



The Acquisition of Didactic-Pedagogic Skills by Higher Education Teachers

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ABSTRACT

The objective of this article was to identify the activities that contributed most to the acquisition of didactic-pedagogical skills by teachers of undergraduate courses in Civil Engineering, Computing, Electrical, Electronics and Mechanics on three campus of a public university in southern Brazil. The research methodology used was the mixed sequential explanatory design, in which quantitative data were collected and, subsequently, to deepen these results, interviews were conducted with professors. The main results show that the experience acquired in the day-to-day was the main source of contribution to the acquisition of didactic-pedagogical skills, although the Brazilian legislation predicts that the preparation for teaching in higher education takes effect in graduate courses.

KEYWORDS

Higher education. Professor training. University professor.

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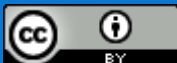
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A Aquisição de Habilidades Didático-Pedagógicas de Professores do Ensino Superior

RESUMO

O objetivo deste artigo foi identificar as atividades que mais contribuíram para a aquisição de habilidades didático-pedagógicas de professores dos cursos de graduação em Engenharia Civil, de Computação, Elétrica, Eletrônica e Mecânica em três *campi* de uma universidade pública do sul do Brasil. A metodologia de pesquisa utilizada foi o delineamento misto sequencial explanatório, no qual foram coletados dados quantitativos e, em seguida, para o aprofundamento destes resultados, foram realizadas entrevistas com professores. Os principais resultados mostram que a experiência adquirida no dia a dia consistiu na principal fonte de contribuição para a aquisição de habilidades didático-pedagógicas, apesar de a legislação brasileira prever que a preparação para a docência no ensino superior se efetive em cursos *Stricto Sensu*.

PALAVRAS-CHAVE

Ensino superior. Formação de professores. Professor universitário.

La Adquisición de Habilidades Didáctico-Pedagógicas de Docentes de Educación Superior

RESUMEN

El objetivo de este trabajo fue identificar las actividades que más contribuyeron a la adquisición de habilidades didáctico-pedagógicas de los docentes de los cursos de pregrado en Ingeniería Civil, Computación, Electricidad, Electrónica y Mecánica en tres campus de una universidad pública en el sur de Brasil. La metodología de investigación utilizada fue el diseño mixto secuencial explicativo, en el que se recopilaron datos cuantitativos y luego, para profundizar estos resultados, se realizaron entrevistas con los docentes. Los principales resultados muestran que la experiencia cotidiana fue la principal fuente de contribución a la adquisición de habilidades didáctico-pedagógicas, aunque la legislación brasileña establece que la preparación para la enseñanza en la educación superior es efectiva en los cursos *Stricto Sensu*.

PALABRAS CLAVE

Enseñanza superior. Formación de profesores. Profesor universitario

Introduction

The need for changes in didactic practice in higher education is a recurring theme in studies developed by several authors in the area of higher education didactics (ABREU; MASETTO, 1980; ANASTASIOU; ALVES, 2006; CASTANHO, 2000; CUNHA, 2004; GIL, 2013; GODOY, 2000; MASETTO, 2003; PEPPER; ANASTASIOU, 2014). Many studies discuss the need for teachers to adopt teaching and assessment methodologies that will surpass the traditional methodology, where the mechanical transmission of knowledge to be memorized and the guarantee of order in the classroom were the main functions of the professor.

According to Vest (2006), for the 2020s, the teacher needs to advance from the “wise man on stage to the guider on the side”, for team project development, open problem solving, experiential learning, for research engagement and the philosophy of designing, planning, implementing and operating. These changes impact directly on teacher's action because in order to do that it is necessary to transform perceptions about teaching objectives, how to teach, about the planning of subjects matter, and about how to conduct the classes.

However, when we take into consideration all those needs for changes and also the fact that in Brazil, to work in higher education teaching, there are no requirements related to didactic-pedagogical training, it is important to discuss the main activities that contribute for the acquisition of didactic-pedagogical skills for teaching in higher education.

2 Acquisition of Teaching Skills for Higher Education

Currently the Law of Guidelines and Bases of National Education (Law 9394/96), provides that the preparation for teaching in higher education will be done preferably in postgraduate programs. On the other hand, for CAPES (Coordination for the Improvement of Higher Education Personnel), this preparation should be accomplished through teaching internship¹, which the agency consider “an integral part of postgraduate education, aiming at the preparation for teaching, and the qualification of undergraduate education” (Art. 18, CAPES, 2010, p. 31). However, in practice, what happens is that the teaching internship is mandatory only for students who have scholarship, and are not teachers yet. That is, students who do not have scholarship and who entered higher education teaching before starting masters and / or doctorate courses are exempted from the teaching internship (Art. 18, item VII, CAPES, 2010, p. 31). Moreover, according to researchers dedicated to studies in the area of teacher training (ALMEIDA, 2012; AMBROSE; NORMAN, 2006; BATISTA, 2011; PIMENTA; ANASTASIOU, 2014), the postgraduate programs in Brazil have their attention focused mainly for the training of researchers and not teachers.=

¹ The guidelines for conducting the teaching internship are set out in the Social Demand Program (DS) Regulations, approved by Ordinance 076 of April 14, 2010 - CAPES (CAPES, 2010). This program seeks to promote the training of high-level human resources by granting scholarships to students of *Stricto Sensu* postgraduate courses. One of the criteria for granting the scholarship is the accomplishment of teaching internship.

Specifically about teaching in engineering education, Dantas (2014) states that the idea that still prevails is that to teach in engineering, just being an engineer is enough, and that to teach classes for adults, there is no need to worry about didactic aspects. Dantas (2014, p. 510) also reports in his studies that “85% of professors did not experience a specific didactic-pedagogical preparation to work with teaching” and that their practices in classroom are mainly based on the recognition of their vocation and the practical knowledge they develop within the institution, not being the didactic-pedagogical preparation of the professors, object of reflection. As a result, teachers tend to work using the pedagogy of practice built into daily life, although they recognize that practice alone is not enough for professional development.

