Chapter #26

THE DESIGN OF THE RESEARCH METHOD IN GRADUATE RESEARCH WORK

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ABSTRACT
Regardless of the discipline or institution in which scientific research will be conducted, the "method» is present. It remains fundamental of all research work that can inevitably affect problem-solving, development of the nation, and threaten quality of life.
This is an exploratory study on research methods used in graduation projects in the following disciplines (health sciences, engineering, biological and agronomic sciences, and social sciences).
The method used in this work is based on: (a) semi-structured survey by interviewing supervisors of final dissertations and theses in different selected disciplines (b) systematic analysis of the fifty-research work of graduate students. The works obtained from the libraries of the University Hassan II of Casablanca in different disciplines, submitted between 2014 and 2018. The parts of the empirical phase were analyzed, according to the processes and concepts of each discipline, to highlight the elements of the research method.
The findings indicated the influence of the national scientific production by the design of the research method. The data collection and analysis are the sections that may affect the integrity of the research method. Our contribution is to remedy the standardization of the method and adapting it to the contexts of the needs of different disciplines.

Keywords: scientific research, research method, dissertation work, data collection, data analysis.

1. INTRODUCTION

Research is not limited to science and technology. There are vast areas of research in other disciplines such as languages, literature, and history. So whatever the discipline and or subject, research must be an active, diligent and systematic process of inquiry not only to discover, interpret or revise facts, events, behaviors, and theories but also to refine knowledge in other fields or to improve the quality of human life (Rajasekar, Philominathan, & Chinnathambi, 2006).

Yin (2003) adds that "in everyday language, a research process is a plan of action to get from here to there, where 'here' can be defined as the initial set of questions that need to be answered and 'there' is a set of answers.

Crotty (1998) states that a methodology is a strategy, plan of action, the design process that underlies the selection and use of certain and by linking the selection and use of methods to desired outcomes. In addition, Methods are the techniques or procedures used to collect and analyze data related to a research question or hypothesis.

For example, the research design considers itself as the logic or blueprint for a research study that highlights the method of the study. It shows how to develop all major parts of the research study - samples or groups, measures, treatments, or programs.

Fortin (2010) stipulates that the method is one section of the research process and contains the sub-sections that are sample, type of study, data collection and instruments, procedure and the details of all the previous parts, and data analysis.

In the same order of ideas, research methods help us collect samples, data, and find a solution to a problem. Particularly, scientific research methods call for explanations based on collected facts, measurements, and observations and not on reasoning alone (Rajasekar et al., 2006).

However, certain factors can bias, corrupt research and lead to erroneous scientific judgment and decision-making (Steneck, 2004; Shamoo & Resnik, 2015),

These factors can affect epistemology, theoretical perspective, methodology, and methods as basic elements in any research process (Crotty, 1998).

The research is composed of these four elements, which are interrelated, the methodology and method remain the representation of the previous ones because any question about epistemology and theoretical perspective of any research work appears in the methodology and method of research.

Thus, scientific integrity is under threat throughout the research process. This is why many strategies have been developed to promote it.

This scientific integrity encompasses both "integrity of results" and "integrity of the process". With respect to the "integrity of results", it is the achievement of goals and the production of results that are empirically adequate; while "integrity of the process" is the adherence to standards that promote these goals (Shamoo & Resnik, 2015).

In addition, from a methodological perspective, if these subsections are not applied precisely, and if they do not meet standards, they can lead to empirically inadequate results. (Shamoo & Resnik, 2015)

Accordingly, where the researcher has used inappropriate tools or inadequate methods to obtain his or her results, and if the standards are not properly adhered to scientific integrity, the latter is certainly violated (Douglas, 2014).

Therefore, the methodological integrity of the research is a priority. It is an approach relevant to all areas of scientific research in order to produce empirically adequate conclusions.

Furthermore, the lack of preconditions in the conduct of research is at the root of the difficulties in publishing quality papers, and the delay in the promotion of many African researchers , and the share of Africa's scientific production in the world does not exceed hardly exceeds 1% (Bossali et al., 2015).

In addition, the number of publications is growing less rapidly than in other countries and does not correspond to the number of research projects funded (sources: the National Statistics Department).

The number of doctoral students is growing, although the graduation rate is not the same. In 2009, the number of doctorates awarded, all disciplines combined, was 676 and in 2018, the number of doctorates awarded is 392 (sources: the National Statistics Department).

