Difficulties Found by Students in the Disciplines of Post-graduation in Electrical Engineering

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Abstract

In this study, we explore the difficulties of students in the disciplines of post-graduation in electrical engineering. To the extent that the student is able to elucidate his difficulties during the disciplines of the postgraduate course, your research can flow with greater satisfaction and success. Our findings are based on interviews of students with different backgrounds and educational experiences, allowing to capture different difficulties and motivations found in the classroom, which influence the researches of masters and doctoral students. We found that most of the students in the postgraduate course in electrical engineering had background training in distinct areas (73.3%), and that they are generally related area students, such as math, computing, and other areas of engineering. Another aspect is that most interviewees reported that their difficulties were related to the disciplines that addressed the development of algorithms and mathematical calculations (66%), suggesting that this problem was a consequence of insufficient knowledge base for the disciplines. The findings suggest that even with the difficulties encountered in the classroom, the students of the course had no disapproval, because most of the time they sought to discuss their difficulties in groups of studies created by classmates, and thus, elucidating the difficulties faced with colleagues who had different skills.

Keywords: Difficulties; Disciplines; Electrical Engineering; Post-Graduate.

1. Introduction

The first steps of graduate studies in engineering in Brazil were taken in 1961 at the Technological Institute of Aeronautics - ITA, in which it was intended to guide younger teachers, and thus offer ample opportunities to pursue advanced studies in the country and abroad. Since this period, postgraduate courses

in Engineering have evolved considerably in recent years, expanding in several areas of knowledge, with an increase in the number of programs created, in the offer of courses and in the entry of new students each year of selection. However, when compared to other areas of knowledge, it is still evident that there is little representation in a world scenario of technological competition [1-2]. However, it is clear that even with an expansion in this level of education and an increase in the offer of courses in Brazil, there is still a concern related to the deficit in the number of doctors trained in the country [3].

The small number of postgraduates in Brazil often look for alternatives to jobs that are far from classrooms and research. Because, the technological areas guarantee better business working conditions, as well as Engineering, Administration and Medical Clinic, whose main field of work is (public and private) companies [4]. In addition, several factors imply the graduate's decision to enter graduate school, as well as financial issues, the need for immediate employment and quality of life.

However, the student faces several difficulties when arriving at a stricto sensu post-graduation, such problems may be related to the lack of depth of knowledge that was sometimes “decorated” during graduation, with this he faces serious dilemmas: “the to study, why to study this (and not that), where to start, who will help him, how much time he will have to complete the work, how he will know that he is ready and what to do to avoid problems in defending the dissertation ”[5] . Another aspect is the frustrations of students who were considered excellent at graduation, but when they entered graduate school, they did not achieve the same performance, facing failures for the first time [6]. All of this can cause an uneasy relationship in the research. Thus, in order to complete the highest degree of research, the student faces an arduous task, in which he requires that both the student and the advisor have good management skills for research projects. However, a delay or failure to complete this higher level can put more pressure on students.

Currently, there are several other difficulties encountered in the post-graduate period (master's and doctorate), in which they may be related to orientation, which includes the lack of communication between the advisor and the student, in addition to the absence of supervisors in institutions and institutions. in research labs (leaving their students alone), as well as supervisors' retirement, sabbaticals and vacation periods. Another factor related to the difficulties encountered in this study period, involves the ego of the supervisors who do not give a chance to hear and accept the opinions of the supervisors, thus causing the change of supervisors during the research and, thus, influencing the loss of motivation during the study. course period.

In addition, problems related to the line of research, such as the choice of the theme and the appropriation of the targeted content, including the subjects taken to complete the required credits, which sometimes are from different areas of the basic training, can contribute to the difficult understanding and course and research. According to Silva [3], “the quality of teaching at the university must result in quality of life, a premise that cannot be ignored”, as the university institution assists in the quality of life of all those involved, directly or not with the university.

Therefore, these notes are currently being discussed a lot, and studies related to postgraduate studies are quite extensive.

However, the greatest concentration of themes is directed to the discussions of public policies of higher education, how the structure of the programs is organized, the creation of new courses, the mapping of

diploma indexes and the evaluation of courses, examples of which are the studies by Cirani, Silva and Campanário [7]; Kornis, Maia and Fortuna [8]; Oliveira e Siqueira [9] and Tourinho e Palha [10]. However, there are still few that address the themes that relate the interest in the development of university careers, covering aspects related to the choice of courses, life projects, academic satisfaction and dropout [11]. In addition, the lack of discussions on the aspects related to the motivation to choose the topic, difficulties faced in the course subjects, student-tutor relationship or colleagues, and other factors that can directly influence the research in the academic life of graduate students graduate programs still need to be discussed with greater vigor.