For Suhr (2008), teaching activity in higher education requires specific knowledge to be properly exercised. However, teachers often have few moments of dialogue, exchange of pedagogical experiences that could be significant for teaching practice and the quality of teaching. These conditions tend to favor the teacher's isolation, who in turn base his practice on experiences as students and on common sense. Regarding the effectiveness of the exchange of information between fellow professors, there are divergent thoughts. According to Madeira and Silva (2015, p. 36), “the advice or guidance of the most experienced teachers on how to conduct teaching is of little use, unless it is an official tutelage”, given the wide variety of didactic situations. For Marcelo² (1999 *apud* PRYJMA; OLIVEIRA, 2016, p. 853), the support of more experienced colleagues is a factor of improvement and “can be seen as essential for the professional development of teachers, as it expands the repertory of teachers’ theoretical knowledge related to didactics”.

3 Methodology and Procedures

3.1 Study Design

The results presented in this paper are part of the results obtained in a larger study, which investigated the teaching and assessment strategies used by teachers involved in the training of engineers.

Given the breadth and complexity of the subject, a mixed method approach was used for the development of the study (TASHAKKORI; TEDDLIE, 2003), which is a procedure to collect, analyze and mix or integrate quantitative and qualitative data at some stage of the study research process in a single study (CRESWELL, 2005). The justification for mixing both types of data is that neither quantitative nor qualitative methods are enough to capture trends and details of situations. When used in combination, quantitative and qualitative methods complement each other and provide a more complete picture of the research problem (GREENE; CARACELLI; GRAHAM, 1989; JOHNSON; TURNER, 2003).

² MARCELO, C. **Professor education:** for an educational change. Porto: Porto Publisher, 1999.

The research design used was the explanatory sequential, developed in two distinct phases (CRESWELL; PLANO CLARK *et al*, 2003). In this design, quantitative (numeric) data is collected and analyzed first, while qualitative (text) data is collected and analyzed in sequence and helps to explain or elaborate the quantitative results obtained in the first phase. The priority (CRESWELL; PLANO CLARK *et al*, 2003) in the study was given to the qualitative approach, which focused on detailed explanations of the results obtained in the first, quantitative phase.

3.2 Population and Sample

The target population of this study was 396 professors of professional and specific subjects matter from the undergraduate courses in Civil Engineering, Computing, Electrical, Electronics and Mechanics of three campuses of a public university in southern Brazil. The quantitative phase sample consisted of 199 professors selected through non-probabilistic judgment sampling. The qualitative phase participants were 17 intentionally selected professors, taking as reference the quantitative phase participants and using the maximum variation sampling strategy.

4 Quantitative Phase

In the quantitative phase of the study, data were collected from a cross-sectional survey applied in the first half of 2015, using a closed questionnaire as a research instrument. The applied questionnaire, an adaptation of the instrument used by Moreira, Gravonski and Aranda (2012), is composed of three Likert scales, which aim to evaluate different aspects related to teaching strategies, assessment and didactic-pedagogical skills acquisition.

In this article we will report only the results obtained with the Didactic-Pedagogical Skills Acquisition Rating Scale (DPAR). This scale was subdivided into two sets of variables. The first set refers to the importance given to activities that can contribute to the acquisition of didactic-pedagogical skills, consisting of 5 points, with anchors in: 1 (Not important), 2 (Not very important), 3 (Important), 4 (Very important) and 5 (Extremely important). The second set refers to teachers' agreement on aspects related to the acquisition of didactic-pedagogical skills, consisting of 5 points, with anchors at 1 (Strongly disagree), 2 (Disagree), 3 (I have no opinion), 4 (Agree) and 5 (Strongly agree).

Demographic information and participant responses were analyzed using descriptive statistics procedures from the Dell Statistics software, version 13.

4.1 Presentation and Analysis of Quantitative Results

The study participants were compared on the following demographic characteristics: *campus*, gender, time spent in higher education, type of degree and academic degree. Typical participants were predominantly male (85%), in advanced teaching professional internship (49%), bachelors (93%) and doctoral degrees (65%) (see Table 1).

Table 1. Characteristics of the quantitative phase sample

Variable	Category	Quantitative Phase (n = 199)
Campus	Campus 1	101 (51%)
	Campus 2	71 (36%)
	Campus 3	27 (14%)
Gender	Female	30 (15%)
	Male	169 (85%)
Performance time in higher education	Early stage (0 to 5 years old)	59 (30%)
	Intermediate stage (6 to 12 years old)	42 (21%)
	Advanced stage (13 years or above)	98 (49%)
Graduation Type	Bachelor degree	186 (93%)
	Technology	13 (7%)
Highest Academic Degree	Graduation/Specialization	12 (6%)
	Master's degree	57 (29%)
	doctorate degree	130 (65%)

Source: Own elaboration (2016).

The results of the first set of DPAR variables, which refer to the respondents' manifestations regarding the importance of activities that can contribute to the acquisition of didactic-pedagogical skills, are presented in Chart 2. It can be observed that most respondents indicated that the acquisition of pedagogical skills for teaching in higher education takes place mainly informally through the “daily experience” and the “observation of teachers” during their experiences as students (learning from observation). These results corroborate the results presented in studies by several authors, such as Dantas (2014), Cunha (2004), Luz and Moreira (2015) and Suhr (2008).

The item “*Stricto Sensu Preparation*”, considered by the Law of Guidelines and Bases of National Education (BRAZIL, 1996), as a priority in the preparation for the exercise of higher teaching, was marked as “important” and “very important” by most respondents. This result is in line with the results obtained in studies developed by Dantas (2014), in which 98% of engineering course teachers answered that the activities they develop as researchers have contributed to improve the teaching activity.

