

MATHEMATICS TEACHING DEGREE: KNOWLEDGE DEVELOPED BY INTERN STUDENTS IN THE 5TH GRADE OF ELEMENTARY SCHOOL - TRAINING FUTURE MATHEMATICS TEACHERS

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ABSTRACT

This paper reports part of the project developed at the Institute of Mathematics of the Federal University of Alagoas (UFAL), funded by the National Council for Scientific and Technological Development (CNPq) between 2012 and 2014. The investigation aimed to articulate actions between the university and the elementary school by monitoring four mathematics intern students in the early primary grades¹, especially the 5th grade. This paper focused on the analysis of reports of intern students in order to investigate the knowledge that the Degree in Mathematics developed along the internship in the 5th grade of elementary education. The results indicate that this was an important teacher training experience, because, besides observing teaching practice, intern students could also develop activities in which they established relationships among math contents for the elementary grades and those they learn at university.

Keywords: Degree in Mathematics; Internship in the early primary grades; Mathematical content.

RESUMO

Este artigo trata de um recorte do projeto desenvolvido no Instituto de Matemática da Universidade Federal de Alagoas (Ufal), financiado pelo Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), vigente no período de 2012 a 2014. A investigação objetivou articular ações entre a universidade e a escola básica do ensino fundamental I, por meio do acompanhamento de quatro estagiários da Licenciatura em Matemática nas salas dos anos iniciais, em especial do 5º ano. Este artigo focalizou a análise do relatório dos estagiários com vistas a investigar os saberes que os alunos da Licenciatura em Matemática, desenvolveram ao longo do estágio no 5º ano do ensino fundamental. Pela análise dos relatórios foi possível depreender que essa experiência foi importante para a formação docente, pois além de observarem práticas docentes também puderam desenvolver atividades em que estabeleceram relações entre os conteúdos matemáticos do ensino fundamental e os que aprendem na licenciatura.

Palavras-chave: Licenciatura em Matemática; Estágio nos anos iniciais; Conteúdos matemáticos.

¹ In Brazil, the early elementary education comprises grades 1-5.

1. Introduction

This paper reports part of the project developed at the Institute of Mathematics of the Federal University of Alagoas (UFAL) titled “Internship in the early primary grades – A space for training mathematics teachers”, funded by the National Council for Scientific and Technological Development (CNPq) between 2012 and 2014. The objective of the present paper is to investigate the knowledge developed by mathematic students during their internship in 5th grade from the analysis of the content of reports written by the intern students at the end of the project.

In order to situate the reader in the context in which the present paper is included, we initially present a brief description of the project funded by CNPq, which corresponds to the fourth stage of a doctoral research thesis developed by Carvalho (2009). The research was about the teaching of mathematics in Pedagogy courses in order to verify whether the mathematical skills that the student teacher learned in their courses resignified their pedagogical practices. From the data analysis, it was possible to verify that the content learned in the course had little influence on students’ knowledge, and that the knowledge they brought from basic education was insufficient. Therefore, the researcher found that discussing the teaching practice of the elementary school teacher would have to go further and involve the teaching practice of mathematics teachers, since these professionals were responsible for teaching basic mathematical concepts to future educators.

In 2009, the researcher started working at the Federal University of Alagoas and at the Institute of Mathematics, teaching Supervised Internship I. The researcher suggested that her students dedicated a few hours of internship to observe teaching practices and mathematical content developed in the early primary grades. Part of these students carried out their internship in these classes, bringing discussion about the teaching of mathematics in the elementary education.

In the following semester, the researcher suggested that the Supervised Internship I should be performed in the early grades to the course coordinator, who accepted it immediately. In 2010, throughout the semester, the students did their training at a school near UFAL campus, an experience that resulted in the book *Teaching degree in Mathematics- observation internship in the early primary years*. In that same year, an Undergraduate Research Internship proposal (Pibic) titled *Supervised internship in elementary education – A space for educating mathematics teachers* was presented. In this project, a research student followed a 5th semester mathematics class during the internship in the early primary grades, and a student who was already teaching the 6th grade and had performed his internship in the early primary grades. The purpose was to investigate whether the internship in the 5th and 6th semester for undergraduate students in Mathematics (IM- UFAL) provided a better understanding of this segment, contributing to their pedagogical teaching practice.