In 2014, the number of students reached nearly 18600 while the number of doctorates supported was less than 1200, with a graduation percentage of 6.4. This rate is relatively low rather than to Tunisia, which is 7.2%, South Africa 12.6, and France 19.3 (Gaillard & Bouabid, 2017).

From this observation, it can be said that the number of doctorates has decreased, and consequently the decline in scientific production. In addition, there are several reasons related to the system and/or process that constrain research in Morocco.

Otherwise, the Higher Council of Education, Training, and Scientific Research (2017) indicated that 60% of Ph.D. students have not received training in bibliographical research and there is any access to knowledge without methodological preparation and initiation to bibliographical research. However, no study is interested in research design.

To deal with this problem, the research method must be adapted and based on norms and standards to meet the research objectives and provide useful results and conclusions to serve sectors of society.

This study is both descriptive and exploratory. Its purpose is to explore the research methods of empirical studies of the basic disciplines of scientific production at the University HASSAN II OF CASABLANCA.

In the other words, the chapter reviews the research methods and design used in the research work-study including strategies, instruments, and methods for data collection and analysis, results, and discussion in order to compare and contrast them with the norms.

The scientific disciplines taken into account in this study are (engineering sciences, health sciences, biological and agricultural sciences, social sciences); in addition, these fields have made a considerable contribution to national scientific research in recent years.

2. METHOD

2.1. The interview survey

The majority of Hassan II University establishments have research units and laboratories, which represent official bodies responsible for scientific production, and they are also the first involved in any research process or methodology.

The interview involved teacher-researchers supervising theses and dissertations at the end of the study, all the interviews were recorded in audio to be processed on "Nvivo" after having received their consent through an explanation of the purpose and orientation of the study, the survey lasted five weeks to reach a sample of 6 participants.

The interview is designed in three parts: the first part focuses on the general data of study participants, a second part focuses on the process of the end-of-study paperwork, and the third part opts for participants' suggestions for achieving research method integrity.

2.2. Analysis of dissertation work

Fifty dissertations and end of study projects obtained through the libraries of Hassan II University. For each discipline, ten end-of-study dissertations were taken randomly, we have included only those disciplines that have recorded a strong scientific production in the major fields mentioned above, which are engineering; medicine, biology and agriculture, and sociology.

These studies will exploit using different variables that may conceptualize the research design, which includes the type of study, sample, instruments, data collection, results, analysis, and discussion.

The triangulation of the three survey methods, which involves the collection of a few indicators at the doctoral cycle level, the semi-structured interview of teacher-researchers, and the analysis of the research work of master's students, was undertaken in order to compare and reinforce the results and the objective of the study.

3. RESULT

3.1. Interview results

3.1.1. Factors influencing scientific production

A textual analysis of the interviews revealed some repeated concepts. The table below shows the frequency of each concept.

Table 1.
Word Frequency Query.

WORD	LENGTH	NUMBER	WEIGHTED PERCENTAGE
Method	7	15	15.79
Ressources	10	8	8.42
Thematic	10	8	8.42
Data	7	5	5.26

Figure 1.
Textual Analysis Word Clouds.

From the table and textual analysis, it is clear that the method is the predominant factor affecting the students' research work.

3.1.2. The sections that may affect the integrity of the research method

A textual analysis of the interviews revealed some repeated concepts. The table Bellow shows the frequency of each concept.

Table 2.
Word frequency query.

WORD	LENGTH	NUMBER	WEIGHTED PERCENTAGE
Data	7	21	6.25
Collection	8	10	2.98
Analysis	7	11	3.27
Standard	6	6	1.79
Procédure	9	6	1.79

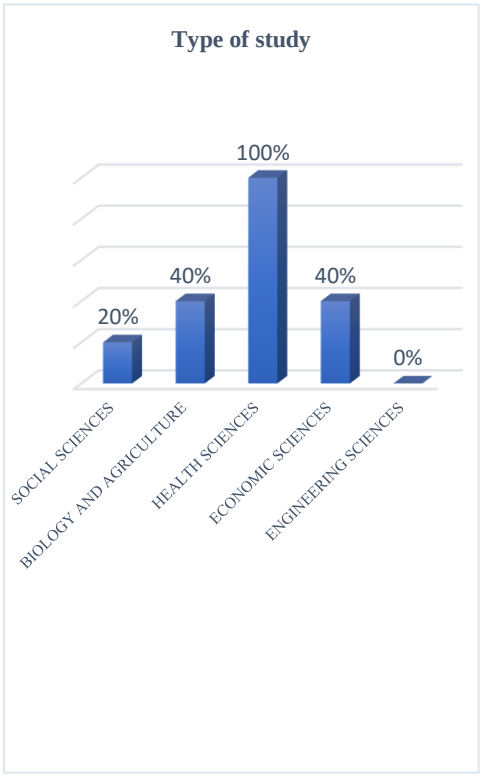
According to the table, the concept of "data" is predominant, and it is linked to the other two concepts of collection and analysis.