However, it should be considered that teachers often assess that improving their specific knowledge makes them better teachers or that they have learned a lot from teachers they were involved in postgraduate programs, which does not determine that those programs have complied with its formative function for teaching in higher education, as provided for in Brazilian law.

Table 2. Importance attached to activities that may contribute to the acquisition of didactic-pedagogical skills - Frequency (%)

Item	Not important	Not very important	Important	Very Important	Extremely important	Sequence
Everyday experience	1(1%)	1(1%)	24(11%)	59(30%)	114(57%)	1
Observation of teachers	1(1%)	7(4%)	26(12%)	62(31%)	103(52%)	2
Lato Sensu Training	8(4%)	9(5%)	53(26%)	54(27%)	75(38%)	3
Exchange of information with colleagues	4(2%)	9(5%)	56(28%)	80(40%)	50(25%)	4
Individual Studies	14(7%)	28(14%)	76(38%)	52(26%)	29(15%)	5
Trial and error strategies	15(8%)	29(14%)	86(43%)	47(24%)	22(11%)	6
Continuing Training Courses	42(21%)	38(19%)	66(33%)	29(15%)	24(12%)	7
Lato Sensu Training	71(36%)	37(19%)	48(24%)	25(12%)	18(9%)	8

Source: Own elaboration (2019).

The “exchange of information with other colleagues”, “individual studies” and “trial and error strategies”, likewise considered as informal activities, were marked by most respondents as “important” or “very important” (Table 2).

The respondents also pointed out that “continuing education courses” had “little importance” for didactic-pedagogical training and contributed “little” to the acquisition of didactic-pedagogical skills. Among the activities related in the questionnaire, the “Lato Sensu formation” was considered by teachers the one which contribute least to the acquisition of didactic-pedagogical skills. However, it is important to consider that the study participants' responses to these activities were relate to their own experiences, so that more or less participation in courses may have influenced the responses.

Table 3 shows the results of the second set of DPAR variables that refer to teachers' agreement or disagreement regarding aspects related to the acquisition of didactic-pedagogical skills.

The results show that the majority of respondents indicated that they “agree” or “totally agree” that the mastery of the didactic-pedagogical questions is essential for their daily teaching performance in classroom and that the didactic-pedagogical knowledge they have is “adequate” and “sufficient”, which, in short, means that the acquisition of didactic-

pedagogical skills informally, in the opinion of most respondents, has been enough to teach in higher education.

Table 3. Professors' agreement on aspects related to the acquisition of didactic-pedagogical skills - Frequency (%)

Item	Strongly disagree	Disagree	I have no opinion	Agree	Strongly agree	Sequence
Essential for teaching performance	1(1%)	24(12%)	21(11%)	98(49%)	55(27%)	1
Suitable for professor training	3(2%)	24(12%)	20(10%)	122(61%)	30(15%)	2
Sufficient for teaching performance	8(4%)	64(32%)	28(14%)	76(38%)	23(12%)	3

Source: Own elaboration (2015).

5 Qualitative Phase

The second phase of the study was qualitative. According to Moreira and Caleffe (2008, p. 73), this research model “explores the characteristics of individuals and scenarios that cannot be easily described numerically. The data is often verbal, and is collected by observation, description and recording. The qualitative phase in an explanatory sequential mixed project is intended to assist the interpretation and explanation of the results arising from the initial quantitative results (CRESWELL; PLANO CLARK, 2013; SAMPIERI; COLLADO; LUCIO, 2013).

The interview protocol used was elaborated from the observation of the results obtained in the quantitative phase, and questions were formulated aimed to know or understand in greater depth what had already been objectively answered in the quantitative phase. The protocol consisted of five blocks of questions: 1 - Initial questions; 2 - Teaching process; 3 - Teaching strategies; 4 - Evaluation strategies; 5 - Acquisition of didactic-pedagogical skills. In this paper only the answers that refer to the acquisition of didactic-pedagogical skills will be discussed.

The data collection technique used was the semi-structured individual interview. The interviews were conducted in the second semester of 2016, with 17 professors who participated in the first phase of the study and expressed interest in participating in the second phase. With the intention of “capturing the various variations in the sample and identifying common patterns” (MOREIRA; CALEFFE, 2008, p. 175), an intentional sample of maximum variation was used to select participants. Each interview was audio recorded and fully transcribed.

The number of participants in the qualitative phase was not defined a priori, because according to Bogdan and Biklen³ (1994 *apud* MOREIRA; CALEFFE, 2008), the number of participants is determined by “data saturation”, that is, the moment of data collection where the results become redundant.

To verify the validity of the data, the members checking strategy was used, also known as informant feedback or respondent validation, that is, the interview transcripts were sent to the interviewees to read and verify the authenticity of the information (MOREIRA, 2017).

To analyze the qualitative data, the constant comparative method was used (CHARMAZ, 2009; LEITE, 2015). The method involves the following steps: a) reading and rereading the interview transcripts and notes; b) code creation; c) comparisons and groupings of codes into preliminary categories of similar opinions; d) connection of preliminary categories; e) interpretation and discussion of categories.

5.1 Presentation and Analysis of Qualitative Results

Considering that the participants of the second phase of the study were intentionally selected from a perspective of maximum sample variation, the sample characteristics were very similar to those of the first phase. The typical participants were predominantly men (76%), in advanced teaching professional internship (42%), bachelors (94%) and doctoral degrees (70%). Chart 4 shows the demographic characteristics of the sample (see Table 4).

