear relationship between two continuous variables.
- To test the strength of an association between categorical variables
- To investigate whether a sample matches the population.

When analyzing differences, students will be able:

- To test the significance of the difference between two related means.
- To test the significance of the difference between two independent means/groups.
- To determine whether there are any significant differences between the means of more than two independent (unrelated) groups.
- To test the effect of one or more independent variables on two or more dependent variables.
- To find out whether the means of a dependent variable are equal across a treatment, while trying to control for the effects of other variables (extraneous) that are not of primary interest.

When analyzing prediction, students will be able:

- To test how a change in the independent predicts the level of the change in an outcome variable.
- To tests how a change in a combination of two or more independent variables predicts the level of change in the outcome variable.

d. *The statistical tests*: students should be able to perform these statistical tests and run them through the SPSS.
   - Comparing difference tests,
   - One sample tests, Survival analysis tests,
   - Reliability tests,
   - Predicting scores tests,
   - Association tests,
   - Data reduction test,
   - Assumptions tests,
   - Moderation tests

These specific aims should be supported with much time and material to enable the students to acquire enough theory and more practice. In the following section, more details are explained in bellow sections

4) Reading Sources and Materials

In order to achieve the above cited aims, either general or specific, the course needs to be supported with enough sources and materials.

a) *Reading Sources*: students should be supported with enough reading sources to widen their knowledge and to help them read outside the classroom to gain more time for practice inside the classroom. Reading about statistics on the internet cannot be very helpful to students; rather it can be very confusing. For this reason, students should be given sources that are related to their context and that present the content of statistics in a clear and organized manner. We suggest these sources:

- Gaur, A. S. & Gaur, S. S. (2009). Statistical Methods for Practice and Research: A guide to data analysis using SPSS (Second edition). Response Books: SAGE publications.
- Kothari, C.R. (2004). Research Methodology: Methods & techniques (2nd Revised Edition). *New Age International Publishers.*
- Walliman, N. (2011). Research Methods: The Basics. Loondon & New York: Routledge.
- Reardon, D. F. (2006). Doing Your Undergraduate Project. London, Thousand Oaks & New Delhi: SAGE Publications.
- Jupp, V. (2006). The SAGE Dictionary of Social Research Methods. London, Thousand Oaks, New Delhi: SAGE Publications.

This list of sources can be updated by the teachers to reach the aims of the lectures as these are important but are not the only ones.

b) *Materials*: the teaching of statistics should alsobe supported by materials and technological aids that can be needed inside or outside the classroom:

- The lectures should take place in the computing centers which are supported by computers.
- Boards (chalkboards or whiteboards) to enable the students to understand theoretical concepts and notions, through drawing schemas and diagrams.
- SPSS software should be available to the students inside and outside the classroom.
- Internet: students should have access to the internet in order to discuss and collaborate with either the teacher and/or classmates in case they need advice or help. The teacher may create Youtube channels for their students in order to

be used when teachers are not available or absent. This helps the students to visualize closely the ways of performing statistical tests or running the SPSS through teachers' tutorials.

- Students should have emails and be able to use Microsoft Word to type their works.
- Data shows when needed.
- Handout if needed
- Sample articles and dissertations to be discussed with students.

5) *Assignments, Assessment and Evaluation Methods:*

a) *Works and Assignments*:

Statistics requires the students to practice inside and outside the classroom, hence; the teachers should assign activities and tasks to be completed. In order to acquire the needed competencies, students should perform research work (conduct preliminary research especially at Master 1 level) in order to put into action the acquired notions and concepts. Moreover, other activities should contain analysis and discussion or published or reviewed research articles. The activities should target not only data analysis parts but both data analysis and data collection parts of the research works understudy to identify the link that ties all the research steps. Besides this, each lecture should be supported with an in-class activity to enable students to practice immediately what they have learned. In short, three types of activities should be used:

- A preliminary research study: students should choose a topic and study it. Students should go through the different research steps (data collection, data analysis, and interpretation), in order to allow them to practice what they learn in the context of research.
- Research articles analysis: students can be provided with sample articles to be analyzed by the students
- In-class activities: these are short activities performed in the classroom to ensure a well understanding of the students. These activities can include practicing on the SPSS for example.

b) *Assessment and evaluation methods*:

The students' success and achievement in the course of statistics is decided based on the following procedures that assess the students' ability to understand, use and explain what they have learned:

- The students' accomplishment of the assigned activities and research project (it should constitute 20% of the whole mark)
- The students' accomplishment of the research project in addition to the presentation and its submission before deadlines (50%)
- A midterm and final exams (constitutes 30% of the final mark).

The evaluation and the assessment should be based more on the students' ability to make use to the acquired knowledge not on their ability to memorize and recall what they have learnt.

6) ***Course guidelines***

In order to achieve better results in the statistics, teachers and students are required to follow the following course guidelines and policies:

a) *Guidelines for students*:
  - Students are asked to assist and attend the lectures;
  - They should participate in classroom discussions and should collaborate with the students and/or teachers when needed.
  - They should respect individual works when they are asked to do it individually.
  - Students should be honest and make efforts in the assigned works, they are not allowed to copy answers from their classmates nor to just write their names when the work is in pairs where they did not afford any effort into it (especially in the activities assigned to be done at home).
  - Students are asked to download the sources asked and to install the required software and the materials.
  - In collaborative works, students are asked to respect each other.
  - Students are asked to avoid plagiarism.
  - Students should come into the classroom with good attitudes towards statistics and research.
  - Students should submit their works within deadlines.

b) *Guidelines for teachers*:

- Teachers should be severe against the plagiarized works.
- Teachers should be open and flexible to learning because teaching statistics is also learning.
- Teachers should act more as a guide than a dominant in the classroom because students need to apply their decisions and be responsible for them.
- Teachers should always evaluate their class success and failure to depict the strong point and weaknesses of the teaching methods or techniques.
- Teachers should provide feedback to students to help them develop. Works and activities should be corrected and supported with feedback and should be returned to students.
- The teachers should deal with the students' statistics anxiety and fear with comprehensibility and should help the students enjoy and get rid of these negative attitudes.

Finally, we recommend that both teachers and learners should collaborate in order to achieve better results. Both teachers and students should act seriously towards the lectures and the above-mentioned policies.

7) **Course schedule**:

We recommend giving more time for teaching and learning statistics to ensure better results. The course should be designed on two sessions per week, designed to transmit both theoretical and practical knowledge.

Weeks and time needed	***Content outline***	***Needed material, works and course requirements***
Chapter I: Quantitative Data collection This chapter requires 6 weeks (or 12 sessions) with the employment of different materials		
One week required with two sessions per week (theory and practice)	Introduction to quantitative research:	-The lecture requires the introduction of quantitative research through authentic material using previous master theses and works, articles, and so on

One week (two sessions) required to both theory and practice	Review types of research variables: including mainly: dependent, independent, extraneous, and controlled variables.	-Students should work on the analysis of available dissertations and the classification of their research variables. Lectures may base on classroom discussions.
1 week (with two sessions for theory and practice)	Sampling, sampling methods and sampling errors	-The teachers may use different samples extracted from online articles to be discussed inside the classroom.
Two weeks (for both theory and practice)	Strategies and tools to collect quantitative data: including Experimental design and Observational or non-experimental design. This includes also tools for collecting quantitative data: questionnaires, tests, scales, observation checklists and so on.	-Students need to visualize closely these tools; students should bring different templates to discuss the differences in the construction of each tool and the difference in the results. -Moreover, students can work on their own tools outside the classroom. Teachers should give their feedback towards the students' final works. Students can work in pairs or individually.
Chapter II: Statistics and Quantitative Data Analysis This chapter needs 11 (22 sessions) weeks at least to achieve better results and enclose all statistical tests. However, it depends on the designed lectures and tests the teachers decide to work on.		
1 week (two sessions)	Theoretical introduction into statistics (definitions, why should EFL learners study statistics, types of statistical analyses: Descriptive and	-Students should use the sources (cited above or others) for especially extra reading.

	Inferential	
1 week (two sessions that base on both theory and practice)	Introducing scales of measurements in Quantitative Research (Categorical scales, Ordinal Scales and Interval Scales (that include: Ratio Scales, Interval and ratio))	-Students may use two sources of data in the practice phase of the lecture: either their own data collected by their own tools or work with already existing data (previous dissertations and/or articles available on the internet). Students are asked to be serious and complete classroom assignments.
2 weeks (4 sessions)	Understanding Statistical Tests in quantitative analysis: the lecture involves the following parts (Types of tests, Parametric Vs Non-parametric tests, one tailed Vs two tailed tests, Significance tests and hypothesis testing). Introducing tests used to compare differences and to find relationships (t-tests, Pearson Correlation, ANOVA …etc)	-This part of the chapter is also theoretical and needs the students to attend the lectures and to make extra readings.
1 week (2 sessions)	Introduction to SPSS: installation, data entry and variable entry.	-The student need to attend lectures where they learn how to use the SPSS software
1 week (2 sessions)	Running Descriptive statistics through the SPSS	-SPSS - Different types of data should be used.
4 to 6 weeks	Running statistical tests of differences: T-tests, ANOVA,	-tests are to be chosen by the teacher based on the

(depends on the introduced tests)	ANCOVA, Chi Square …etc)	students'needs or the students' works. -lectures should take place in computing centers and work with the SPSS. -Different types of data should be used during the lectures.
2 to 4 weeks (depends on the introduced tests)	Running statistical tests relationship: like Pearson correlations, simple and multiple regressions …etc.	-tests should be selected based on the students' needs. -lectures should take place in computing centers and work with the SPSS. -Different types of data should inused during the lectures.
Chapter III: Data Interpretation and Data Presentationand Communication This chapter requires 6 -8 weeks at least (12 or more sessions).		
4to 5weeks (depending on the number of the students' presentations)	-Reading the data and making inferences -Presenting data in form of tables graphs via SPSS. -Reading the output graphs	-students should work in the classroom with authentic data -students should do their own projects and present them in the classroom -final written projects should be submitted to evaluation
2 to 3 weeks (depending on the number of the students' presentations)	Reporting statistical data in APA: Reporting correlation studies Reporting cause and effect studies.	-teachers should work with the data they have prepared inside the classroom and students should work with their projects' data and present them in the classrooms -final written projects should be submitted to evaluation -Students should have access to the internet and emails to submit an electronic version of the

		works.

This schedule represents the most important content and the required approximate time, materials, and policies. The teachers should always analyze the needs of the students to explore the needed content to be taught. Students should be active and responsible for their learning, and teachers should guide them and provide them with the needed sources to support their learning.