Therefore, this study sought to investigate the main problems encountered by students when taking courses during the master's and doctorate courses, especially in the electricity engineering course, addressing the main decision-making to stand out from the problem situation.

2. Materials and methods

2.1 Participants and Place of Collection

In this study, we conducted a qualitative research based on information reported by students in the form of a questionnaire. The study was carried out on the main campus of the Federal University of Maranhão - UFMA, city of São Luís, state of Maranhão, Brazil, during the second semester of 2017 and was aimed at masters and doctoral students enrolled in the Postgraduate Course in Electricity Engineering. This Postgraduate Program started officially in 1995, having been recognized by CAPES in master's and doctoral courses in the areas of concentration: Automation and Control, Computer Science and Energy Systems. Up to the date of the research, 45 students were enrolled in the master's course and 35 students in the doctoral course. A total of 15 (18.75%) students participated, of which eight were enrolled in the master's course and seven enrolled in the doctoral course. The survey was conducted in October 2017 at the participants' own University.

2.3 Participants and Place of Collection

An evaluation questionnaire was developed by the research team and administered among the students. The data for this study were collected individually through printed questionnaires. The questionnaire consisted of two scales: (1) a learning competence scale, which comprised 6 items in order to investigate the demographic data and the scientific literacy of the students; and (2) a scale of the difficulties found in the course subjects and self-regulated learning, comprised of 4 questions capable of examining the students' perceptions of preparation, the difficulties faced in the graduate courses and the solutions found to elucidate the difficulties faced.

2.3 Study Procedures

The collected data were obtained in an academic context. All participants were informed of the objectives of the study and that their participation was voluntary, in addition to guaranteed anonymity. All the questionnaires answered by the research participants were followed during the filling out as some guidelines, stimuli and questions asked by the participants in the discursive questions related to the

challenges encountered by the interviewees about the content covered in the discipline and the strategies used to help overcome such difficulties. Then the collected data were analyzed, formatting the results and analyzed using statistical calculations for the questionnaire questions through the interpretation of the answers.

4. Result and Discussion

The categorical characteristics of master's and doctoral students in the electricity engineering course are shown in table 1. Of the 15 students who participated in the survey, 66.7% were male, while 33.3% were female. Regarding the age group, 66.7% were between 24 and 29 years old, another 20% were between 30 and 35 years old, while 13.3% were older. In this way, it is clear that the relationship between men and women when choosing a postgraduate course in the exact field still exists a greater predominance of men, as well as the training public is made up mostly of young people. In this sense, Barbosa et al. [12] highlight that since the year 2000, graduate school has been increasingly attended by young students, indicating a direct transition from undergraduate to graduate school in an increasing way.

In relation to the basic training course, it is observed that only 26.7% of the interviewed students have a degree in the area of the postgraduate course they attend, while 73.3% are from related areas, such as computing, mathematics , physics, chemistry and other engineering, in which the majority (86.7%) studied at public institutions (federal or state). With the expansion of graduate courses in Brazil, Schwartzman [13] informs that it is not easy to know exactly the number of students enrolled in graduate school as a whole in the country, however 54% of students enrolled in the lato sensu modality are in private institutions, while strictu sensu graduate courses are mostly enrolled in public institutions.

Table 1 . Category of graduate students in electricity engineering (UFMA)

Characteristics	%	Frequency (n = 15)
Sex		
Male	66,7%	10
Female	33,3%	5
Age Range		
24 a 29 years	66,7%	10
30 a 35 years	20,0%	3
36 a 40 years	13,3%	2
Graduation course		
Electrical Engineering	26,7%	4
Mechanical Engineering	13,3%	2
Mechatronic Engineering	6,7%	1
Food Engineering	6,7%	1
Computer Engineering	6,7%	1
Computing	13,3%	2
Physics	6,7%	1

Mathematics	13,3%	2
Chemistry	6,7%	1
Type of Educational Institution		
Public	86,7%	13
Private	13,3%	2
Graduate (current)		
Master	53,3%	8
PhD	46,7%	7
Works		
Yes	33,3%	5
No	66,7%	10

Given the interviewees, 53.3% are studying for a master's degree, while 46.7% are studying for a doctorate in electricity engineering. The majority (60%) of these students say that they are in the course because it is their area of interest, 20% say that the postgraduate course in which they are taking is a personal achievement, another 13% say that there was no other course related to the training area and therefore opted for electricity engineering, while only 7% reported that it is a favorable area for the job market, since there is a narrowing of job opportunities, however, the expansion of schooling “becomes a possible choice among young people who are about to finish their undergraduate courses ”[14]. In addition, only 33.33% conciliate work with postgraduate studies, with 66.7% receiving scholarships from an institution that fosters research and scientific development.