Table 4. Sample characteristics of the qualitative research phase

Variable	Category	Quantitative Phase (n = 17)
Campus	Campus 1	9 (53%)
	Campus 2	5 (29%)
	Campus 3	3 (18%)
Gender	Female	4 (24%)
	Male	13 (76%)
Career Stage	Early career stage (0 to 5 years old)	5 (29%)
	Mid-career stage (6 to 12 years old)	5 (29%)
	Late career stage (13 years or above)	7 (42%)
Graduation Type	Bachelor degree	16 (94%)
	Technology	1 (6%)
Highest Academic Degree	Graduation/Specialization	3 (18%)
	Master's degree	2 (12%)
	doctorate degree	12 (70%)

Source: Own elaboration (2016).

³ BOGDAN, R.; BIKLEN, S. Sociological paradigms and organizational analysis. London: Heinemann, 1979.

From the interview analysis process, five categories of analysis emerged: “The beginning of the teaching career: different paths, difficulties in common”; “The acquisition of didactic-pedagogical skills: the main sources of knowledge found by teachers”; “The definition of teaching and assessment strategies used: main influences”; “Implications of different understandings and ways of using teaching strategies”; “The practice of assessment in engineering courses: between the perspectives of traditional and formative assessment”. In this article we will present the results of the category “The acquisition of didactic-pedagogical skills: the main sources of knowledge described by teachers”.

5.2 The Acquisition of Didactic-Pedagogical Skills: The Main Sources of Knowledge Found by Professors

Regarding the main means used by professors, at the beginning of the teaching career, to acquire didactic-pedagogical skills, twelve (12) study participants mentioned that colleagues’ was the main source of guidance received regarding didactic-pedagogical issues. The I5 report exemplifies the opinion of the participants:

I asked a lot of help from my colleagues who had already been teachers. I used to ask: “How do you do it? How is it? What do you think? What do you guys suggest?” So it was like that, a lot of talking, exchanging experiences (I5, Civil Engineer)

In addition to colleagues offering help in different ways, such support also varied with the experiences and conceptions of colleagues with whom newcomers exchanged ideas.

Therefore, although the help of colleagues is an important resource for beginning teachers, not always the suggestions provided were contributions to the development of didactic proposals committed to student learning. The I7 account shows how the “tips” provided by colleagues guided their early career stage:

I had that concern: “I have to create content to teach two classes,” and it stressed me out. A day before the class, it was very stressful. I had to prepare a lot of material and I prepared it in a notebook, in my hand, to write on the board. So one of the things I was told at the time was, “Write a lot on the board that it kills time.” So I would go there and write on the board to kill time. We had no pedagogical orientation and were a bunch of engineers who went to teach (I7, Electronic Engineer).

In this report, it is possible to see what Woods⁴ (1990 *apud* BOA SORTE, 2015) calls the practice of the “survival” didactics, based on drowning, the anxiety of filling the classroom time with some kind of activity. Faced with the insecurity inherent in the exercise of a function previously unknown, the resource was to seek help from fellow newcomers, who were similarly, building their didactic practices based on common sense and trial and error. Given this, the suggestions of colleagues, although, at first, helped the teacher to overcome some of the early career difficulties, did not prioritize the learning of students.

⁴ WOODS, P. **Teacher skills and strategies**. London: The Falmer Press. 1990.

On the other hand, the experience reported by I14 shows that the suggestions provided to him by other colleagues led to a didactic practice in which there was a greater concern with student learning:

I talked to colleagues. Even a colleague here who said: “Oh, ask some questions that students will answer, developing their thinking” (I14, Civil Engineer).

The guidance provided to I14 was towards the adoption of pedagogical practices more focused on the development of students' thinking, promoting more active participation in the activities and not just the use of tricks to “fill classroom time”.

The two reports above, I7 and I14, exemplify how varied suggestions and guidance from colleagues can lead to different teaching practices that certainly influence the attitude of new teachers. According to Marcelo⁵ (1999 *apud* PRYJMA; OLIVEIRA, 2016), the support of more experienced colleagues is a factor in the improvement of teaching work, but when the support is only found in colleagues who are also facing difficulties inherent to the beginning of their career, there is no exchange of ideas based on robust experiences already experienced as professors, but only exchange of opinions arising from experiences as students and from the common sense.

Regarding the issue of exchange of information with colleagues as a way of learning and improvement, I also asked to the participants: “Do you have the opportunity to talk about didactic-pedagogical issues with your colleagues and/or with course coordinators?” Seventeen (17) teachers answered that, in general, meetings are not held in by course coordinators or academic departments, with the purpose to talk about didactic-pedagogical questions. According to the report of twelve (12) and seventeen (17) respondents, what happens occasionally, quite informally and spontaneously, are “chats” or conversations between colleagues, in order to exchange ideas about didactic aspects or content and objectives of each discipline. Some of the questions teachers used to clarify doubts on these informal conversations were: “How do you do it?” “How do you rate it?” “Do you apply retake tests?” “What content do you work on?” The I5 report, below exemplifies, how those information exchanges had normally occurred between teachers:

It occurs among teachers in our area.. In engineering there is the area of structures, so we ask to colleagues: “How do you do it?” “I don't understand that. How do you think it could be?” “We have a lot of that. We have meetings in the department, but there are no discussions focused on didactic-pedagogical aspects. That's something the group or the person will have to look for (I5, Civil Engineer).

The exchange of ideas between colleagues has a very informal character and happens between teachers of the same subjects matter or related areas if there is interest and affinity, that is, they are initiatives of the teachers themselves, without prior structuring and without institutional involvement.

⁵ MARCELO, C. **Professor education**: for an educational change. Porto: Porto Publisher, 1999.

Of these twelve (12) professors, only the I12 reported that the exchange of ideas on pedagogical issues among colleagues in the same area is stimulated by the head of the academic department to which they belong:

Here in the Department we have a lot of information exchange with colleagues. I have a colleague that develops activities with me, we exchange ideas about what we will use or not in the evaluation, what topics we are working on, etc. So we exchange many ideas. Always in the pedagogical week, where we plan, the activities. there is guidance coming from the leader: "look, exchange information about the teaching plans". [...] "Exchange, talk, to know if they are speaking the same language". We have this concern a lot. It's our particular thing here, you know, to have the same attitudes (I12, Economist).