VII.4. IMPLICATIONS FOR FURTHER RESEARCH

The present study was able to achieve the aims set at the very beginning; however, we have met throughout the investigation process different other research constructs and variables that were related to our research variables, and that required further investigation Among these, we cite the followings:

- It is highly important to seek the validation and the update of the statistics syllabus and which bases on other students' needs because research studies can include or rarely met aims.
- Through this study, we aim to study the effect of statistics education on the students' decision-making skills during the research process. Nevertheless, further research can be undertaken to test the effect of research on students' sense of responsibility problem-solving skills, risk-taking, critical thinking, and so on.
- We have been able to find a way to develop thoroughness and principled decision-making styles, therefore; further research can be done to find other ways to develop other decision-making styles.
- Moreover, further research can be made to investigate the decision-making individual differences and their influence on the students' decision-making during the research and decision-making processes decisions making. In addition, researchers may study how statistics teachers can deal with the decision-making individual differences and the decision-making techniques used by the students.
- Furthermore, further research can be conducted to explore the reasons for statistical anxiety and the effect it can have on the students' statistics' achievement and involvement.
- Many research works can be conducted to investigate types of reasoning students' may use, types of thinking that are used by EFL students when making decisions at different research steps.

All these studies and others can enrich and support the field of statistics in the EFL context. Moreover, the research works may reduce the different problems that could be met when teaching and learning statistics and may help the students to benefit from this subject as much as possible.

VII.5. LIMITATIONS OF THE STUDY

This study investigates the effect of statistics education on the EFL students' decision-making in the academic research process. Throughout this work, many limitations have been faced and affected the study. We mainly focus on these:

- ***Time afforded to this subject is not enough especially with the strikes***: the syllabus needs enough time especially that the subject needs both theoretical and practical support.
- ***Students' attitudes towards research and their fear from statistics***: these negative feelings affect the students' attendance in the lectures.
- ***The small sample size***: we have 25 students selected as an experimental group and 25 students are selected as a control group. These 25 students are said to be representative of the whole EFL Master's students who are conducting research at the University of BEJAIA but not in all Algeria universities. Therefore, the lack of randomization and the small number of participants prevented the generalization of the results for all the Algerian Master's students.
- Low response rate of the questionnaires: respondents on the questionnaire provided less information than asked in the questionnaire. Moreover, students were reluctant to answer the long questionnaires which affect the amount of the answers they provide.

CONCLUSION

This study introduces different aspects concerning the teaching of statistics in the EFL context. More specifically, it investigates the effect of statistics education on the learners' decision-making of EFL students' during their academic research process. Moreover, the study attempts to elaborate the statistics course syllabus which is based on Master's students' needs. Even though we have met some limitations and difficulties through the implementation of the study, it enclosed satisfying results.

Therefore, through this chapter, we went through the recommendations and implications that we collected through this study. The implications are divided into implications for teaching and learning statistics which guide the teachers and learners in different aspects when engaged in statistics lectures. Moreover, the study presents strategies that should be applied to develop the students' decision-making, mainly; the thoroughness and principled styles. Besides, some implications are recommended for further research- which other researchers who are interested in this field- can investigate. Finally, the study suggests a statistics syllabus designed for Master's students in the EFL context. The implementations of these suggestions lead to satisfying results in the field of statistics education in the EFL context.

CONCLUSION

Since EFL research bases widely on quantitative research methods, EFL students have to acquire different statistical skills in order to be able to conduct valid and reliable research works. Therefore, the integration of statistics education is highly recommended in EFL curricula.

Through the discussion of the results, reviewed through the first chapter of this part, we have seen the different research-related and decision-making problems that master EFL students face when conducting academic research. We have discussed the benefits and challenges of statistics education in EFL research, and the effect of statistics education on the students' decision-making skills and decision-making styles when making research. Finally, through the discussion chapter, we discussed our findings in relation to other researchers' results concerning the statistical content to be taught to master EFL students.

Furthermore, through this part, we recommended some implications that should be applied to reach better results. These implications include recommendations to teachers and learners, we proposed strategies to develop students' decision-making skills and styles through statistics education, implications to further research in this domain. Moreover, we have presented a statistics syllabus constructed basing on Master's students' needs. Finally, the study reports the different limitations met through this study.

GENERAL CONCLUSION

The importance of research has been recognized in all life aspects as it enables the human being to develop and create easy life through discovering new knowledge or correcting the existing one. However, the importance of research is not only confined to the development of life materials and discovering new things, but it also has a crucial role in developing the human mind, human thinking, and affective capacities. From the affective side, human beings face different negative feelings (like anxiety, despair, fear, tire and exhaust, stress, pressure, and so on) that they should get over in order to advance. From the cognitive side, researchers are required to have and to acquire different thinking skills because research is a problem-solving process, and researchers should be able to think correctly and reasonably when investigating any field. The required cognitive capacities in research are mainly reasoning capacities, decision making, creativity, critical thinking, and others. Therefore, the role of Meta research (research about research) studies is to develop both affective and cognitive sides of the researchers to help them perform their research in a valid and reliable manner.

Therefore, the study in hand has investigated the influence of statistics education on Master EFL students' decision-making skills.

The relationship between decision-making and research has been established through previous research works. It is said that human beings would perform better decisions if they base their decisions on well-investigated facts which are represented in the form of numbers. However, our goal is quite different since we have aimed at developing the students' decision-making skills when making the investigation. This is related mainly to the different selections and choices the researchers make when engaged in a research process. Therefore, the basic aim of our research is to help novice researchers (in our case: Master's students) make quality decisions during the research process. Consequently, in order to achieve this aim, we proposed statistics education as a way to help the researchers develop their decision-making skills. In the literature, statistics are known to be related to numbers and logic where people have to make calculations to decide whether to select this fact or the other. In our study, we do not focus on statistics as a field but the teaching and learning statistics (statistics education); that is to say, we were interested in showing how the teaching and learning processes of statistics can help novice researchers make research-related decisions. On this basis, our study has been guided by four main hypotheses:

1. The students' lack of decision-making skills during the scientific research period may be caused by their lack of knowledge about statistics and statistical procedures;
2. Adopting statistics into academic research may affect positively the research results as it can foster the students' decision-making skills.
3. Through following Statistical instructions, students can provide concrete evidence to each decision they make during their research process.
4. The EFL learners' needs can dictate the appropriate Statistics Syllabus as they present different profiles, different attitudes, and different perspectives

In order to prove or disapprove the above-cited hypotheses, we conducted an experimental study with 25 Master one students at the department of English, University of BEJAIA. The results obtained from this experimental group have been compared with a control group (25 students). Different tools and methods have been employed in order to achieve the basic and secondary aims of our study. We have used an error analysis as a pilot method to detect students' difficulties and errors when conducting research work, we have administered a pre and post questionnaire to explore the students' attitudes towards research and statistics lectures. Diagnosis tests have been employed to detect the students' errors and level of development in the decision-making skills, and a scale has been administered in pre and post periods in order to measure the pre and post levels of the decision-making skill of the students. Besides, to validate our findings concerning the content to be taught in statistics, we have administered a needs evaluation questionnaire to the teachers. Finally, after defending their research projects, we have conducted an interview with six randomly chosen students to explore their attitudes towards research, the difficulties they met, and the role that statistics education played in their graduation projects.

The results of the error analysis have revealed that students face many problems at different phases of the research process mainly at the level of the title, variables, hypothesis, research designs, data collection tools and methods, data analysis, interpretation and conclusion, and finally, data communication. Moreover, the diagnostic tests conducted with our sample have revealed the same errors in the pre-study (when compared with the error analysis) and have shown an interesting development in the post-tests. Furthermore, the pre questionnaire's findings have shown variation in the students' attitudes towards research in both control and experimental groups; it has revealed the different problems faced by the students when making research and their attitudes towards the effectiveness of research methodology lectures in the application of research. Finally, the pre questionnaire presented the students' expectations towards statistics education before being engaged in the lectures. The post questionnaire has targeted the students' attitudes towards their ability to conduct research and their decision-making abilities. Moreover, it has explored the experimental groups' attitudes towards the lectures they were introduced to and the advantages they gained from attending the lectures.

On another side, the decision-making scales attached in pre and post questionnaires have revealed a significant development of the students' decision-making skills of the experimental group and a non-significant decline of the control group's decision-making skills. More specifically, the control groups' decision making skill was significantly higher than the experimental groups' decision making in the pre-study. However, in the post-study, the experimental group's decision-making was significantly higher than the DM skill of the control group. In addition, the designed scales have intended to investigate the decision-making styles that are employed by the students. The study has enclosed that there is a significant development of all the decision-making styles when comparing pre and post-scales except for the instinctiveness. Concerning the control group, there has been a significant decline in the students' thoroughness and significant development in the instinctiveness style; whereas there has been a non-significant decline in the control, hesitancy, and social resistance styles; the optimizing and the principles styles have shown a non-significant development. When comparing the difference between the control and experimental groups' pre styles, the findings have revealed that the control group has a higher level in the thoroughness and hesitancy styles, whereas, in the post scale, the experimental group has shown significant means in thoroughness and principled styles. In short, the decision making scales have revealed that the experimental students have developed their decision making skill throughout our experiment, more specifically, the students' Decision Making became more thorough and principled.

In addition, the teachers' questionnaire has disclosed that the teaching of statistics is important to Master's students and has revealed that the lectures should be taught at both master one and master two levels. The content should cover the data collection, data analysis, and interpretation, and data communication phases. Students should be supported with all the needed information in order to conduct reliable and valid studies. Students should be able to find accurate ways to collect the data: including problem definition, research aims, research designs, data collection tools, and methods. Moreover, students should be able to analyze data correctly and to interpret them properly, and then draw conclusions thoroughly. Finally, the interview has revealed that statistics education was helpful to the students in the accomplishment of their graduation projects, although, interviewees declared that the module needs much time to allow more practice. In addition, the interview has disclosed that attitudes towards research are important in the completion of the graduation academic research and on the decision-making skill.

Therefore, the study at the end has generated some important implications that are important for the teaching and the learning of statistics in the EFL context and the EFL research in general. We have mainly emphasized the importance of the syllabus, teachers' and students' roles in the success of the statistics' lectures. The syllabus should be designed based on the learners' needs; it should be supported with the needed materials to ensure the good transmission of the knowledge. Moreover, the teachers should employ different tools and strategies to motivate students to learn statistics and conduct research, and more importantly, to help them get involved in the classroom. Besides this, the students should work seriously and attend the lectures; they have to accomplish the works assigned to them in order to benefit at maximum from what is being taught.