Figure 2.
Word Cloud Textual Analysis.

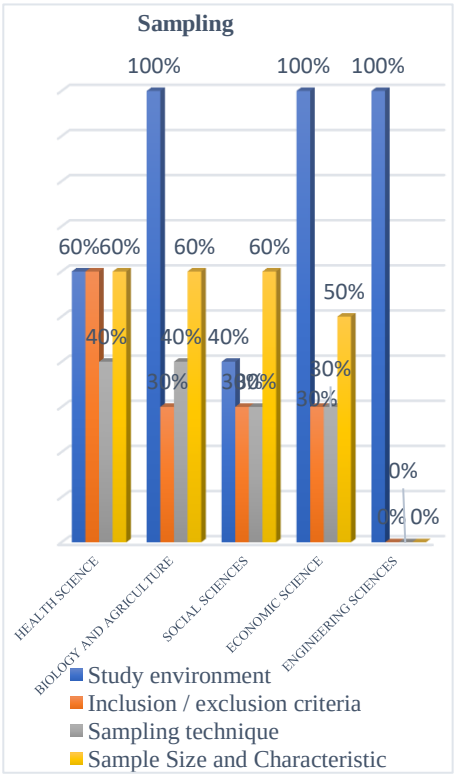
Based on the data collected above, data collection and analysis are the two components that can threaten the integrity of the research method.

3.2. Results of the research analysis

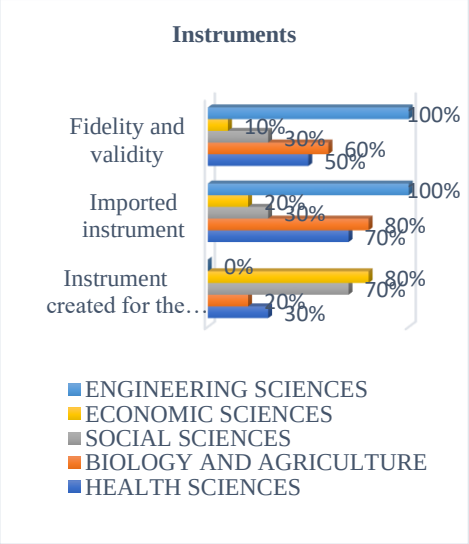
Graph 1.
Type of study in the five fields studied.



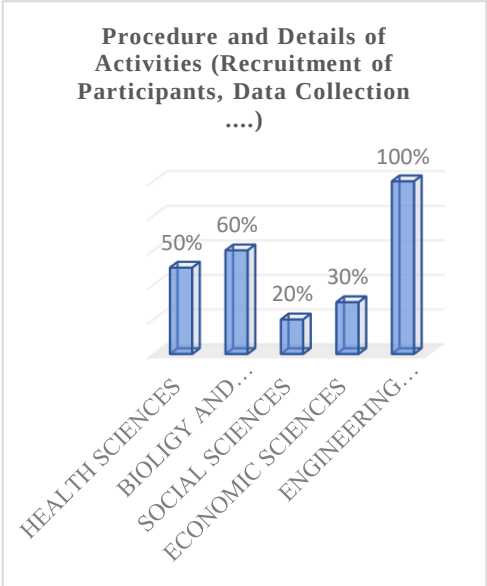
Graph 2.
Sampling in the five fields studied which includes (study environment, sampling technique, inclusion/exclusion criteria, sample size and characteristic.



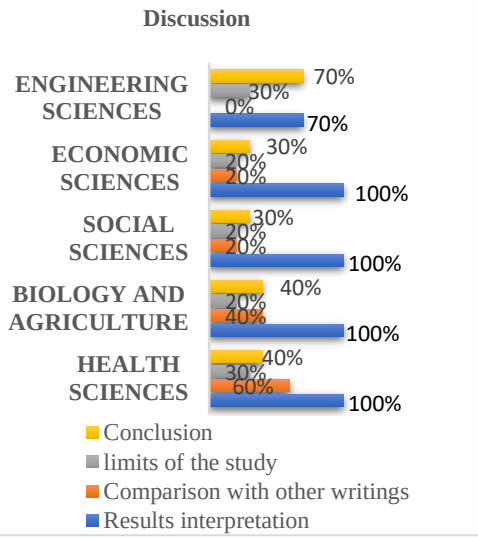
Graph 3.
Instruments used in each study for the five fields studied (Fidelity and validity, instrument imported or created for study).