In 2012, the project *Supervised internship in elementary education – A space for educating mathematics teachers* was approved with the objective of articulating actions between the university and elementary school, by accompanying four intern students of mathematics, along the discipline Supervised Internship I and II in the first grades, specially the 5th grade.

2 . Legislation and supervised internship

Training teachers with sound knowledge of both the subject content and the didactic content of the subject (SHULMAM, 1986) is one of the factors favoring the teaching quality in elementary education. However, educating teachers is not a simple task since these professionals will work mostly in schools with diverse needs and specificities, involving students from different socioeconomic status.

According to the CNE/CP Resolution 1/2002, which regulates the National Curriculum Guidelines for Teacher Education in Higher Education, in order to act at different levels of basic education, there is a set of principles, fundamentals and procedures to be observed in the institutional and curriculum organization of each school and applied to all stages and types of elementary education.

This resolution presents a design change with regard to teacher education. The Guidelines and Bases of the National Education n. 9.394/96 states that the teacher should have a higher education degree to act in different segments of elementary education; teachers who will teach the early primary grades and early childhood education should be trained in the former School of Education. Until the enactment of that law, this training was given in such mid-level courses.

The education of teachers to act in the last years of elementary education and secondary education continued to occur at university level. However, the curriculum of teacher's education courses was organized in the 3 + 1 conception, which enacted the title of Bachelor in Mathematics, for example, to those who had conducted studies over three years on specific area content; those who had attended one more year of studies involving foundations and educational theories could become a teacher with a university degree.

Accordingly, Resolution 2/2002 means a breakthrough in educating future teachers, because the specific (Bachelor's degree) and teaching (undergraduate) disciplines are concurrent, distributed in the curriculum. The Article 3 of that resolution states that:

“The training of teachers who will teach in the different stages and modalities of basic education will notice guiding principles of this preparation for specific professional practice, to consider:

I - competency as a core conception in course design;

II - consistency between the training offered and expected practice of future teachers, considering:

a) an inverted symmetry, where the preparation of the teacher, that occurs in a place similar to where he will act, demands consistency between what he does in training and what is expected from him;

b) learning as a construction of knowledge, skills and values in interaction with reality and with other individuals, in which personal skills are considered;

c) the content, and as a means and support for the competence skills; [...]

III - the research, focusing on the teaching/learning process, once teaching requires both having knowledge and mobilizing it to action, and understanding the process of knowledge construction.”

The item III of this article places the research in the core of teachers training. Currently, faced with the educational needs, it is desirable that teachers reflect on their pedagogical action, and therefore they should be researchers. However, it is worth noting who these researchers are. Educating a teacher with an investigative character, making it possible

to question and "select instruments and data that help him to elucidate his problems and find alternative paths in his teaching practice" (ANDRÉ, 2001, p. 59) is relevant. However, the teachers who investigate their practice are not the researchers that have the research as the focus of their work and have the minimum necessary resources to develop it.

Therefore, the supervised internship brings many opportunities to meet the training of future teachers with a focus on research, because they will be experiencing the school routine. According to art. 1, item II of Resolution CNE / CP 2/2002, Pedagogy students must accomplish 400 hours of supervised internship from the second half of the course, as well as 400 hours of teaching practice, which can take place in a laboratory, or even provide discussions, roundtables, teaching practice proposals from observations and actions performed during the supervised internship.

2.1. Internship – a place for investigating teaching and pedagogical practice

The internship is an activity contemplated by The Guidelines and Bases of the National Education n. 9.394/96, being mandatory for training at university level courses. However, research in the area of Education indicates that this activity is, most of the times, not performed satisfactorily and does not meet the minimum educational training principles. In teacher education programs, the internship, when articulated in conjunction with other curriculum subjects, both the specific content and the pedagogical content, can contribute to the training of future teachers, creating dialogue between theory and practice.