Through the discussion of the study's results, the findings of the employed tools have been conforming to each other, and more importantly, our results obtained from all the research tools were conventional with previous research findings and results. Therefore; we come to provide answers to the previously set research questions in the discussion phase of this study. Here is a short review of the answers:

1. Do Master's students of English face problems in making decisions during their academic research process?

Through the study, we have concluded that Master's students of English face different difficulties at all the research steps. These problems are mainly related to decision making skills and that are classified in the study into problems at the level of Getting Started Decisions (including the decision about the research variables, research problems, research aims, decisions about Hypothesis and construction of the titles), Data Collection Decisions: (like the selection of the sample and population, the choice of the research design, and finally deciding about the research methods and tools. Moreover, the study has also reported problems in Data Analysis, Interpretations, and Presentations of the Data Related Decisions: in which students are not able to select data analysis methods, make conclusions, and choose types of tables to use. Finally, the study has concluded that students also Conclusion Decision problems: in which students are not able to make conclusions from the data obtained in their study. Other problems include: hesitancy, lack of confidence, and lack of motivation which have been always associated with the above-cited problems.

2. What are the factors that hinder Master EFL students' decision making skill during academic research?

The findings of the study have revealed that the students' decision making skill during the research process is affected by the theoretical knowledge (either providing less or much knowledge to the students), and the practical knowledge which helps in developing the students' confidence. Moreover, methodology lectures, lack of authentic material that may lead to insufficient practice, lack of scientific knowledge (reasoning and statistical knowledge), and the researchers' affective side are also affecting the students' decision-making skills.

Moreover, through this study, we have come to prove the role that statistics education plays in developing the students' decision-making skills. Three main questions have been asked at the beginning about the role of statistics education in developing the decision making skill:

3. How can we develop the learners' decision making skill during the academic research process?
4. What is the effect of statistics education on EFL learners' decision making skill?
5. What is the role that teaching and learning statistics play in enhancing EFL Learners' decision making style?

Therefore, the study has enclosed that statistics education lectures affect positively the students' decision-making skills; if well planned and well implemented, they are able to develop the Master's students' decision-making skills. The lectures can build a theoretical and practical base for the students concerning the research steps. Students were able to provide enough justification and argumentations to their decisions and they were aware and conscious about the decision-making process. Furthermore, through our study, we showed that statistics education push students to think logically and use their reasoning in making their decisions; the students learned how to be thorough and principled when making decisions. That is to say, the students learned to search for the details and analyze the alternatives before making a given selection instead of making random decisions; moreover, students learned that research needs to be accomplished through the employment of good principles and avoid laziness and fear of affording effort to accomplish the research work.

6. What would be the most suitable statistics' syllabus for EFL Master's students?

One of the aims of this study was to elaborate a statistics syllabus dedicated to Master's students. We have concluded from this study that the statistics syllabus should be based on the students' needs. The good implementation of this syllabus bases on the role teachers and students play in the classroom and outside the classroom, both teachers and learners should collaborate to achieve better results; attendance and seriousness of both of them are highly required. In addition, the lectures should be supported by the needed material and enough time should be afforded to ensure the students' practice with the acquired knowledge, and perform the needed activities and assignment in order to achieve better results.

To which extent can the results be generalized?

The present study has been conducted with 25 students of English at the University of BEJAIA. Although the validity and reliability of the study's procedures, we cannot say that the study's results can be generalized to all the Algerian Universities regarding the few numbers of participants in our study and the lack of randomization.

Consequently, the conclusions and the answers provided via this study lead us to prove the hypotheses we have suggested at the beginning of our study. Therefore, we come to prove that:

The students' lack of decision-making skills during the scientific research period is not only caused by their lack of knowledge about the statistics and statistical procedures but also the lack of their reading about research and research methodology. As we have seen through this study, the knowledge and information about research in general and statistics in specific are very significant in making decisions; most importantly, statistical knowledge provides the students with a way to justify and argue their decisions.

Moreover, we come to prove that adopting statistics into academic research may affect positively the research results as it fosters the students' decision-making skills. The validity and reliability of the research works' results basing on the correctness of the decisions made by the researchers concerning the data collection, data analysis, interpretation, and drawing conclusions. The students' decision-making became more thorough and principled. Moreover, we emphasize the importance of practice in statistics education.

In addition, we have proved in this study that through following Statistical instructions, students can provide concrete evidence to each decision they make during their research process. Since statistics education elaborates to the students the logical links that exist between the research steps through clarifying the statistical tests' assumptions and provides the details needed about the different alternatives that can be met during the research process.

Finally, we have proved that the EFL learners' needs can dictate the appropriate Statistics Syllabus as they present different profiles, different attitudes, and different perspectives. Since the research is based on the researchers' interests and the researchers' logic and view, there are endless kinds of research that can be investigated. Therefore, in order to elaborate any syllabus, the needs of the students should be analyzed, this will help in attracting their attention and getting them involved in the lectures.

To conclude, the study has targeted mainly the teaching and learning statistics to Master EFL students. In spite of the limitations of this study, we could prove that statistics education develops the students' decision-making skills by making it more thorough and principled. However, this study could not investigate in-depth autonomous learning of statistics and the ways to foster the students' self-confidence in learning statistics and lot other secondary aims. Therefore, different further studies could be undertaken to investigate and enrich other angles in this research domain.

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APPENDICES

APPENDIX A: THE PRE QUESTIONNAIRE

Dear students;

This questionnaire is part of a research work conducted on the students' research process. We would be very grateful if you take part in our research. Make sure that all the provided answers will be confidential.

Thank you

GENERAL INFORMATION:

1. Age: …..
2. Gender: …….
3. How many years have you been studying English at the University: ………………

SECTION I: ACADEMIC RESEARCH

4. How long have you been studying research methodology?

………………………………………………………………………………………………..

5. How often did you conduct preliminary research work(s)?

☐ Once
☐ Twice
☐ More than twice

Explain please:

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…………………………………………………………………………………………

What kind of problems did you meet in conducting these works?

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

6. What did help you **<u>MORE</u>** in completing these research projects?

☐

☐

☐ Your personal effort (autonomy, inquisitiveness, intuition …etc)

Research methodology lectures

Classmates, peers and/or Teachers

Others, please state:

……………………………………………………………………………………………

……………………………………………………………………………………………

7. How do you perceive your acquired knowledge in research methodology?

☐ Poor

☐ Average

☐ Good

☐ Very good

8. What is (are) the most difficult phase (s) in the research?

☐ Deciding about the right topic of interest

☐ Defining and representing the research problem, aims, hypothesis …etc

☐ Collecting the data (tools, sampling, application …etc)

☐ Deciding upon the data Analysis methods

☐ Making interpretations and drawing conclusions from the data obtained

9. Explain the different constraints you have met during this (these) research work (s)? (What makes the above steps difficult?)

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10. Do you think that the content of research methodology lectures provide you with the necessary knowledge to take the right decisions during the research process?

☐ Yes

☐ No

If "No", could you please list some of the points (content) that the research methodology lectures did not include and that will help you more to take the decisions during the research process?

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SECTION II: DECISION MAKING IN ACADEMIC RESEARCH

11. Have you met any situation where you had to make decisions during the research process?

☐ Yes

☐ No

When was it?

……………………………………………………………………...………………………

……………………………………………………………………………………………

…………………………………………………………………………………………...

12. Which among the following research steps, you were very likely to make decisions?

☐ Research topic of interest and topic formulation

☐ Defining and representing the research problem

☐ Collecting the data

☐ Analysing the data

☐ Making interpretations and drawing conclusions from the data obtained

Which decisions to which research step have you been able to make?

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……………………………………………………………………………………………

13. Have you been confident about the different choices you had to take or you have been hesitating?

☐

☐ Sure

Hesitant

Please justify

……..

....

....

14. What might be the challenges you might meet when making decisions during the research process?

☐ Not enough knowledgeable about the research and about choosing the appropriate tools, methods and designs.

☐ The lack of the knowledge about how to use research sources (references)

☐ Do not know how interpret and to critically evaluate the data obtained

☐ Do not know how to get a conclusion from the data obtained.

☐ Do not know how to represent the results through tables, graphs and how to read them.

15. According to you, what are the causes of these difficulties?

☐ Lack of scientific reasoning

☐ Lack of practice with authentic data

☐ Lack of statistical knowledge and education

☐ All above

16. Are you confident about the systematic way of defining a research problem and resolving it?

☐ Yes

☐ No

What is the procedure you use to solve your research problems with enough reasoning?

....

....

....

17. When do you think of the appropriate research design?

☐ Before the data collection

☐ After the data collection

Explain please:

....

....

....

18. Are you always confident about your own decisions during the research decisions?

☐ Yes

☐ No

19. When you have to choose among alternatives during your research process, do you effectively justify your choice or do you proceed randomly?

☐ Giving effective reasons

☐ Random choices

If you provide the reasons, how do you generate these argumentations?

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……………………………………………………………………………………………

20. When making your decisions during the research projects, do you rely on your own knowledge and reasoning or you ask for help from your classmates and other students/ teachers about the appropriate choice?

☐ Rely on your own self

☐ Rely on others

Please justify

....

....

....

21. According to you, what can help you in being successful when making decisions during the academic research process?

☐ Learning about how to reason and to present evidences
☐ Consulting new resources for enhancement
☐ Asking help from the others
☐ Keep confident about yourself and widen knowledge by yourself.

SECTION III: STUDENTS'ATTITUDES TOWARDS STATISTICS EDUCATION

Researchers define statistics education as: the practice of teaching and learning of the different procedures of collecting, displaying, analyzing, and drawing conclusions from quantitative data.

22. As an EFL student, how do you feel about learning statistics?

☐ You are anxious
☐ It is challenging
☐ You appreciate it
☐ You find it enjoyable
☐ It will be helpful

Can you state why?

…………………………………………………………………………………………………

……………………………………………………………………………………………………..

23. Do you think that if you are taught about how to reason when making research, you will be able to take your own decisions?

☐ Yes
☐ No

Please justify?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

24. Statistics education deals with making the students aware about the LOGICAL procedure and the REASONABLE way of conducting research: from constructing the

title to the conclusion. Do you think if you are taught about this, your difficulties will be reduced?

☐ Yes
☐ No

If yes, can you justify?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

25. Do you think that statistics education will help you to make autonomous decisions?

☐ Yes
☐ No

SECTION VI: FURTHER SUGGESTIONS

Would you please add other suggestions concerning the statistics education and its importance in your Academic research process?