Even with the encouragement of the leader of the academic department, moments of idea sharing among colleagues are not structured in advance to promote in-depth guidance or debate. What happens are exchanges of experiences and planning activities together.

In contrast, the other five (5) teachers reported that didactic-pedagogical questions are not discussed, even with colleagues. Only three (3) of the seventeen (17) professors interviewed mentioned discussions on this topic in lectures or courses offered at the beginning of school periods, at times called "Pedagogic Week". These results corroborate the arguments presented by Dantas (2014) that the didactic-pedagogical preparation of teachers is not an object of reflection among these professionals.

To identify the opinion of the professors interviewed about the importance of discussions on didactic questions, I asked to the study participants: "Do you currently consider important the actions by the institution to promote discussion of pedagogical aspects?" Of the seventeen (17) interviewed, fifteen (15) answered yes and even suggested ways for the institution to develop actions in this regard.

The actions suggested by the teachers were: individual guidance provided by the department or by pedagogues; promotion of discussions about the institution's objectives, the course, teaching and didactic issues in academic departments; the performance of the Structuring Teaching Center of each course, with students and teachers, to broaden the understanding about the objectives of the course; the promotion of courses in the area of higher education methodology taught by pedagogues and also by engineer teachers; the observation of classes of more experienced colleagues; the organization of moments of exchange of experiences between early career professors and well-evaluated professors on didactic aspects; the organization of pedagogical structures in the academic departments, to accomplish the teaching activity and offer guidance; and the provision of a support structure for the elaboration of didactic material. Teachers' suggestions are exemplified by the I16 report.

I think we need training, not only on how to teach, but also on how to evaluate. These two things. We need to discuss how to teach and how to evaluate. The students are not all the same. The way you teach may work for some students, but not for others, and you have to find a way to make to reach everyone. So, I think we need training. (I16, Mechanical Engineer).

Reports of institutional support for pedagogical issues show two important aspects. The first refers to the fact that most of the teachers interviewed consider this type of action important and necessary, although they already have some years of experience in the classroom. The second concerns the different actions suggested, which show different needs and expectations, certainly arising from different experiences and contexts.

Only two (2) teachers stated that they do not consider the didactic-pedagogical support needed today, considering that, with the acquired experience, their knowledge is enough and adequate to teach. Let's look I11 opinion on this issue:

I think at this point that I am now, no it is not necessary. By the time I entered, if I had not had the support of colleagues, I would have missed it. (I11, Bachelor of Computer Science).

The experience acquired in teaching, due to the years of teaching, was important for the professional improvement of the I11 and the other participants of the study. In this regard, the reports of the seventeen (17) respondents reveal that the experience gained in years of working in the classroom made contributions, and was considered the main source of teacher learning.

The aspects that stood out most in the teachers' answers regarding these contributions relate to the experiences they had with the application of various teaching strategies, in order to recognize those experiences that generally “work” or “do not work” in certain situations and about conducting the classes, the way they speak, explain, guide etc. Let's look at I2's report:

I heavily rely on disappointments. So, I know that that way is not always working and then I try to find alternatives. It's almost trial and error. This is not 100% because you know that with certain students, it won't work. Then you try to change a little. When the class starts participating more, you go further (I2, Mechanical Engineer).

Everyday life in the classroom provides teacher with a wealth of knowledge related to the teaching strategies used, the subjects matter they teach and also the general characteristics of the students, which over time constitute a repertory of information that facilitates the definition of which practices are best suited to each situation. This translates into a continuous and uninterrupted process of teaching learning, given that each new school period, the classes and often the subjects are renewed. For Tardif (2014, p. 51), teaching experience tends to become a “personal way of teaching, in tricks of the profession, in habits, characteristics of professional personality”.

Another aspect identified as change, due to classroom experience, is the fact that teachers are now using teaching dynamics and strategies that enable more active student participation. The I14 report exemplifies this change:

I have to confess that at the beginning, it was comfortable for me to have my classes ready in PowerPoint and give that content all day. "I did my part: period." But, I began to realize that this kind of class does not have much return and was not the goal of teaching either. I saw that the students could not assimilate the content. So,

sometimes I prefer not to give all the content, but to give them exercises. So the class, for me too, started to get lighter, not so heavy. Because you also pass on to the students and they assimilate more. You see they like it better and you don't have to tell a joke for them to pay attention. By itself, placing the students as part of the class make them pay more attention (I14, Civil Engineer).

The confidence acquired as a result of the experience led the teachers cited above, with the perception of the students' difficulties to assimilate the contents, to expand the communication through strategies that allowed the discussion and the exchange of ideas. Reports also indicate that teachers regard this change as positive for their learning.

In addition to the aspects already discussed so far, the adoption of more flexible attitudes in conducting the subject matter, classes and assessment were also identified as a change due to classroom experience. This is clear from the I17 report:

I used to be more strict, less malleable in terms of assessment. And I think that nowadays I don't work like that anymore. I think that's not the right path. I really changed a lot (I17, Civil Engineer).

In everyday classroom practice, teachers who, at the beginning of their careers, had more directive and rigid attitudes, became more flexible, both regarding the planning and the evaluation criteria adopted.

In addition to the contributions related to didactics, the teaching experience also brought contributions related to the content of the subjects. This was observed in the report of seven (7) participants who mainly referred to the identification of issues considered fundamental or most important in the subject matter and for the ordering of the contents. The I8 report exemplifies how teaching experience contributed for him in this regard:

Of course it has changed a lot from the first version. I'm in the third, third semester with this discipline. The ordering of the contents is already totally different from what I had originally thought. But I learned by doing. So I did the first time, I saw what worked and what did not work., I got better, I got better again. Probably for the next semester there will be some minor changes, but the number of changes has been falling (I8, Economist).