Figure 1 shows the list of the main difficulties found in the subjects, reporting the level of learning, the methodologies addressed by the teachers and the main solutions found to elucidate the problems of learning in the classroom.

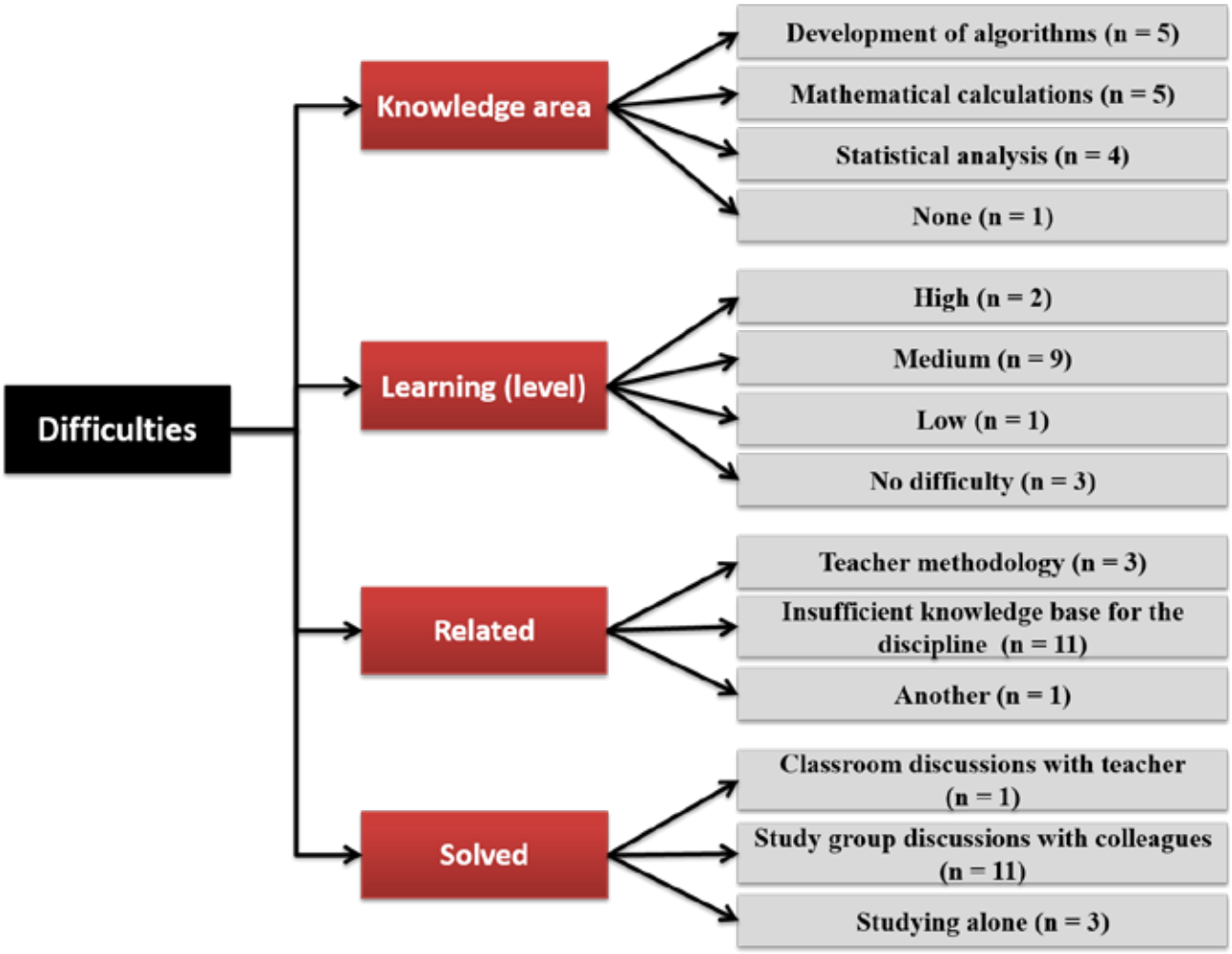

Figure 1 - Scheme of the relationship between the categories of difficulties in the disciplines

When asked about the difficulties found in the subjects studied, 66% reported that the subjects related to the development of algorithms and mathematical calculations have a higher degree of complexity of understanding, and for this reason, they become the subjects with the greatest option of difficulty, another 27% state that the greatest difficulty found is in the disciplines with a statistical analysis approach, while only one student said that there is no difficulty in relation to the disciplines. In this sense, the subjects most mentioned in the research as being the most complex to understand, during the course of the course, were Stochastic Processes and Non-Linear Systems Optimization. In fact, these subjects present an overload of mathematical calculations and complexity of algorithms, normally, the student needs a deep base of statistics and mathematical models, in which, many times, these contents are seen only in engineering courses. However, students who have basic training in another area experience difficulties in understanding in the first contact with the discipline, and normally the teacher leaves the responsibility for the student to seek knowledge alone.