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THANK YOU FOR YOUR COLLABORATION

APPENDIX B: THE POST QUESTIONNAIRE

Dear students;

This questionnaire is part of a research work conducted on the students' research process. We would be very grateful if you take part in our research. Make sure that all the provided answers will be confidential.

Thank you

SECTION ONE: Readiness to conducting academic Research

1. How many research-related modules have you been engaged in during this year (Master 1)? Can you list them?

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…………………………………………………………………………………………………
…………………………………………………………………………………………………

2. Have you developed your research Knowledge and skills through these modules?

Yes
No

3. Which among these modules have helped you most? What are the major concepts achieved from each module?

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…………………………………………………………………………………………………
………………………………………………………………………………………………….

4. Do you feel that you are ready to conduct an academic research next year?

Yes
No

Why?

…………………………………………………………………………………………………
…………………………………………………………………………………………………

5. How do you evaluate your Knowledge of these research steps (put the appropriate letter in front of the suggestions):

   a. Very good b. good c. Low d. Very low

☐ Data collection (including research variables, aims, designs, methods and tools):

☐ Data Analysis (including the data analysis methods ad tests):

☐ Data Interpretations and drawing conclusions

☐ Data communication

SECTION TWO: Learners' Decision Making Skill in Research

6. How confident do you feel about any decision you have to make concerning the research process?

☐ Very confident

☐ Confident

☐ Somehow confident

☐ Not confident

7. What makes you feel confident (from somehow to very confident) about your decisions?

……………………………………………………………………………………………

…………………………………………………………………………………………….

8. Do you feel uncertain about the decisions you have to make in your academic research process?

Yes
NO

9. If yes, do you think that this Uncertainty is due to the lack of information about research Methodology?

Yes
NO

10. On what do you base your decisions during the research process

- [ ] Reasoning (observe and analyze using the facts and the knowledge you have about the research).
- [ ] Your knowledge (both theoretical and practical) about the research
- [ ] Taking others' opinions
- [ ] Your inner feeling (gut feeling)
- [ ] All above

11. What can affect negatively your decisions in research?

- [ ] When you have not enough information
- [ ] When you have much information
- [ ] When there are many people you have asked
- [ ] When you are emotionally attached to one decision (you like that decision for example)
- [ ] Your own desires (even the decision is not logical but you take it because it helps you research your hidden desires)
- [ ] All above

12. Do you think you can make autonomously decisions during the research process?

Yes
No

If yes, please explain how did statistics lectures help you be more autonomous in making decision?

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………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………

SECTION THREE: Statistics Education

13. Did you study statistics?

yes	No

14. ***If yes*** have you benefited from the module?

Yes	No

15. What have benefited from statistics lectures?

- [ ] You can easily decide upon the type of relationship between the variables (correlative, experimental and exploratory)
- [ ] You can easily decide about how to choose your sample.
- [ ] You can easily decide upon the data collection methods and procedures (decide which design, method and tools that is appropriate to the type of relationship above).
- [ ] You can easily decide about data analysis methods (the data analysis tests that are appropriate to prove the relationship between the variables and the type of the data you collected?
- [ ] You can decide which conclusion to draw from the data you have analyzed?
- [ ] You can decide how to present your data in tables and graphs?
- [ ] All the above
- [ ] None of above

16. Can you explain briefly what did the lectures of statistics add to your research knowledge?

....
....
....
....

17. What did you like most about the lectures of statistics?
    a. They helped you to reason and to think logically well when it comes to the different choices in the research process

- **b.** The decisions you may take and the way to take them during research seems clear.
- **c.** The lectures were enjoyable
- **d.** using technology (internet, PCs) during the practical parts of the lectures
- **e.** all above

others:

……………………………………………...………………………………………………

………………………………………………………………………………………......

....

18. What did not you like about the lectures of statistics?

☐ Statistics are hard to understand

☐ I did not benefit anything from them

☐ I hate research and I do not wish to conduct research

☐ They are boring

Others:………………………………………………………………………………...

………………………………………………………………………………………...

....

19. How did you find working with the SPSS?

Easy	Hard

Please explain:

……………………………………………………………...……………………………

………………………………………………………………………………………......

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20. According to you, did the statistics lectures enable you to make research decisions in the right way?

Yes	No

Can you explain this way?

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21. Do you think that Statistics lectures helped you to overcome the decision making problems in the research process that you have faced at the beginning of the year?

Yes	No

If yes, can you specify the research steps at which you can better make decisions and that statistics lectures helped you to develop?

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22. Did statistics education help you to look to details before taking any decision during research process? (explain how)

Yes	No

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23. Did statistics educations help you have a control over your decisions during the research process (for example to make logical decisions instead of emotional or the most liked ones)? (explain how)

Yes	No

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24. Did statistics education help you to be confident in your decisions during the research process? (explain how)

Yes	No

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....

25. Did statistics education help you to look for better choices in your decisions during the research process (choices that lead to better results not the choices that are easier to complete)? (explain how)

Yes	No

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....

26. Did statistics educations help you to base your decisions on logical reasons during the research process? (explain how)

Yes	No

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SECTION VI: FURTHER SUGGESTIONS

Would you please add any other suggestion concerning the statistics education and what did its lectures add to your ability to make decisions in your Academic research process?

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THANK YOU FOR YOUR COLLABORATION

APPENDIX C: THE DECISION MAKING QUESTIONNAIRE

Dear students;

This scale is part of a research work conducted on the students' research process. I would be very grateful if you take part in our research. Make sure that all the provided answers will be confidential. Please show how often each of the following applies to you by circling the number that you think applies:

1. Very Infrequently
2. Infrequently
3. Neutral
4. Frequently
5. Very Frequently

Thank you

SCALE ITEMS	**SCALE**				
1. You enjoy making decisions during your academic research process.	1	2	3	4	5
2. You rely on 'gut feelings' or your inside and intuitive feeling when making decisions during the academic research process.	1	2	3	4	5
3. You like to consult others (like classmates, other students, teachers …etc) whenever you have a decision to make when making research.	1	2	3	4	5
4. You keep to your decisions whatever the results are during the research process.	1	2	3	4	5
5. When you find one option that will just give acceptable result, you leave it at that acceptable result and do not look for better results.	1	2	3	4	5
6. You remain calm when you have to make decisions very quickly during the research process.	1	2	3	4	5
7. You feel in control of things during your research process.	1	2	3	4	5
8. How often are your decisions governed by your ideals regardless of practical difficulties you meet when making your research work?	1	2	3	4	5
9. You make decisions during the research without considering all of the implications.	1	2	3	4	5
10. You change your mind about things you have already taken decision about in your research.	1	2	3	4	5
11. You take the safe option during the research process if there is one.	1	2	3	4	5
12. You prefer avoiding making decisions if you can.	1	2	3	4	5

13. You plan well ahead during your research process?	1	2	3	4	5
14. When making decisions during the research process, you find yourself favouring first one option then another.	1	2	3	4	5
15. You carry on looking for something better even if you have found a course of action that is just about OK.	1	2	3	4	5
16. You find it difficult to think clearly when you have to decide on something in a hurry during the research process.	1	2	3	4	5
17. You make up your own mind about things regardless of what others think.	1	2	3	4	5
18. You avoid taking advice over decisions in your research work.	1	2	3	4	5
19. You work out all the pros and cons before making a decision in your research.	1	2	3	4	5
20. In your decision making how often are practicalities (results) more important than principles (what you aim to reach)?	1	2	3	4	5
21. Is your decision making a deliberate and purposeful logical process?	1	2	3	4	5

Please if you have any comment or addition to one of the above scale items, put it here (put the number of the item and your comment next to it):

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THANK YOU FOR YOUR COLLABORATIONS

APPENDIX D: PRE DIAGNOSIS TEST

OBSERVE THESE RESEARCH TITLES THEN ANSWER THE FOLLOWING QUESTIONS:

- **a)** The Effect of Test Anxiety on students' Performance
- **b)** The Relationship between the test anxiety and teachers' negative feedback
- **c)** Exploring the EFL learners' attitudes towards the integration of ICTs into EFL classes
- **d)** The Effect of Code-Switching on Learners' willingness to communicate
- **e)** Raising Learners' Motivation through Game-base-Activities

Activity One: **Data Collection**

1. Decide on the appropriate research design, method and techniques that each research is going to use? Justify your answer?
2. Does each of the above investigations need a hypothesis? Explain.
3. Do you think that it is important to know which kind of data you obtain in order to decide upon the research design needed to the study?
4. Is it important to know the method they used to choose their sample in the reliability of the results? Justify.

Activity Two: Data Analysis

After collecting the data needed, you have to decide on the appropriate data analysis procedures to draw reliable conclusions:

1. Do you think that the research aim is important in choosing the data analysis methods? Justify your answer with examples using the above titles.
2. Do you think that same data analysis procedure is going to be used for all the above research titles? Justify your answer.
3. Decide which of the following type of data is going to be ENOUGH to reach the aim of your research? (For each of the above titles), please justify.
   - **a.** Frequency: (for example: 7 students said "yes", 8 said "no")
   - **b.** Percentage (for example: 30% of students said "yes", 60% said "no")
   - **c.** Test-scores (marks)

Activity Three: Interpretation of the Data and drawing conclusions

After analyzing the results, the researcher 1 and 4 got these conclusions demonstrated by the attached tables. Decide whether the decisions they reached **are correct** or not and whether the data analysis procedures used were enough to get right and sound conclusions? **Justify both answers**.

Conclusion to the title 1:

Does anxiety affect your performance in the exam?

		Frequency	Percent
Valid	yes	7	70,0
	No	3	30,0
	Total	10	100,0

How often does anxiety affect your performance in the exam?

		Frequency	Percent
Valid	never	1	10,0
	sometimes	4	40,0
	always	5	50,0
	Total	10	100,0

The above tables show that 70% of the students said "yes" and 50% say that anxiety affects their performance. Therefore, we conclude that anxiety affects negatively the students' performance.

***Conclusion to title 4*:**

		experimental_ willingness_ test_scores	control_ willingness_ test_scores
N	Valid	10	10
	Missing	0	0
average		2,4000	1,7000

experimental_willingness_test_scores

		Frequency	Percent
Valid	do not like to communicate	2	20,0
	sometimes like to communicate	2	20,0
	like to communicate very much	6	60,0
	Total	10	100,0

control_willingness_test_scores

		Frequency	Percent
Valid	do not like to communicate	5	50,0
	sometimes like to communicate	3	30,0
	like to communicate very much	2	20,0
	Total	10	100,0

From these tables, we can see that the average of the experimental group is higher than the one of the control group (Ex: 2.4, Cont = 1.70). This concludes that code switching raises the students' willingness to communicate.