The teaching experience provided the knowledge that allows him to make adjustments, as to what should be emphasized, suppressed, prioritized and also as to the logic established in the ordering of contents, in order to facilitate learning.

In addition to exchanging information between colleagues and teaching experiences in the classroom, another issue analyzed was the contribution of the postgraduation programs (*Stricto Sensu*) to learning. The results of the quantitative phase revealed that the teachers considered that this level of education was important for the acquisition of didactic-pedagogical skills. Given this, I asked them: "In what aspects did the *Stricto Sensu* training contribute to learning didactic-pedagogical questions?" This question was only asked to the fourteen (14) participants in the study who completed their postgraduate programs. The other three (3) professors did have doctoral degree, only master degree.

In their answers, each interviewee listed several contributions that were grouped into four aspects related to attitudes; scientific methodology; technical/scientific knowledge, and teaching practice.

The attitudinal contributions, mentioned by nine (9) of the fourteen (14) professors, refer to the professor's behavior in classroom, procedures such as self-confidence, self-learning, the ability to discuss and to argue, the perception of knowledge limitation and the ability to withstand moments of pressure. The reports of I16 and I7 are representative of the opinion of the other teachers and exemplify how attitudinal changes influenced the daily classroom lives of these teachers:

The doctorate boosts confidence, so to speak, I don't know if self-esteem is the right word, but it gives me more authority. Even if you are not teaching a discipline in that particular area that you searched for a doctorate, it gives you more authority, even if it is formal. Of course, higher authority is not what it will give, but I felt more self-confident (I16, Mechanical Engineer).

For me, the postgraduate program contributed to the aspect that I became more self-taught. So I can better qualify for my subjects matter, I can look for things without having to wait for some material. Therefore, it was fundamental (I7, Electronic Engineer).

Regarding the attitudinal contributions mentioned by the teachers interviewed, it is important to note that they are personal. They are not specifically related to teaching practice, pedagogical knowledge, not even technical-scientific knowledge, but, according to the reports, they positively altered teachers' professional classroom daily life.

Regarding the technical-scientific knowledge, contributions were reported by six (6) teachers. That is, the main aspects mentioned were the expansion of scientific knowledge and also the perception of relationships between different disciplines and areas of knowledge. This is exemplified in the I5 report.

The main contribution was in terms of scientific knowledge, content and also linking knowledge, to realize that the subject is not just it. "Not only that. How is that knowledge going to get in there, even in engineering, inside structures?" (I5, Civil Engineer).

To I5, the masters and doctorate courses collaborated so that he could expand and establish relationships between different subjects matter, in order to gain a broader view on the application of the contents taught. This, in his opinion, contributes to the development of classes and, consequently, to the expansion of student learning.

In the contributions related to the exercise of teaching, the answers of four (4) teachers were grouped, which concern the "being" and the "know-how" of the teacher. Let's look at the I14 report on that makes reference to these contributions:

When I started to do my master degree, I thought about specializing in the market. But then, I did the teaching internship, I saw the opportunities and ended up, during the doctorate, finding myself as a teacher. I started to observe the teachers in the program, what a higher education does, and concluded: "I will do my doctorate and then become a teacher" (I14, Civil Engineer).

Observations of the teachers in the postgraduate programs provided these teachers the right identification with teaching activity as a result of the experiences and observation of different professional attitudes adopted by those postgraduate teachers.

Regarding the contributions related to scientific research, the ability to distinguish between what is and is not a scientific production, to develop research and to write texts following scientific criteria were mentioned by two (2) of the participants in the study. The I12 report illustrates this opinion:

Separating the scientific from the opinion. It's different. Using the methodology. These were things that I essentially learned in my master and doctorate degrees. So it was very important for my training and even to learn how to guide the work, to be able to guide the writing of articles, to be able to choose and select reading material for my students (I12, Economist).

The evidence, from the teachers' reports, showed that the contributions of the postgraduate programs (*Stricto Sensu*) for teaching training do not constitute teachers' professional knowledge⁶, but rather contributed to personal attitudes toward teaching, to improve their experiences, that end up composing, even indirectly, teachers' "being" and "doing".

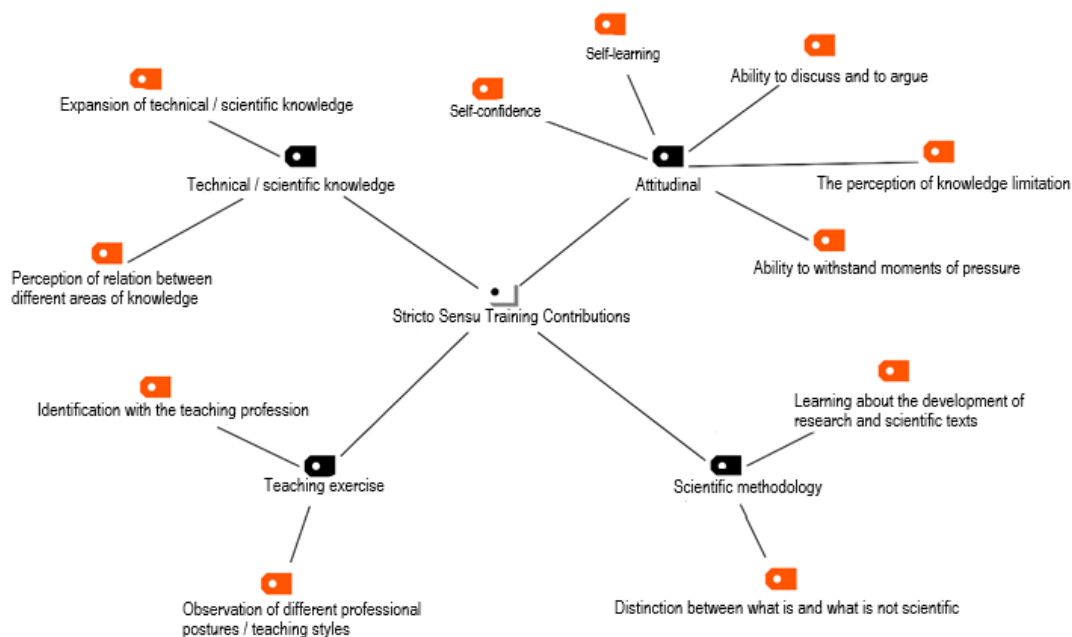
However, it is important to consider Gimeno Sacristán's (2010) point of view, that the building of teaching professionalism⁷ is formed from a composition between personal and professional experiences. Thus, many experiences, although not teaching the teacher how to "teach", bring contributions to teaching practice.