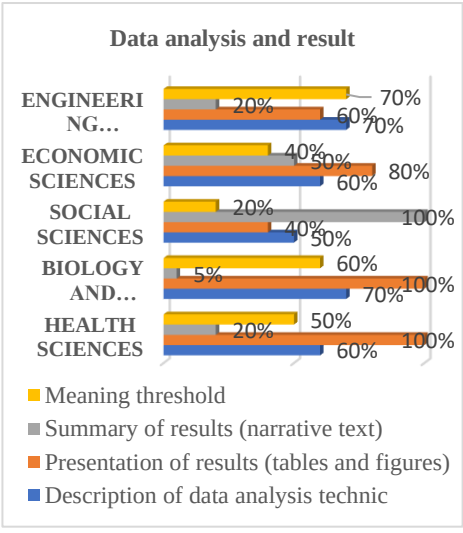
Graph 4.
Procedure and detail of activities (Recruitment of participants and data collection.



Graph 5.
The section «discussion» in the five disciplines studied.



Graph 6.
Data analysis and results with (Meaning thresholds, Presentation of results, description of data analysis technic.



The results of the study showed that in medicine: the type of study and ethical considerations are taken into account in all work. 60% of the studies indicated the number and characteristics of the sample and only 40% mentioned their sampling techniques, however, the fidelity and validity of the data collection instruments were highlighted in only 40% of the studies,

All the works described their procedure, the statistical analysis generated results in all the works, however, the discussion section considers the other writings in only 40% of the cases, and the conclusion section appears in only 40% of the works.

In biology and agriculture, just 30% of the studies declared the type of study, the predominant criterion in the sampling section is the study environment in 100% of the cases. The sampling technique, the number, and characteristics of the sample appear in only 40% of the cases, and the precision and validity of the measuring instruments were not explicit in 40% of the cases,

Moreover, just 40% explain their significance level; however, in the discussion section, all cases indicate that the results are consistent with other publications through comparative studies.

In sociology, the type of study appears in only 10% of the cases. The study environment and the number and characteristics of the sample appear in 60% of the cases. 70% of the writings create their instruments however their validity was not maintained, the statistical analysis reveals raw descriptive results, and only 10% of the cases carry out a discussion part which indicates an interpretation of the results,

In economics, 40% of the works indicate their type of study; the study environment is present in all the works. however 50% are interested in sample size and characteristics, however, 80% use instruments created for the purpose of the study and just 10% clarified their validity, 30% of the cases described their procedure in detail, 40% pronounced their significance of the results. The discussion section just deals with the interpretation of the results in 100% of the cases, and 20% of the works used other literature, and just 30% cited their study limitations.

In engineering sciences, the total of work mention their study environment, but the type of study is not reported in all of the paper. The instruments are all imported and their validities were clear, whereas 20 % of the projects have not given results, by the way, 30% of the studies reported their study limitations.

Consequently, the majority of the research work lacks a part of the method that affects methodological integrity

4. DISCUSSION

This survey is necessary because it highlights the practice of research methodology that is as the guarantor of methodological rigor, as it contains subsections, and because they influence each other.

The present study concerns the most productive disciplines in Morocco. This diagnosis makes it possible to raise the gaps in the practice of the research method for improvement purposes.

The present study has identified several particularities that each section of the method can take into account in each discipline.

Because, the hierarchical nature of the research process determines that the assumptions embedded in the primary element inform each subsequent element (Crotty, 1998). Furthermore, the research process is the representation of a logical sequence determined by epistemology and theoretical perspective.

Given the results of the interviews with teacher-researchers, the sections most at stake are data collection and data analysis.

However, for all scientific disciplines, depending on the object of study, the researchers should consider and choose one or more methods for their scholarly endeavors (Chu & Ke, 2017).

For instance, research conducted using the given data collection method is related to the particular methodology, which itself has been adapted to a particular theoretical perspective, which related to epistemological current. Nevertheless, there are specific research designs that take into account different research paradigms (Feast & Melles, 2010), which requires a sufficiently vigilant conception to have results incorporated into reality.

Our discussion focuses much more on the operational section, which is necessary for any empirical phase regardless of the field of application of the research,

First, these procedures use instruments that must obtain a certain validity and reliability to ensure methodological rigor (Fortin, 2010).