In teacher education, the internship must "enable that future teachers understand the complexity of institutional practices and actions conducted by practitioners as an alternative in the preparation for professional career" (PIMENTA and LIMA, 2010, p. 43). However, with regard to Mathematics Education, the internship hours performed in the early primary grades are not considered, since it is designed for the Pedagogy course, which educates teachers to work in early primary grades.

Therefore, if the classroom is a space of knowledge for research and understanding of the educational processes, "a meeting place between teachers and students with their life histories, teaching and learning possibilities, shared knowledge the construction" (PIMENTA and LIMA 2010, p . 156), then, the early primary grades may be a privileged place, in which the undergraduate students of mathematics will be able to carry out studies on the contents and procedures of children's learning, such as numerical assumptions and strategies for problem solving among other mathematical content.

According to the World Declaration on Education for All (JOMTIEN, 1990), the educational processes occur throughout life, and teachers go through different moments of continuing education and service. However, Tardif (2000) states that initial training is an important moment because "voice" is given to prospective teachers, and the knowledge created and mobilized by them is covered with legitimacy to develop their practice.

"In initial education, the knowledge encoded from education sciences and professional knowledge are close to each other, but do not interpret or interpellate each other." (TARDIF, 2000, p. 18)

Tardif (2000, 2002), often cited in research in the areas of Education and Mathematics Education, discusses teacher education from the perspective of teacher knowledge, which he defines as "a plural knowledge, formed by more or less coherent amalgam of knowledge derived from training and disciplinary, curricular, and experience knowledge" (2002, p. 36). The author categorizes this knowledge in time, plural and heterogeneous, situated, and personalized.

The temporal knowledge is that built over time and takes place through models, because much of what teachers know about teaching comes from their own life experiences, mostly school life experiences, their previous knowledge, beliefs, representations, and constructed certainties. Before starting teaching, teachers had "models" of teachers for at least sixteen years. According to Tardif (2000), teachers generally pass through the training courses without being able to change their beliefs about teaching and when they begin to teach, they rescue these models to solve their professional problems.

We understand that models are important and necessary for teachers and future teachers. However, they cannot function as an "armor", making it difficult for teachers to think about their practice and build their professional identity. Therefore, it is important that teachers have a solid background in both basic education and university, since it mobilizes this knowledge to develop their practice.

Teachers' knowledge is plural and heterogeneous because it comes from different sources. To develop their teaching practice, the teachers mobilize all their knowledge about the discipline, built during the time they attended the BA in Mathematics and Pedagogy, for example. They also mobilize their work from their personal culture, which comes from their life history and elementary education, besides the

"Didactic and pedagogical knowledge from his/her professional training; he/she also relies on what we call curriculum knowledge conveyed by the programs, school guides and textbooks; he/she relies on his/her own knowledge linked to work experience, the experience of some teachers and in the peculiar teaching practices " (TARDIF, 2002, p. 262-3)

Thinking about the education of future mathematics teachers from the knowledge mentioned resizes the discussion of the dialectic between theory and practice, which frequently creates conflict because, on one side, there is the knowledge produced by experts based on research or theoretical reflections organized into general abstract categories, often idealizing and simplifying the reality of the classroom, while knowledge from practice seems to be closer to what teachers do in practice, because it is linked to the different dimensions of pedagogical action, according to Fiorentini et al (2000).

2.2. Mathematics Teaching Degree and the Pedagogy course - dialogue needed

According to conclusions drawn from analyses carried out by Carvalho (2009) in the teaching of mathematics in Pedagogy courses, these students did not resignify their knowledge and mathematical knowledge in the discipline intended to mathematical content during the course. Also, they showed many conceptual gaps. Therefore, the researcher asks:

"This research dealt with the teaching of mathematics, which is, traditionally, an area of knowledge with which most of the times "people deal poorly with" (PIRES, 2003, p. 8), but would we have different results if we were dealing with disciplines such as History, Geography, Sciences, Arts, or Portuguese? Further research should answer these questions." (CARVALHO, 2009, p. 180)

To the abovementioned researcher, thinking the initial or continuing teachers education without a dialogue with mathematics is fearful, because the future teachers and/or teachers who already teach, when in elementary education, had classes with a math's teacher and studied concepts that must be redeemed when developing their discipline and classroom plans. However, they do not frequently recognize their learning (if they happened) when developing their pedagogical activities.