However, with regard to learning difficulties in the subjects, the majority (60%) of the students reported that they are at a level considered satisfactory, in other words, they are at an average level of understanding of the contents, while only 27% reported there is little or no learning difficulty, in which it is observed that these students have training in mathematics or electrical and mechanical engineering courses, these courses

have a very deep curriculum in calculations and statistics, and thus, these students tend to understand better the calculations covered in the disciplines.

Another important aspect to mention is the methodology addressed by the professors, normally the graduate professor only presents the content in class, understanding that master's or doctoral students need to search for their answers alone, in articles, books, internet or journals. The methodology employed prepares the student to be a researcher, and there is not always the need for the teacher to fully untangle the content. In this sense, the students reported in the research that the greatest difficulty found in understanding the disciplines is not related to the teacher's methodology (20%), but to the insufficient knowledge base for the discipline (73%), which may be the reflection of poor training in the undergraduate course or even the lack of time for dedication of studies, linked by external work. Bujdoso [15] pointed out in his work some less pleasurable aspects of master's students in Civil Engineering, Medicine and Law courses, in which they highlighted the disciplines, the qualification exam, the lack of time, the accumulation of tasks, the waivers imposed by the master's and the concern about meeting the deadline as a key factor for the difficulties encountered in graduate school. In addition, it informs that the search for the master's degree is related to the supply of deficiencies detected during graduation.

However, when asked if the subjects taken were directly associated with their research, 33% revealed that there was no association with their research topic and the subjects taken were to fulfill mandatory credits for training in the course, while 27% stated that all disciplines have been or will be used in your research, so they are necessary to complement knowledge in order to develop your work plan. But not all subjects are necessary, according to the reports of 40% of the investigated students, they inform that depending on the research topic, there are often lack of subjects in the postgraduate course in which they are taking and that sometimes it is necessary to seek more knowledge in other postgraduate courses to complement the necessary knowledge. In this sense, 53% of respondents intend to seek other subjects in other graduate programs, while 47% reported that they are satisfied with the subjects taken.

Another important point is the relationship of the research with the basic training of graduate students, 67% of the students questioned affirm that there is no direct relationship with their research to basic training, and being the biggest challenge they found, reporting that the acquisition of the knowledge different from their basic training requires time and a lot of dedication, thus constituting the biggest problem to carry out their research. But this was already expected, since most of the students in this study are from areas other than the electricity engineering course, but related areas. For this reason, there are difficulties in triggering your research or the development of disciplines in the post-graduate course.

To solve the problem situation of the difficulty of understanding the subjects, mainly of students who have training in other areas of knowledge (or similar areas), they proposed discussions in study groups with colleagues (73%), who are usually the same research laboratory, while 20% solved their difficulties by studying alone, and only 7% went to the teacher to answer questions and ask necessary questions about the content covered in the classroom.

The *stricto sensu* postgraduate course is considered a difficult construction, which needs dedication and a basis for the development of knowledge throughout the years of study, this generates anxiety and anguish to develop your research, but which is rewarded by maturity , meetings and positive expectations.

5. Conclusion

Our findings provide some insights into the difficulties faced by graduate students in electricity engineering when taking the program subjects, especially those who have no basic training in electrical engineering, but in related fields. In this way, he was able to observe the influences caused by the difficulties linked by engineering master's and doctorate students to the progress of their research topics, as disciplines unrelated to research, but that needed to be studied in order to comply with the protocol in the post-graduate program. University graduate.

This study was based on a diverse sample of students with different degrees to understand how these difficulties can affect the research of master's and doctoral students in electricity engineering.

It was observed that the greatest difficulty of students is related to disciplines with deep calculations of mathematics and complexity of algorithms, in addition, most students do not complain about their level of learning and report that they have a medium level of knowledge, but that can improve with a little more effort. His biggest concern when attending a postgraduate course was the lack of basic training to attend the disciplines. However, the solution found by the students themselves was to meet in a study group to elucidate the difficulties faced, as the group study strengthens learning with a distribution of knowledge.

As future work, we intend to expand our analysis proposal, interviewing more students and collecting historical data to associate with the identified difficulties. We hope that our results can help teachers to identify the students' learning deficit related to the subjects taken, being able to outline new strategies to elucidate the problems faced by master's and doctoral students, thus reflecting on the development of the researches worked on.

6. Acknowledgement

We are grateful to all participants in the research at the Federal University of Maranhão, who made themselves available to answer the questionnaires so that this study could be developed.

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