APPENDIX E: POST DIAGNOSIS TEST

PART ONE: DATA COLLECTION

Make your decisions about the following steps and answer the two last questions. (if two similar answers are found, both would be excluded). Make sure you provide a suitable and appropriate justification for each decision you make:

1. The title you want to work on
2. Your hypothesis if any
3. Your aim
4. How are going to choose your sample from your population
5. Your design to collect data
6. The method (s) to collect data
7. The tools to collect the data
8. Once you collect the data: on what will you base your decision upon the data analysis procedures?
9. What is the way you will use to analyze your data?

Can you explain more about your method you will use?

10. How are you going to decide whether you reached your aim or not? (How to get your conclusion from the data you obtained?

PART TWO: DATA ANALYSIS

Using the SPSS, perform the following actions:

1. Enter the data you collected in a correct way.
2. Present the descriptive statistics table
3. Perform the appropriate inferential statistics methods to your study.
4. Present the tables in the appropriate manner (following the APA style)
5. Read the table (of inferential statistics) and draw the appropriate conclusion.
6. Use appropriate graph to present your data and make an appropriate reading for them.

Instructions:

- The practical part should be sent to boughani.mrm@gmail.com. A receipt is going to be sent once the work is received. Those who do not receive this email should resent the work again before the deadline.
- The types of the files that should be sent are: (.spv) for the output file and (.sav) for the data organization in the SPSS.
- The tables (descriptive and inferential) and the interpretation should be sent in (.doc) format (means in Microsoft Word format).
- The Theoretical part should be submitted to the teacher on Monday, May 7th, 2018, before 1p.m. in the stuff room. The students should sign after submitting their works.

ALL THE BEST

APPENDIX F: NEEDS EVALUATION QUESTIONNAIRE

Dear Teachers,

This questionnaire aims at identifying Master students' needs at the level of Statistics and Statistics education from the teachers' perspective. Therefore, you are kindly invited to fill in the following form. Your answers are anonymous and highly confidential. They will be used mainly for research purposes.

Thank you for your collaboration and time.

General Information

1. How long have you been supervising Master students? …………………………………………………………………………………………………
2. How do you feel when supervising EFL Master's students:

☐ Students are sufficiently and appropriately acquainted with theoretical research notions?

☐ Students show mastery of research principles but still need more applications related to some important research issues?

☐ Students show appreciated commands through their research projects and papers?

3. According to the different Master's fields at the department of English, University of Bejaia, are the syllabi -designed to teaching research as a Unit- homogeneous?

☐ Yes

☐ No

- If "Yes", what can the syllabuses contents provide the novice researchers with?
- If "No", make the difference between the research studies Master EFL students acquire in applied linguistics and in Didactics specialties at the department of English, University of Bejaia?

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4. Do you think Statistics Education should be taught at the level of:

☐ Master 1

☐ Master 2

☐ Both

Please, justify your answers in any case?

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5. What is (are) the type (s) of methodology-based research that is (are) mostly conducted by Master EFL Students?

☐ Descriptive & diagnostic

☐ Exploratory

☐ Hypothesis-testing

Other (s):

…………………………………………………………………………………………….

6. When testing a hypothesis: do students:

☐ Estimate the population parameter (characteristics) from the selected sample statistics (data calculated from the sample)

☐ They do not care whether the sample data represent the population characteristics

7. What type (s) of data is (are) being usually measured in the field of EFL research?

☐ Categorical (data that can be classified into categories like gender, nationalities, skills …etc)

☐ Numerical (data in form of numbers like test/exam score ...etc)

☐ Both

Others

………………………………………………………………………………………………

Section One: **Statistics Educations**

1. ***Please express how important the following aims are to be taught to Maser students of English in "Statistics Education" Unit: (*****please write the number in front of the statement)**

1	2	3	4	5
Not at all important	Slightly Important	Important	Fairly Important	Very Important

Aims	**1**	**2**	**3**	**4**	**5**
How to decide about "what, where, how much, by what means" a research study is conducted					
How data collection designs relate to data analysis designs					
Research designs in exploratory studies					
Research designs in case of descriptive and diagnostic research studies					
Research designs in case of hypothesis testing research					
Sampling designs and techniques and Sampling errors					
The types of the data and the levels of measurements (types of data obtained from the different research tools: nominal, ordinal, discrete and continuous)					
How to describe, organize, classify and present the data					
How to make inferences and drawing conclusions from the different types of the data					
The different APPROPRIATE ways of checking validity, reliability and practicality of the research study					
How to apply the statistical and mathematical calculations					
How to use technological aids including the SPSS					
The graphs that fit each type of data and research aim					

2. ***How often are the following cases treated in EFL Master Research works (applied and didactics): (***Please put the number in the appropriate case)

[1] Very Frequently	[2] Frequently	[3] Occasionally	[4] Rarely	[5] Never

EFL students conduct studies to test/asses/ or to study:	**1**	**2**	**3**	**4**	**5**
One variable					
whether an association exists between two variables					
whether an association exists between more than two variables					
whether a cause and effect relationship exists between two variables					
whether a cause and effect relationship exists between more than two variables					
Whether change in one variable forecasts (predicts) change in another variable (for example through scores in a learning unit, the researcher predicts the success or the failure of the sample)					
When analyzing relationships, students:					
Want simply to present the data and express the variable in form on numbers and percentages.					
Want to determine the degree of correlation between two variables in case of ordinal data (data that are ranked from lower to higher or vice versa-like data coming from scales-)					
Want to measure the degree of a linear relationship between two continuous Variables (it means if one variable increases or decreases, the other increases/or decreases respectively: the two variables go in the <u>same</u> direction).					
Want to test the strength of the association (whether the relationship is strong or not) between two categorical variables (categorical means the data that can be put into categories like gender (male & female) or nationalities (English, Rusian, Algerian ...and so on) … etc),					
Determine whether a sample matches the population (the sample statistics estimate really the population characteristics).					
When analyzing the difference between the means of variables/ groups, Students want to:					
Test the significance of difference between <u>tworelated</u> means/ averages (of					

same group in pre and post tests for example)					
Test the significance of the difference between two independent group of means/ averages (of different groups; for example: comparing between group 1 and group 2's scores)					
Determine whether there are any significant differences between the means of more than two independent (unrelated) groups (like the above statement but here we have more than two variables)					
Test the effect of one or more independent variable on two or more dependent variables.					
Find out whether the means of a dependent variable are equal across of a treatment, while trying to control for the effects of other variables (extraneous) that are not of primary interest (for example: studying the effect of Anxiety on Test Performance but at the same time trying to control the effect that another variable –say like intelligence- may have on the test performance).					
When analyzing prediction relationships, students want to					
Test how a change in the independent variable (predictor) predicts the level of change in the outcome (independent) variable (for example: increasing motivation (predictor variable) at a certain level predicts the same level of development in speaking performance).					
Test how a change in a combination of two or more independent variables predicts the level of change in the outcome variable (the same as above, but here we have more predictors and one dependent variable)					

3. ***According to your readings of different EFL research studies (related to applied linguistics and didactics), could you say which of the following statistical tests are needed/ or not needed to be taught to EFL Master Students?***

Not needed	***Lowly needed***	***Moderately needed***	***Needed***	***Highly needed***
1	**2**	**3**	**4**	**5**

Please put the number (from 1 to 5 according to the above scale) in the case of "your opinion"

statistical tests	**Your Opinion**	**Statistical Tests**	**Your opinion**
Independent-samples t-test		Kruskal-Wallis H test	
Paired-samples t-test		Jonckheere-Terpstra test	
One-way ANOVA		Friedman test	
Repeated measures ANOVA		McNemar's test	
Two-way ANOVA		Cochran's *Q* test	
Factorial (three-way) ANOVA		Sign test	
Within-within-subjects ANOVA		Test of two proportions	
Three-way repeated measures		Chi-square test of homogeneity (2 x C)	
ANOVA		Chi-square test of homogeneity (R x 2)	
Three-way mixed ANOVA		One-sample t-test	
Mixed ANOVA		Chi-square goodness-of-fit	
Hotelling's T^2		Kaplan-Meier	
One-way MANOVA		Cronbach's Alpha	
Two-way MANOVA		Cohen's kappa	
One-way MANCOVA		Fleiss' kappa	
One-way ANCOVA		Weighted kappa	
Two-way ANCOVA		Kendall's *W*	
Mann-Whitney U test		Linear regression	
Wilcoxon signed-rank test		Multiple regression	
Hierarchical multiple regression		Chi-square test for association (2x2)	
Logistic regression		Chi-square test of independence (RxC)	
Ordinal regression		Fisher's exact test (2x2) for independence	
Pearson's correlation		Relative risk (2 x 2)	
Point-biserial correlation		Odds ratio (2 x 2)	
Pearson's partial correlation		Goodman and Kruskal's λ (lambda)	
Spearman's correlation		Loglinear analysis	
Kendall's τ_b (tau-b)		Principal components analysis	
Goodman and Kruskal's γ (gamma)		Testing for normality	
Somers' *d*		Transforming data	
Mantel-Haenszel test of trend		Dichotomous moderator analysis	

Cochran-Armitage test of trend	

FURTHER SUGGESTION

Please add any further suggestions according to the aims of this questionnaire to enable cover legibly and validly the different points that might have or may cause areas of troublesome to our research students. (You are free to express your beliefs, ideas, expectations to better topics, methodologies, teaching contents and designs related to Research as a Unit)

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THANK YOU FOR YOUR COLLABORATION

APPENDIX G: INTERVIEW GUIDE

1. Had you the choice to make training or the research and you have chosen research? How did you make choice? And why you choose research?
2. What is your title and why are you interested in this topic?
3. How was the preparation to your research proposal? What were the difficulties you met? Can you talk about the decision making difficulties?
4. What were the problems you faced for :
   - The decision you made for the topic generation and title formulation?
   - The decisions you made about data collection phase?
   - The decisions about data analysis phase?
   - The decisions about interpretation, did you have any idea of how to analyze the data?
   - When deciding about the appropriate graphs to use?
5. Did the statistics lectures last year helped you to decide about the above phases, can you explain?
6. What are the benefits and the disadvantages of the statistics lectures of master one that you discovered in your master two dissertations? please explain?
7. When you meet your supervisors, do you list your decisions and then discuss them or you ask the teachers for their final decisions just to apply it? please explain.
8. Do you feel that the way you make your decisions in research became more accurate and thorough due to the lectures of statistics? Explain
9. Did statistics teach you that it is better to look for the decisions that are logical even that they are hard to attain? Explain
10. When you defended your dissertations, did you feel that you have enough arguments to defend your methodology (design tools and so on) choices? Explain please. Is that related to what you have studied in statistics?
11. Do you think it is important to study statistics in master two too?
12. Please can you add any other suggestions?