Regarding the teaching of mathematics, Fiorentini and Castro (2003) argue that "the course is much more about training a professional who has the operational and procedural domain of mathematics than a professional that talks about mathematics and knows to explore his ideas in a variety of ways" (p. 137).

The inclusion of undergraduate Mathematics Education students in the dynamics of the early grades will possibly favor their understanding of this educational segment, since studies on the taught content and the processes of student learning in the early grades are not included in this course.

After graduating, the BA in Mathematics will possibly teach the 6th grade of elementary education, a critical period for the child, since until the 5th grade they had a versatile teacher (educator), and at this grade they are presented to many teachers of different disciplines.

The licensed teachers that have not conducted studies on reality of the early grades will probably have difficulties in understanding the dynamics of these pre-adolescents. This possible lack of "savvy" might cause unresolved questions about the teaching and learning of mathematics, which will be revealed in institutional assessments, such as Prova Brasil and PISA, with below the expected indicators.

3. The research route

In order to offer a better understanding regarding the analyses of the reports produced by the intern students, aim of this paper, first we expose the synthesis of the method adopted for the development of the project.

The project Internship in elementary education – A space for educating mathematics teachers refers to a qualitative study in the form of an action research, because it intended to establish a dialogue between the university and the elementary school, since mathematics students have close contact with the day-by-day of the classroom of the first grades, specially the 5th year of elementary school. This research modality "has a twofold objective: to enhance the effectiveness of actions and acquire new knowledge [...] the action research is a collective approach that integrates both a research strategy and an action strategy" (DIONNE, 2007, p. 76). Therefore, the action proposed in the project aimed at provoking changes in attitudes, both in the intern students and the teachers of the first grades, specially the 5th year of elementary school, that is:

- interns - know the content and mathematical procedures taught in the early primary grades, especially the 5th grade, and how the contents are related to those studied in other segments of basic education and higher education;
- educators - teachers of the early primary grades - effectively participate in a research project, contributing, with their teaching experience, to dialogue with prospective teachers and that they see their work as a space for knowledge construction .

3.1. Data collection

According to Dionne (2007), the "Action research is a way of collective action that is part of a process of social change" (p. 77). Therefore, for the development of the research discussed in this article, we predicted some actions that represent the longest and most complex moment of the research. According to that author:

[...] The dynamics of the relationship between research and action is not evident

[...] The application of research procedures are usually performed in a more linear way [...]. The researcher must be flexible not to counteract the imperatives of the ongoing action. (p. 112)

Thus, considering that the project lasted about two years, we conducted the research work of interns in the 1st to 5th grades of primary school by means of several activities and actions:

- A proposal of diagnostic activity to investigate the students' prior knowledge about mathematics. This activity was developed by the interns, guided by the classroom teachers, staff and coordinators of the project.
- Analyze the diagnostic activities, aiming to investigate the mathematical knowledge and strategies used by students to solve the situations proposed. From these analyzes, we decided to focus on the 5th year, since it is closer to the 6th grade, in which the interns will probably have the opportunity to work after they graduate.
- Interns attended classes on mathematical content and analyzed students' materials, the course plans and class curricula, teachers' seminars, to investigate their content knowledge.
- Interns discussed with the professors about the content and mathematical procedures performed in the early primary grades.
- Interns conducted an educational workshop on mathematical content studied and developed in the early primary grades for teachers of the school where the internship was taking place.
- Interns taught classes for students in the early grades, with the accompaniment of the classroom teachers, collaborators, and the project coordinator.

Concerning the classroom teachers, it is possible to affirm that they participated actively, guiding students as to the pedagogical practices adopted when working with mathematics and the learning process, and contributed to the activities conducted by the students. In the research article *Teachers in the early grades - learning mathematics by*

means of games, presented at the XI Ibero-American Congress of Mathematics Education (XI Cibem), the results of the teachers' participation were exposed.