This study has reviewed the practice of these procedures, most disciplines do not describe their procedures for either data collection or data analysis, which limits their transparency (Fortin, 2010).

Similarly, and in the health field, statistical analysis is the main component that allows research to be empirical rather than abstract, it allows us to confirm our findings (observations and experiments), moreover, the accuracy of the statistics depends heavily on the accuracy of the data collected (Manille, 2003).

Thereby in a study by Wayant, Ross, and Vassar (2020), the Clinical trials in oncology had methodological shortcomings, these shortcomings include alpha values and confidence intervals that do not match, lack of citations for data that justify the chosen non-inferiority margin, and pre-specification of only one analysis. By the way, the methodological shortcomings may lead to spurious conclusions that may be due to study design.

In the social sciences, Campenhoudt, Marquet, & Quivy, (2017) assert that it is not a matter of proceeding anyhow but of "method", and the group "data collection and analysis" into a single "epistemological act".

On the other hand, Campenhoudt et al. (2017) and De Ketele and Roegiers (1991) stipulates the proper conduct of data collection and the validity of these tools to provide some veracity to the information collection process, however in the projects of the students the validity is not demonstrated in most graduate work. Furthermore, regarding the interpretation, which remains the core of the social sciences and humanities, the Scientists should avoid violating the research integrity, not only in designing experiments, and accepting hypotheses or theories but also in interpreting data (Resnik & Elliott, 2018).

In engineering sciences, Assar (2015) stipulates that the artifact must meet the needs of the claimant; by the way, the rigor in data collection and processing is necessary to have scientifically valid results. Moreover, it must be adequate with the context of use, however, in our study 20 % of the projects have not given result in this way, furthermore, the researchers refer to replication to extend knowledge and this remains a guarantee of rigor in data collection and analysis, nonetheless, in this study, some works cited their replication.

In order to confront the different deficiencies in research method design, there are several strategies and approaches that the precursors of research methodology have talked about.

Onboard, there is critical thinking, which is the intellectual basis of the research method, it is used for undertaken the valid and reliable research method and to verify the veracity of the information, that scientific knowledge is constructed and developed by scientists (Halim & Mohtar, 2015).

Furthermore, the norms for research methods by Shamoo and Resnik (2015) include evidentiary support, rigor, objectivity, carefulness, openness /transparency.

Evidentiary support may take the form of facts and statistics, expert opinions, or evidence, to prove the validity of the research work, in order to draw inferences based on the empirical evidence and/or sound logical, statistical, or mathematical arguments. While the rigor is subjecting research to rigorous tests; critically scrutinizing research; considering the limitation of one's methods and results, whereas objectivity aimed at minimizing or controlling experimental, theoretical, and other biases. Whilst carefulness is intended for minimizing human and instrumental errors; keeping good research records. And the openness/transparency consists of disclosing methods and assumptions; sharing data, results, ideas, and materials)

In addition, the same authors stipulate among others, the policies that define and prohibit research misconduct, such as the procedures for reporting, investigating, and adjudicating research misconduct, and the procedures for auditing data and other research records. Furthermore, the rules for designing experiments, the rules concerning standards of evidence for accepting or rejecting hypotheses, and the rules concerning good statistical practice.

5. CONCLUSION

Students in different disciplines at the Hassan II University of Casablanca carried out this study with the aim of diagnosing the application of the research method. The results obtained show that the method is intact, thus, the rules and standards relating to the normative practices of the methods are not respected in most of the works.

For this, some recommendations in order to remedy the standardization of the research method, and its adaptation to the contexts of the needs of different disciplines, raised throughout the study. and which include: the non-reporting of the type of study, the non-respect of standards in the design of instruments for data collection and analysis as well as the absence of reporting of some particularities of the method in certain disciplines such as (sampling technique, size, representativeness ...), recommendations have been formulated:

• The reinforcement of research methodology courses within training courses (bachelor's degrees, master's degrees, and doctorate) in all disciplines.
• The requirement for the development of a research work plan and the clarification of the method
• The characterization of each method section and linking all parts of the method in order to respect the epistemological act and ensure their monitoring and evaluation
• Teaching based on the universal standards of critical thinking to generate critical thinkers.
• At the strategic level, embedding the research culture and adherence to norms, rules, and standards to ensure the integrity of the research method
• The choice and/or design of data collection and analysis instruments must be justified, rational, and clarified.

It is also interesting to compare research designs in different research works that use quantitative, qualitative, or mixed methods. While such surveys increase the understanding of the research design, as they have an impact on the results for the research users.

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