To summarize the participants' responses regarding the contribution of postgraduate programs (*Stricto Sensu*) to the didactic-pedagogical skills acquisition mentioned by the interviewed professors, a scheme is presented in Figure 1.

⁶ For Tardif (2014), knowledge of vocational training refers to the set of knowledge that, based on science and scholarship, is transmitted to teachers during the training process. It is also constituted as knowledge of vocational training pedagogical knowledge related to teaching techniques and methods (know-how), scientifically legitimized and also transmitted to professors throughout their training process.

⁷ For Gimeno Sacristán (1993, p. 54 *apud* CUNHA, 2010, p. 31) professionalism is "the expression of the specificity of teachers' performance in practice, that is, the set of performances, skills, knowledge, attitudes and values related to them that constitute the specifics of being a professor".

Figure 1. Postgraduate training and didactic-pedagogical skills acquisition



Source: Own elaboration (2017).

In summary, although the help of colleagues and postgraduate programs training are considered by teachers as sources of information and learning, teaching experience is still considered the main source of knowledge for the acquisition of didactic-pedagogical skills.

6 Integration of Results

Regarding the acquisition of didactic-pedagogical skills to teach in higher education, the quantitative results showed that most of the participants considered the daily experience in the classroom “very important” or “extremely important”.

By deepening this issue with the participants in the qualitative phase, the reports showed the same result, showing that the experiences lived as teachers are the main source of learning the didactic-pedagogical aspects to teach in higher education. The teachers' reports also showed that the main contributions of learning through the teaching experience are directly related to the didactics and the contents to be taught.

Regarding didactics, the experience in the classroom allowed teachers to more easily recognize the appropriate strategies for certain situations, to acquire more confidence in conducting classes, in the way they speak, explain and guide students. Moreover, with the experience gained in everyday classroom life, most teachers started to develop classes, where the dialogue between them and students is more frequent, to adopt more flexible attitudes in the conduction of their subject matter, to use teaching strategies that allowed a greater involvement of students in the teaching-learning process and to promote activities that require more than memorization and repetition.

As for the contents taught, the main contributions mentioned in the reports were the identification of contents considered fundamental or more important in the subject and the organization of these contents in order to facilitate students' learning.

In relation to the “observation of other teachers”, 83% of the teachers considered as “very important” or “extremely important”. In the second phase (qualitative) the teachers interviewed, mentioned that it was the main source of didactic-pedagogical knowledge when they are at the beginning of their careers.

Another activity that was considered as “very important” for the acquisition of didactic-pedagogical skills by 65% of the professors in the first phase of the study was the postgraduate training. However, the results of the qualitative phase deepened this issue and showed that the contributions of this training do not relate to the acquisition of specific teaching knowledge, but to attitudinal aspects, the expansion of technical-scientific knowledge, the identification with the teaching practice and to the acquisition of knowledge related to the scientific research, which positively affect the daily classroom practices.

The exchange of information with colleagues to acquire didactic and pedagogical skills was also considered very important for 65% of respondents in the first phase of the study. Findings from the second phase are in line with these results, given that colleague's help was reported by twelve (12) professors as the main source of early career guidance. However, the reports also showed that, despite being an important resource for beginning teachers, help varies according to the experiences and conceptions of colleagues, not always contributing to a teaching practice aimed at student learning.

Other activities, such as individual studies, participation in continuing education courses and Lato Sensu training, both in the first and second phase of the study, were considered by teachers as less important for the acquisition of knowledge related to teaching practice. However, it is noteworthy again to emphasize that these perceptions refer to the personal experiences of the study participants and may not reflect the contribution of individual studies, continuing education and Lato Sensu training to the acquisition of didactic-pedagogical skills in a broader perspective.

Indeed, it should be noted that teacher's experiences with new teaching and assessment strategies on the basis of trial and error, and, in the face of unsatisfactory results, they return to strategies which they have greater mastery and confidence, that is, traditional mechanistic methodologies.

The set of quantitative and qualitative results shows that it was the daily, informal experiences that constituted the main source of knowledge for teaching practice. Ironically, the teachers, who prepare so many professionals, who care for the scientific training of their students, end up building their own profession, the teaching profession, basically based on common sense, without scientific backing regarding pedagogical issues. Table 5 below summarizes the main results of the two phases of the study regarding the acquisition of didactic and pedagogical skills.

Table 5. Main activities for the acquisition of didactic-pedagogical skills - results of the quantitative and qualitative phases of the study.