Concerning the evaluation, it is part of the development of a research project. According to Dionne (2007), it is not necessary to make an ongoing assessment of the activities, but we should be judicious so we can have "an ongoing critical feedback on actions taken" (p.113). Therefore, we recorded classes, diagnosed assessments, elaborated mathematical activities and staff meetings, evaluation tools and project organization, besides the individual interviews recorded in audio, of the round talks, group reunions at the end of each class.

Therefore, for this paper, and because of the large number of data collected by means of actions here presented, we opted by the content analysis (BARDIM, 2009) of the reports written by the intern students at the end of the project, with the aim of investigating the knowledge of these math students developed when performing the internship in the 5th grades of elementary education.

In these records, students wrote about the experience in the internship (development of classes, learning of students, attitudes of the teacher, the meaning of training), they also informed about the age, the reasons that took them to choose the Mathematics Teaching Degree and the characteristics of a good teacher.

4 . The intern students in the 5th grade of elementary education

4.1. The school and the intern students

The internship took place at a public school in Maceió, located near the campus of Universidade Federal de Alagoas (UFAL), which accepted to participate in the project. The intern students were four students of the 5th year of the Mathematics Teaching Degree, afternoon classes. The rooms have reduced number of students.

4.2. The profile of the intern students

In this section, we present the profile of the interns who participated in the research discussed in this article. To do so, in the reports, students informed about age and school education and open-ended questions about why they chose to study mathematics, which are the characteristics of a good mathematics teacher in their opinion, their expectations for the internship, and the teaching of mathematics in elementary education and in mathematics teaching degree courses.

4.2.1. Who are the interns and what they think

In the original proposal of the project discussed in this article, we intended to include five subjects. However, the 5th period of this course consisted of four students, and all agreed to participate and to be followed over a year.

Table 1 - Profile of intern students

	Male	Female	Between 18 e 20 years	Between 21 e 25 years	Public School	Private School
Gender	2	2				
Age			1	3		
Elementary education					3	1

4.2.2. The option of studying mathematics

According to the reports, it was possible to conclude that to like mathematics and to be a good student in basic education were the most important aspects for choosing the course.

Because I always liked discipline, I wanted to go deeper in the study area, my high school teacher inspired me a lot and I think the art of teaching is very pretty. (E1)

To understand mathematics and understand its applications. (E2)

It has always been my favorite subject since elementary school.(E3)

Because I liked math in high school, and a high school teacher encouraged me, and I ended up falling in love with it. (E4)

It is noteworthy that the interns E1 and E4 mentioned in their responses the influence of the mathematics teacher for the course selection.

[...] My high school teacher inspired me a lot. (E1)

[...] a high school teacher encouraged me, and I ended up falling in love with it (E4)

To Tardif (2002), the object of the teaching profession is human beings and, therefore, it involves ethical and emotional components. Thus, considering that the act of learning is individual and the teacher plays an important role in students' education, collaborating so that they are likely to become fond of the discipline because of the teachers' teaching strategies, these interns, according to their testimonies, had teachers that motivated them to work the mathematical issues and like them.

4.2.3. A good mathematics teacher

We sought to know what the characteristics of a good mathematics teacher are, according to these interns. The intern E1 highlighted mainly the affective aspect. Again, we can mention Tardif (2002) with regard to the object of the teaching profession: humans. In a classroom that brings together students with different life histories, it is difficult for a teacher to solve everyone's problems, but students are sensitive and know how to recognize teachers who care about the teaching/learning process and have respect for them.

I believe that regardless of the area of education, the teacher should be thoughtful, seek good relationship and give his best in the classroom. (E1)

The intern E2 speaks about modeling, as he believes that the teacher should set an example. Assuming that part of Brazilian students undergoing public schools are in economic, social, and family disadvantage and the only positive role model that students can have is often the teacher, a model in which they can mirror themselves can contribute to the educational process. But we emphasize that we understand these models as possibilities so that the students can think and create their own identity.