APPENDIX H: LESSON PLANS

Course: Statistical Analysis in Quantitative Research **Date:** Wednesday, October 11th, 2017
Chapter 1: Introduction to Quantitative Research
Lecture1: Quantitative Research in educational Research
Learning Area &Time: Room 25 B08 (1 p.m. to 2.5 p.m.)
Year Level: Master 1 Ling. & M 2 Didactics

LESSON OUTCOME:

This lesson is designed to establish a detailed difference between quantitative and qualitative research from a general perspective; this includes mainly the data collection tools and data analysis methods. More specifically, the lecture aims at helping students differentiate between the two methods at different research process steps from title to conclusion.

LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
15 mins	The lecture starts with a warming up questions about students' opinions about research process, research tools, and methods and so on.	Classroom discussion

Time	**Main Content:**	**Teaching Approaches and Material**
1 hour and 15 min.	1. What is quantitative research? 2. Aims of Quantitative Research? **3.** Benefits and shortcoming of Quantitative Research?	- Theory presentation: teacher tries to make students understand theoretical background of the module and main benefits and challenges of the quantitative research.

	Tips1: repeated theory may push students get bored, and then it is better to rely on the students reviewing these parts by themselves and discuss the wrong idea and correct them. Tip 2: try to introduce notions of statistics indirectly so as to introduce students to field gradually	-Chalkboard needed.

Time	**Conclusion:**	**Teaching Approaches**
/	Provide a pre data collection and data analyses tests to the students as homework	/

RESOURCES

Students might use different books to enrich their knowledge about research quantitative research. Mainly:

1. Dörnyei, Z. (2007). Research Methods in Applied Linguistics: Quantitative, Qualitative, and Mixed Methodologies. Oxford University Press.
2. Kothari, C.R. (2004). Research Methodology: Methods & techniques (2nd Revised Edition). *New Age International Publishers.*

Course: Statistical Analysis in Quantitative Research **Date:** Wednesday, October 18th, 2017
Chapter 1: Introduction to Quantitative Research
Lecture 2: Research Variables in Educational Research
Learning Area &Time: Room 25 B08 (1 p.m. to 2.5 p.m.)
Year Level: Master 1 Ling. & M 2 Didactics

LESSON 2 OUTCOME:

At the end of this lecture, students should be able to:

- Differentiate between the different types of research variables,
- Be able to locate the variables in the research titles and find their types
- Be able to construct their own research titles.

LESSON STRUCTURE:

Time	Introduction (Set):	Teaching Approaches and Material
10min.	**Brainstorming activity** - ask the students to review previous lecture's main points. - introduce the variables in research from general perspective (talk about different fields)	-Classroom discussion -Mobile and and lap tops' Search engines are allowed to search for different trending research issues around the world according to the different students' interests

Time	Main Content:	Teaching Approaches and Material
1 hour and 10 min.	1. Types of Research Aims - Exploring - Finding cause & Effect relationship - Finding correlation relationship 2. The components of Research Title in Educational Research: - Research aim words - Research Variables - Case studies and Population of the study	-Mobile and lap tops' search engines are allowed. -Chalkboard is needed, where students write their own examples. -Discussions within students where they reflect on each title. -teacher may bring

	3. Presentation of different research variables - Independent - Dependent - Extraneous - Controlled Tip1: help the students to differentiate between case studies as research methodology and case study in the title. And introduce the notion of sample and sampling briefly. Tip 2: explain that there are other types of research variables for further reading.	dissertations as example to study the different titles' structures

Time	**Conclusion:**	**Teaching Approaches**
10 min.	The students are divided into pairs to construct their own research titles.	Books, dictionaries and Search engines are allowed

RESOURCES

Students might use different books to enrich their knowledge about research quantitative research. Mainly:

1. Dörnyei, Z. (2007). Research Methods in Applied Linguistics: Quantitative, Qualitative, and Mixed Methodologies. Oxford University Press.
2. Kothari, C.R. (2004). Research Methodology: Methods & techniques (2nd Revised Edition). *New Age International Publishers.*
3. Perry, Jr. F. L. (2005). Research in Applied Linguistics: *Becoming A Discerning Consumer.* Mahwah, New Jersey, London : *Lawrence Erlbaum Associates, Publishers* .

Appendices

Course: Statistical Analysis in Quantitative Research **Date:** Wednesday, October 25th, 2017
Chapter 1: Introduction to Quantitative Research
Lecture 3: Sampling in Educational Research
Learning Area &Time: Room 25 B08 (1 p.m. to 2.5 p.m.)
Year Level: Master 1 Ling. & M 2 Didactics
Lecturer: Ms. BOUGHANI, S.

LESSON 3 OUTCOME:

The students will be introduced to the different concepts and terms which related to population and mainly sampling. Therefore, at the end of this lecture: students will be able to:

- Differentiate between sample and population
- To differentiate between sampling terms: sample unit, sampling size and sampling error and so on
- Be able to differentiate between random sampling and non random sampling methods.

LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
15 mins	Collect the students' pre tests. **Warming up activity:** give the example of an exploratory topic and an experimental topic to explain initially the difference between the need to a large or small number of participants.	- The board is needed. - Classroom discussion

Time	**Main Content:**	**Teaching Approaches and Material**
1 hour and 15 min.	1. Related terms in sampling: - Population - Sample - Sampling unit - Sampling frame - Parameter - A statistic	- Handouts - Board - Question /answer and – - Discussion techniques can be used.

	- Sample size 2. Defining sampling and sampling errors 3. Sampling Methods - Probability sampling (simple random sampling, systematic sampling, stratified sampling, cluster sampling) - Non probability sampling: focus mainly on accidental/ convenience sampling and purposive sampling).	

Time	**Conclusion:**	**Teaching Approaches and Material**
/	<u>Home work</u>: analyse sampling extract from articles and dissertations	Handouts

Resources

Students might use different books to enrich their knowledge about research quantitative research. Mainly:

1. Dörnyei, Z. (2007). Research Methods in Applied Linguistics: Quantitative, Qualitative, and Mixed Methodologies. Oxford University Press.
2. Kothari, C.R. (2004). Research Methodology: Methods & techniques (2nd Revised Edition). *New Age International Publishers.*
3. Perry, Jr. F. L. (2005). Research in Applied Linguistics: *Becoming A Discerning Consumer.* Mahwah, New Jersey, London*: Lawrence Erlbaum Associates*, *Publishers* .

Appendices

Lecturer's name: Ms. S.BOUGHANI	**Date:** 8/11/2017
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics & M2 Didactics	
Chapter 1: Introduction to Quantitative Research	
Lecture 4: Strategies and Tools to Collecting Quantitative Data	

1/ AIMS AND OUTCOMES OF THE LESSON

This lectures aims at introducing the students to different ways of collecting the data in different research types.

Therefore, at the end of this lecture students will be able to:

- differentiate between different research types,
- To differentiate between the related concepts mainly: research Design, Method, and Tool.
- To differentiate between experimental and non experimental designs.
- To know the conditions experimental design and the role of control groups.

2/ LESSON STRUCTURE:

Time	Introduction:	Teaching Approaches and Material
30 min.	**-**choose three research titles that represent the three types of research then ask the students to imagine how to collect the data.	-Role play: teacher divide students into groups, each group will work on one of the topics. Then discuss the students' plans.

Time	Main Content:	Teaching Approaches and Material
1 hour	1. Review types of research aims 'cause and effect, correlation and exploring) 2. Strategies and tools to collecting quantitative data - Experimental design: (manipulation, control and randomization) - Observational or non experimental designs 3. Quantitative Research tools and their aims in quantitative research	Board is needed

	Tip1: use the titles in the warming up part to show students' mistakes.	-here examples of the tools are needed.

Time	Conclusion:	Teaching Approaches and material
/	Ask students to make a summary of the main points they have learnt in the lecture to be submitted in the next session. Task: Students are asked to prepare a research proposal to be submitted at the end of the semester before exams (the research proposal bases on the main point seen through the chapter of data collection and the evaluation will be based on the students' ability to make effective decisions).	The choice of the topic is voluntary: the students can choose topics of their own interest.

RESOURCES

For further reading, students may read different books to enrich their knowledge about research quantitative research. Mainly:

Creswell, J. W. & Creswell,J. D. ().Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th Ed.). *SAGE Publications Inc.*

Appendices

Lecturer's name: Ms. S.BOUGHANI	Date: 15/11/2017
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics & M2 Didactics	
Chapter 2: Statistics and Quantitative Data Analysis	
Lecture 5: Introduction into Quantitative Data Analysis and Statistics	

1/ AIMS AND OUTCOMES OF THE LESSON

This chapter introduces the students to quantitative data analysis; therefore, students should be introduced to the related terms in this field. Therefore, through this lectures students will be able to understand the most important concepts related to quantitative data analysis and statistics.

2/ LESSON STRUCTURE:

Time	Introduction:	Teaching Approaches and Material
15 min.	-Review previous chapters' main points. -Establish a difference between data collection and data analysis	Classroom discussion.

Time	Main Content:	Teaching Approaches and Material
1 hour	1. What is statistics 2. Why should EFL learners study statistics 3. Types of statistical analyses: Descriptive and Inferential Statistics in EFL research - Descriptive statistics (central tendency measures and variability measures) - Inferential statistics (just introduction to it)	Handouts Board Real data sets

Time	Conclusion:	Teaching Approaches and Material
15	**Activity:**	Distribute data sets to the

min.	Calculate mean, median and finding the mode of different sets of data. **<u>Task:</u>** Ask the student to collect real data through putting their research works they submitted in the first semester into practice (only quantitative methods are applied)	students to work on them (handouts are used)

RESOURCES

For further reading, students may read different books to enrich their knowledge about statistics to prepare themselves. Mainly:

Rumsey, D. (2010). Statistics Essentials for Dummies. Indianapolis, Indiana: Wiley Publishing, Inc.