Activities that contributed to the acquisition of didactic and pedagogical skills	Quantitative Phase	Qualitative Phase
	Frequency of professors who consider “important” or “extremely important (n = 199)	Summary of qualitative findings (number of answers / number of professors)
Everyday experience in the classroom	87%	The daily classroom practice of teaching and years of work in the classroom made contributions mainly in relation to didactics (17/17)
Teachers Observation	83%	The strategies experienced as a student were the main sources of didactic-pedagogical knowledge at the beginning of their careers (17/17)
Postgraduate Training	65%	The contributions of this training do not relate to the acquisition of specific knowledge of the teacher training courses, but to attitudinal aspects, the expansion of the technical-scientific knowledge, the identification with the teaching exercise and the acquisition of knowledge related to the scientific research, which positively affect the daily professional teaching (14/17)
Exchange of information with colleagues	65%	Considered as the main source of early career guidance on didactic-pedagogical issues (12/17)

Source: Own elaboration (2017).

Teachers recognize, however, that to become a teacher is not enough to have scientific mastery of their areas of training. According to the results of the first phase of the study, most teachers agree that mastery of didactic-pedagogical issues is essential to teach in higher education, and that the didactic-pedagogical knowledge they possess is adequate to teach. This perception of adequacy was also identified in teachers' reports (qualitative phase), when they referred to the difficulties faced at the beginning of their careers and how they overcome this with the experience gained in years of working in the classroom.

Regarding the need to acquire new pedagogical knowledge, however, the quantitative and qualitative results were different. In the first phase of the study, only 36% of professors indicated the need for pedagogical knowledge complementation. The other teachers indicated that they had no opinion (14%) or agreed that their pedagogical knowledge was enough (50%). This kind of opinion can be considered natural in a context in which classes have been taught and courses are well evaluated.

Most respondents from the qualitative phase (15) reported that it would be important for the institution to promote events that addressed didactic-pedagogical issues that could contribute to the improvement of teaching practice, considering the need for teachers to be always looking for ways to improve the teaching-learning process, due to the constant changes that education undergoes, especially with regard to the profile of new students, which changes year by year.

These different results obtained in the two phases of the study may be related to two aspects. The first concerns the characteristics of teachers who agreed to participate in the second phase of the study. It is necessary to consider the possibility of these teachers having had more interest in the subject matter than teachers who were not available to participate. It is important to highlight, however, that 64% of the professors who participated in the quantitative phase of the study volunteered to participate in the qualitative phase, thus showing interest and motivation for the study.

The second aspect refers to teachers' involvement during the interviews, which allowed them to reflect on their own pedagogical practices. That is, several teachers reported, at the end of the interview, that they considered this moment very interesting, that made them “stop to think” about their classes, which usually does not occur in academic daily life. This may have influenced the answers, leading teachers to, at the time of the interview, attach greater importance to expanding knowledge related to didactics than at the time of completing the questionnaire. A summary of the main results about teachers' opinion about their didactic-pedagogical knowledge is presented below in Table 6.

Table 6. Opinions about didactic-pedagogical knowledge - results of the quantitative and qualitative phases of the study

Didactic-pedagogical aspects	Quantitative Phase	Qualitative Phase
	Frequency of teachers who “agreed” or “totally agreed” (n = 199)	Summary of qualitative findings (number of answers / professors)
Mastery of didactic-pedagogical issues is essential for teaching performance.	78%	Mastery of didactic-pedagogical issues is important and is gained from classroom experience (17/17)
The knowledge they have is suitable for teaching performance.	76%	Early career difficulties are overcome with classroom experience (17/17)
The didactic-pedagogical knowledge they possess is enough to teach. No Complementation is needed	50%	It would be important for the institution to promote events that address didactic-pedagogical issues that could contribute to the improvement of teaching practice (15/17)

Source: Own elaboration (2017).

7 Final Thoughts

The aim of this paper was to identify which activities contributed most to the acquisition of didactic-pedagogical skills for teaching in higher education. Quantitative and qualitative findings have shown that day-to-day experience in classroom is the main source of knowledge for the acquisition of didactic-pedagogical skills, although Brazilian law provides that training for higher education is preferably carried out in postgraduate programs. This training brings other contributions that positively affect teaching practice, but brings few contributions to the acquisition of didactic-pedagogical skills. The observation of teachers during their training in postgraduate programs and the exchange of information with colleagues were also important, especially at the beginning of their careers.

The set of results highlights issues that both a quantitative study and a qualitative study, developed in isolation, would not be sufficient. Therefore, the second phase of the study made it possible to give teachers an opportunity to talk about their practices, and gave us an opportunity to do new interpretations of the quantitative results obtained initially.

The answers to the proposed research problem make evident the need for greater approximation of teachers with the didactic-pedagogical area, which has implications for the institution's managers.

The first implication concerns the creation of mechanisms to support beginning teachers in didactic-pedagogical issues. An action proposal in this regard is the Beginner Professor Insertion Programs. For Garcia (2010), these programs are a real alternative to what is called “landing as you can” (p. 33). For Mira and Romanowski (2014), the follow-up and supervision of beginning teachers, carried out through professional insertion programs, “have been successful, as indicated in the international literature, when performed by qualified and experienced instructors” (p. 15).

The second implication for the institution's managers refers to the continuing education for teachers, focused on didactic-pedagogical issues. For Sousa (2013), continuing education in higher education seeks to leave teachers in a position to reassess and re-elaborate their knowledge built with practice. This training aims to disturb teachers so that they can observe their actions, analyze if what is being developed is leading to satisfactory results for the teacher and students and verify what needs to be changed to improve the learning process.

Therefore, continuing education “is seen as a means of articulating old and new knowledge in teachers’ practices, the guide of the theory, making changes and transformations” (WENGZYNSKI; TOZETTO, 2013), which should be substantiated in everyday life, in reality teaching.

An action proposal that promotes the articulation between old and new knowledge is the organization of Communities of Practice (CoP). According to Ramos and Marinque (2015), the concept of Community of Practice has shown, in recent years, a timely tool for studies related to teacher training and is increasingly being used by researchers in different countries.

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