Lecturer's name: Ms. BOUGHANI	**Date: 17/01/2018**
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics & M2 Didactics	
Chapter 2: Statistics and Quantitative Data Analysis	
Lecture 6: Scales of measurement in Quantitative Research (Types of statistical variables)	

1/ AIMS AND OUTCOMES OF THE LESSON

This lecture is designed to introduce students to the different types of data they can meet during the analysis processes. Therefore, students at the end of lectures will be able to recognize all the types (Categorical scales, Ordinal Scales and Interval Scales (that include: Ratio Scales, Interval and ratio)) and the importance of using each type in research.

2/ LESSON STRUCTURE:

Time	Introduction:	Teaching Approaches and Material
10 min.	Make a difference between research variables and statistical variables	Board is needed Classroom discussion

Time	Main Content:	Teaching Approaches and Material
1 hour **10 min**	**1.** Categorical scales: • Nominal variables • Ordinal variables **2.** Numerical Scales • Discrete variables • Continuous variables Tip: give more details about interval and ratio variables.	Use real data from articles, dissertations and students' own data if any.

Time	Conclusion:	Teaching Approaches and Material
10	**Homework activity:**	**-**use the student questionnaire - TIMSS and

min.	Students will collect real data through different types of questions, and then categorize the types of data they obtained (to be submitted).	PIRLS - Boston College

RESOURCES

For the lecture the students will need:

TIMSS and PIRLS- Boston College. (2006). Student questionnaire. *Progress in International Reading Literacy Study (PIRLS*). Retrieved from: https://timssandpirls.bc.edu/PDF/P06_StudentQuestionnaire.pdf

Lecturer's name: Ms. S.BOUGHANI	**Date:** 14/03/2018
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics	
Chapter 2: Statistics and Quantitative Data Analysis	
Lecture 7: Understanding Statistical Tests in quantitative analysis	

1/ AIMS AND OUTCOMES OF THE LESSON

The most important thing in statistics in the EFL context is the use of inferential statistics especially in hypothesis testing research. Therefore, this lecture is designed to introduce students to the most used statistical tests in the field.

Therefore, students will be able:

- To be acquainted with main concepts in inferential statistics that are repeatedly used in books and web sources
- To know the basic assumption of the designed tests
- To be able to run these tests through the SPSS.

2/ LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
10 min	Review types of statistical analysis procedures (descriptive and inferential)	Classroom discussions

Time	**Main Content:**	**Teaching Approaches and Material**
1 hour 10 min.	Types of tests: review the difference between the following terms: 1. Parametric Vs Non-parametric tests 2. One tailed Vs two tailed tests 3. Significance tests and hypothesis testing 4. Standard Errors, Type 1 and Type 2 errors. <u>Tip 1</u>: introduce null and alternative hypothesis before starting these concepts.	-Students need some theoretical knowledge, therefore, we provide students with handouts that summarize the main points of the concepts. -Board is needed

Time	Conclusion:	Teaching Approaches
10 min.	**Homework:** -divide the students into groups and ask them to analyze previous dissertations' or articles' tests and statistics and categorize them according what they have seen through the lectures. - individual work: summarize the lectures main points (for extra evaluation)	-Distribute Master/doctorate dissertations or articles to students to work on them - students can use internet articles they choose .

RESOURCES

For further reading, students may read different books to enrich their knowledge about research quantitative research. Mainly:

Agresti, A. & Finlay, B. (1997). Statistical Methods for the Social Sciences: (3rd Ed). Prentice Hall.

Kothari, C.R. (2004). Research Methodology: Methods & techniques (2nd Revised Edition). *New Age International Publishers.*

For works of the students:

Bilambri, R. (2013). The Effect of Reading Strategies on EFL Learners' Exam Performance: The case of 4.A.M Pupils of Hadjres Slimane Middle School, Bejaia. (Master Dissertation). Retrieved from: http://www.univ-bejaia.dz/dspace/bitstream/handle/123456789/5704/The%20Effect%20of%20Reading%20Strategies%20on%20EFL%20Learners%E2%80%99%20Exam%20Performance.pdf?sequence=1&isAllowed=y

MERABE,L. & MOUGHARI, F. (2015). Developing Learners' Interactive Competence through the Speaking Skill: Evaluation of Third Year Secondary School Textbook New Prospects (Master Dissertation). Retrieved from: https://dl.ummto.dz/bitstream/handle/ummto/5367/Mas.%20Ang.%20147.pdf?sequence=1&isAllowed=y

Appendices

Lecturer's name: Ms. S.BOUGHANI	**Date: 4/04/2018**
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics	**Learning Area**: S14 Centre de calcul
Chapter 2: Statistics and Quantitative Data Analysis	
Lecture 8: Major Statistical Tests	

1/ AIMS AND OUTCOMES OF THE LESSON

This lecture is a continuity of the previous lecture; students will be acquainted with different statistical tests and their basic assumptions. Therefore, the students will be able to:

- To decide on tests that Compare differences between variables and/groups
- To decide on tests that find relationship between variables.

2/ LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
15 min.	-Review main points of the last lecture	-presented by the students (in response to previous lecture's homework)

Time	**Main Content:**	**Teaching Approaches and Material**
1 hour **15 min.**	A/ Comparing means and making inferences 1. T-tests 2. ANOVA 3. ANCOVA 4. Chi Square B/ Investigating correlations: 1. Pearson correlations, 2. Spearman Rho & Kendall Rank correlations 3. simple and multiple regressions	Use of handouts Board Data Center Labs (centre de calcul): internet and computers are used to visualize the tests.

Time	**Conclusion:**	**Teaching Approaches and Materials**

/	/	/

RESOURCES

For further reading, students may read different books to enrich their knowledge about research quantitative research. Mainly:

Marshall, E. (n.d.). Statistics Tutor's Quick Guide to Commonly Used Statistical Tests. Statstutor community project. Retrieved from : http://www.statstutor.ac.uk/resources/uploaded/tutorsquickguidetostatistics.pdf

Appendices

Lecturer's name: Ms. S.BOUGHANI	**Date: 18/04/2018**
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics	**Learning Area**: S14 Centre de calcul
Chapter 2: Statistics and Quantitative Data Analysis	
Lecture 9: Introduction to SPSS	

1/ AIMS AND OUTCOMES OF THE LESSON

Regarding the importance of technology and mainly the SPSS, this lecture aims at introducing the software to the students. Therefore, at the end of this lecture, the students will be able

- to enter the data into the SPSS
- Run descriptive analysis of data
- Run different tests through the SPSS

2/ LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
10 min.	Importance of SPSS in the educational research	Computers equipped with the SPSS and Internet.

Time	**Main Content:**	**Teaching Approaches and Material**
1hour 30 min.	**1.** Running SPSS **2.** Running Descriptive statistics **3.** Data Entry into variable view and data view **4.** Performing tests via SPSS (base on t-tests, correlations, ANOVA)	-Students sit in pairs and each pair uses a computer interchangeably. -Use YouTube tutorials to make students visualize the processes and practice them in the classroom.

Time	**Conclusion:**	**Teaching Approaches**
/	Ask the students to install SPSS in their personal computers for coming tests.	/

RESOURCES

Teacher and Students' Guides:

Gaur, A. S. & Gaur, S. S. (2009). Statistical Methodsfor Practice and Research: A guide to data analysis using SPSS(Second edition). Response Books: SAGE publications.

Landau, S. &Everitt, B. S.(2004).A Handbook of Statistical Analyses using SPSS. U.S: Chapman & Hall/CRC Press LLC.

Examples of YouTube Tutorials to be used:

SPSS Data Entry: How to Enter Data Into SPSS (2015). Accessed in: https://www.youtube.com/watch?v=BvwNPRy6HJU#action=share

Independent t-test - SPSS (Example 1). (n.d.). Accessed in:. https://www.youtube.com/watch?v=8alv3kZt8Ug

Paired Samples t-test – SPSS. (2012). Accessed in:https://www.youtube.com/watch?v=MJGk2sg4EZU

How to do a One-Way ANOVA in SPSS (12-6). (2017). Accessed in:https://www.youtube.com/watch?v=rS3k8ONVN-o

Appendices

Lecturer's name: Ms. S.BOUGHANI	**Date:** 2/05/2018
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics	**Location**: R14. Centre de calcul
Chapter 3: Data Interpretation and Data Presentation and Communication	
Lecture 10: Reading the data and making inferences	

1/ AIMS AND OUTCOMES OF THE LESSON

After completing the data analysis through the SPSS software, students should be able to make sense of the numbers they obtained. Therefore, the students at the end of thislecture, the students will be able to:

- Read and interpret descriptive statistics
- Read and interpret output data from difference comparison tests
- Read and interpret output data from correlation tests

2/ LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
30 min.	-Run the SPSS -Enter the exam scores and the student questionnaire - TIMSS and PIRLS - Boston College's data to be processed. -save the data in drives/computers	-students work in pairs -The teachers give instructions and guide the students while getting lost Students may use again the YouTube tutorials when needed.

Time	**Main Content:**	**Teaching Approaches and Material**
1 hour min.	Run statistical tests in turn: **1.** Reading and interpreting output from t-tests **2.** Reading and interpreting output from Pearson and Spearman correlations **3.** Reading and interpreting output from ANOVA/ ANCOVA results Tips: -The students work in pairs interchangeably -The students copy and paste the most important	Computers Microsoft Word SPSS

	tables from the SPSS output to Word pages to isolate the needed data for interpretation	

Time	**Conclusion:**	**Teaching Approaches and Materials**
/	Ask the students to follow the same steps with their own reach works (asked in lecture 5) and the works should be submitted before exams of the second semester.	/

RESOURCES

Gaur, A. S. & Gaur, S. S. (2009). Statistical Methodsfor Practice and Research: A guide to data analysis using SPSS(Second edition). Response Books: SAGE publications.

Landau, S. &Everitt, B. S.(2004).A Handbook of Statistical Analyses using SPSS. U.S: Chapman & Hall/CRC Press LLC.

Lecturer: Ms. S.BOUGHANI	Date: 11/05/2018 (catch up session)
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics	**Location**: R17. B8
Chapter 3: Data Interpretation and Data Presentation and Communication	
Lecture 11: Graphical Presentations of Data	

1/ AIMS AND OUTCOMES OF THE LESSON

There are a wide range of graphs that are used in the fields and students may be confused when selecting the appropriate graph. Therefore, at the end of this lecture, the students will be able to:

- Decide on the appropriate graph
- Create Graphs through Excel and SPSS
- Read the Graphs data**.**

2/ LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
10 min.	-Run the SPSS -open saved data	-students work in pairs

Time	**Main Content:**	**Teaching Approaches and Material**
1 hour 20 min.	1. Pie diagrams/charts 2. Bar charts 3. Histograms 4. Scatter, box and Line plots 5. Error bars Tip: After each graph, students should work of the reading of the output.	Personal Computers Microsoft Word SPSS

Time	**Conclusion:**	**Teaching Approaches and Materials**

/	Ask the students to decide on the graphs they will use for their research works.	/

RESOURCES

Kothari, C.R. (2004). Research Methodology: Methods & techniques (2nd Revised Edition). *New Age International Publishers.*

Walliman, N. (2011). Research Methods: The Basics. Loondon & New York: Routledge.

Lecturer: Ms. S.BOUGHANI	Date: 11/05/2018 (catch up session)
Course: Statistical Analysis In Quantitative Research	**Duration:** 1h30 min.
Level: M1 Linguistics	**Location**: R17 B8
Chapter 3: Data Interpretation and Data Presentation and Communication	
Lecture 12: Reporting statistical data in APA	

1/ AIMS AND OUTCOMES OF THE LESSON

Following the dissertation writing standards is highly important in the research process as it enables the communication of the results in a clear and organized manner. In our department the APA style is recommended for Didactics and Applied Linguistics fields. Therefore, the students at the end of the lecture will be able to report the statistical data including tables and statistical values in the APA format.

2/ LESSON STRUCTURE:

Time	**Introduction:**	**Teaching Approaches and Material**
10 min.	Review the main standards of APA	-classroom discussions

Time	**Main Content:**	**Teaching Approaches and Material**
1 hour 20 min.	1. Reporting correlation studies (including tables and reading tables) 2. Reporting cause and effect studies (including tables and reading tables) • Independent tests • Dependent tests • ANOVA Tip: Show students how to use the different needed symbols and tables through Microsoft word.)	Personal Computers Microsoft Word

Time	**Conclusion:**	**Teaching Approaches and Materials**

/	Ask the students to use the APA style in their research works. The works should be submitted in the first week of the exam blocked period.	/

RESOURCES

Guanby, S. S. (2017-2018). APA Style and Grammar Guide. Georgia Baptist College of Nursing of Mercer University. Retrieved from: https://instructure-uploads.s3.amazonaws.com

Paiz, J. M, Angeli, E., Wagner, J., Lawrick, E., Moore, K., Anderson, M., Soderlund, L., Brizee, A. & Keck, R. (2012). Statistics in APA. The Writing Lab & the OWL at Purdue and Purdue University. Retrieved from: http://www.globalcenter.info/gcpr/gcpr-files/APA-style.pdf

ABSTRACT

This study investigates the role that statistics education plays in fostering the EFL learners' decision making skill when conducting scientific research. The students, at Master level, are engaged into independent learning where they need to make their own decisions concerning their research, dissertation writing, selecting methodological procedures, choosing the right interpretations and so on. This is why, in this study, we suggest statistics education as a way to help them think logically and base their decisions on reason and argumentation during the research process. Our population, thus, is constituted of Master students of English at the Department of English, University of BEJAIA from whom 25 students have been selected to participate in the research experiment and 25 students have participated as a comparison group. This study follows the procedures of an experimental design where both qualitative and quantitative methods are used; the data gathered from the questionnaires and the error analysis are analyzed through descriptive statistics and the data from tests and scales are analyzed through inferential statistics. Finally, data from the interview are analyzed thematically. The results of this study have revealed that our sample has developed their decision making skills; the students have been able to make decisions thoroughly and following scientific research principles. Although the students have been prone to statistics anxiety most of the time, their knowledge of the importance of statistics in scientific research led them to make great efforts to understand and apply the lessons. Moreover, the results have entailed a syllabus for an "EFL Statistics Education" which bases on Master's students' needs.

Key words: Scientific research, decision making skills, EFL students, Master students' needs, statistics education.

RESUMÉ

Cette étude examine le rôle que l'enseignement de la statistique joue dans le renforcement des compétences décisionnelles des apprenants de la langue Anglaise comme Langue Etrangère lors de la recherche scientifique. Les étudiants, au niveau Master, sont engagés dans un apprentissage autonome où ils doivent prendre leurs propres décisions concernant leurs recherches, la rédaction de leur mémoire, la sélection des procédures méthodologiques, le choix des bonnes interprétations, etc. Pour cette raison, dans cette étude, nous suggérons l'enseignement de la statistique comme moyen de les aider à penser logiquement et à fonder leurs décisions sur des raisons et des arguments au cours du processus de recherche. Notre population est constituée d'étudiants en Master d'Anglais au Département d'Anglais de l'Université de Bejaia, parmi lesquels 25 étudiants ont été sélectionnés pour participer à l'expérience de recherche et 25 étudiants ont participé en tant que groupe de comparaison. Cette étude suit les procédures d'une conception expérimentale où des méthodes qualitatives et quantitatives sont utilisées. Les données recueillies à partir des questionnaires et de l'analyse des erreurs sont analysées au moyen de statistiques descriptives et les données des tests et échelles sont analysées au moyen de statistiques inférentielles. Enfin, les données de l'entretien sont analysées par thème (analyse catégorielle ou bien analyse thématique). Les résultats de cette étude révèlent que notre échantillon a développé sa capacité à prendre des décisions; les étudiants ont pu prendre des décisions de manière approfondie et en suivant les principes de la recherche scientifique. Bien que les étudiants aient été sujets à l'anxiété statistique la plupart du temps, leur connaissance de l'importance des statistiques dans la recherche scientifique les a amenés à faire de gros efforts pour comprendre et appliquer les cours. L'étude a aussi impliqué un programme pour l' «enseignement de la statistique » dans le domaine de l'Anglais comme langue étrangère qui se base sur les besoins des étudiants en Master.

Mots clés: Education Statistique, Recherche Scientifique, Compétences Décisionnelles, Etudiants d'Anglais comme Langue Etrangère, Les Besoins Des Etudiants En Master

ملخص

تعنى هذه الدراسة بالبحث في الدور الذي يلعبه تدريس مادة الإحصاء في تعزيز وتطوير مهارة صنع القرار لدى متعلمي اللغة الإنجليزية كلغة أجنبية عند إجراء بحث علمي. تتكون الفئة الطلابية قيد الدراسة من طلبة ماستر اللغة الإنجليزية في قسم اللغة الإنجليزية بجامعة بجاية ،حيث تم اختيار 25 طالبًا منهم للمشاركة في تجربة البحث وشارك 25 طالبًا كمجموعة مقارنة. وينخرط الطلاب على مستوى الماستر في التعلم المستقل حيث يحتاجون إلى اتخاذ قراراتهم الخاصة فيما يتعلق بأبحاثهم، كتابة أطروحاتهم، اختيار الإجراءات المنهجية، اختيار التفسيرات الصحيحة ،وما إلى ذلك. لذا، فإننا في هذه الدراسة نقترح تعليم الإحصاء كطريقة لمساعدتهم على التفكير المنطقي وبناء قراراتهم على الأسباب والحجج أثناء عملية البحث. وتتبع هذه الدراسة إجراءات المنهج التجريبي حيث يتم استخدام كل من الأساليب الكمية والنوعية ؛ كما يتم تحليل البيانات التي تم جمعها من الاستبيانات و إجراء تحليل الخطأ من خلال الإحصاء الوصفي في حين يتم تحليل البيانات الاختبارات والمقاييس من خلال الإحصاءات الاستنتاجية. أخيرًا ، يتم تحليل البيانات من المقابلة بشكل موضوعي. وقد خلصت نتائج هذه الدراسة إلى أن عينتنا طورت مهارتها في اتخاذ القرار، ؛ تمكن الطلاب من اتخاذ القرارات بدقة وإتباع مبادئ البحث العلمي. على الرغم من أن الطلاب كانوا عرضة للقلق الإحصائي في معظم الأوقات ، إلا أن معرفتهم بأهمية الإحصاء في البحث العلمي دفعتهم إلى بذل جهود كبيرة لفهم الدرس وتطبيقه كما طورت هذه الدراسة منهجا لتعليم الإحصاء باللغة الإنجليزية كلغة أجنبية والذي سيعتمد على احتياجات طلبة الماستر.

الكلمات المفتاحية: البحث العلمي، صنع القرار ، طلاب اللغة الإنجليزية كلغة أجنبية ، احتياجات طلبة الماستر ، تعليم الإحصاء.

<u>Agzul</u>

Tazrawt-agi tssekyad azal uselmed n « Taddadant » deg useğhed n tzemmar taɣtasin n isdawanen n tutlayt Taglizit ,am tutlayt taberranit deg unadi ussnan . Gar isdawanen i yettikkin deg tezrawt-agi ad naf anagar inelmaden n ugezdu n tutlayt taglizit deg uswir n Master n tsedawit Ɛebdreḥman Mira « Bgayet » . 25 agi isdawanen yettwafernen i wakken ad tekkin deg tezrawt-agi ma d 25 nniḍen ttikkin, deg ugraw n userwes . Isdawanen-agi d wid yellan qqaren Master yewwi-d fell-asen ad ḍefren almad afulman , anida ilaq ad ddmen taɣtast-nsen ɣef ayen yerzan tizrawin-nsen , tira n uktay-nsen , tisekkirin tisnarayin , afran yelhan n usuɣel .... Ɣef waya deg tezrawt-a ad nini d akken aselmed n taddadant ad tili d allal I waken ad tili tidmi-nsen d tameẓlant akked lebni n taɣtast-nsen ɣef tmental d yifukal deg teɣzi n ukala tezrawt .Tazrawt-a teṭṭafar tisekkirin d wayen yerzan Armmus Anagram neɣ tarrayin "T aɣudant, Tamaktant " . Isefka I d-nejmeɛ seg tuttriwin d tasleḍt n tuccḍiwin ttwaselḍent s tddadant taglamant ma d isefka n "les tests et échelles " ttwaselḍen s taddadant "inférentielles" . Ar taggara , isefka n tdiwennit d ttwaselḍen ilmend n yisental d yesmilen , igemmaḍ n tezrawt-agi skanayen-aɣ -d d akken talemmict-nneɣ tuɣal tezmer ad teddem taɣtast , ayagi yuḥwağ ahil I uselmed n taddadant deg taɣult n teglizit yellan d tutlayt taberranit , I ibedden ɣef wayen sran isdawanen n Master .

Awalen isuran*: Assinen n taddadant, anadi akadimi, tizemmar taɣtasin, isdawanen n tutlayt taglizit d tutlayt taberranit , asri n yisdawanen n Master*