In fact, a good teacher is more than that, he/she has to go beyond the teaching profession, he/she has to be an "example". (E2)

All interns, however, highlight the importance of teachers to master mathematical content and instructional procedures, i.e., in addition to having sound knowledge about the field content, they must also possess didactic content knowledge of the subject (GDMUNSDÓTTIR and SHULMAM, 2005). Training teachers with a sound knowledge of both the subject content and didactic goes through their initial education, models of good teachers and supervised internships where the students can establish relationships between the content taught in undergraduate and elementary education, since such connections enable them to understand the purpose of studying number theory, set theory, calculus I, II, II, among other disciplines.

In the case of mathematics teachers, they must also have a good domain of content and seek alternatives to remedy any problems that arise in the course of the profession. (E1)

It is about knowing to transmit the beauty of mathematics in a clear, objective and attractive way. (E2)

[...] He/she must know to transmit the contents properly and know he/she is not only teaching students, but also a future citizen. (E3)

He/she is the one who can make a good didactic transposition every class he/she teaches. He/she is the one who can make each student understands and comprehends the given subject, whether in the form of games or debate or using math problems. (E4)

4.2.4. Expectations regarding the internship

Interns believe that the internship will contribute to their professional training because it is an opportunity to live the daily life of the school. Certainly, the objective of the internship is "to enable future teachers to understand the complexity of institutional practices and actions conducted by practitioners as an alternative for preparing for their career" (PIMENTA and LIMA, 2010, p. 43). The intern E1 also highlights the possibility of understanding the transition from the 5th to 6th grade of primary school (what separates them are just school holidays), as it is the responsibility of the pedagogy course to train teachers who will teach mathematics.

I hope to have a better understanding of students' difficulties; I hope to better understand what is happening with students in the transition from the 5th to 6th grade. (E1)

It enhances my knowledge; I also hope to become an excellent professional. (E3)

To be able to observe the difficulties that students face when in the classroom, to be able to teach the best way to make students understand the subject better. (E4)

The fifth year was wonderful to us. The teachers' didactics, we can see the didactics of the teacher who is already inside the classroom for a long time and the teacher who is beginning. We can see the difference. It's a matter of experience. As you teach you enhance your experience and you learn to deal with ...with certain difficulties that you have in the classroom. A certain subject should not be taught this way and will notice that it should be given another way as you gain experience (E2).

According to the testimony of these interns, it is possible to notice that this experience brings, to these future teachers, questions as to be "a good professional", "understand the students", "observe the difficulties" that are questions that occur in the teaching practice and favor the thinking of the practice, since "learning as a process of construction of knowledge, abilities and values in interaction with reality and with the others, at which are put in use personal abilities" (RESOLUTION n° 2/2002). Therefore, possibly, when teaching, these interns will use their plural and heterogeneous knowledge (TARDIF, 2000), since in their training they were able to observe "a similar place of that they will act", that is, an inverted symmetry.

The intern E2 sees the internship as a way of deciding about her profession.

I hope to learn more about the teaching profession and decide if it is really what I want to become. (E2)

Choosing a profession is not a simple task. There are students who, even identifying themselves with the profession because of the models they had from teachers, feel insecure about the path chosen, and the internship, among its many objectives, can promote decision making. The undergraduates have contact with the school routine, often different from the time when they attended basic education. They can bring in their imaginary "their" school, which is probably different from that they will work at and that, in most cases, are loaded with disturbing situations for the teachers who are beginning their teaching activities, such as indiscipline, aggression, lack of physical, personal, and financial structure, lack of family support, etc.

There were situations that bothered me, the mess in one of the classes. But the point is to control the situation, you have to know how to deal with the students. Because after they start participating, they wanted to answer the questions on the board. So, what was the purpose of such a confusion as we saw in the beginning of the class that chocked us. [...]. If I hadn't seen another reality I would say that I would have given up of my profession (E2).

4.2.5. The teaching of mathematics in elementary education and in mathematics teaching degree courses.

During the Mathematics Teaching Degree Course, students are introduced to both the specific and pedagogical disciplines, which, theoretically, will contribute to the teaching and learning process. It is recurrent, even in higher education, students questioning why certain subjects on certain mathematical content are in the curriculum, since they will not be developed in basic education due to their complexity. However, according to

Shulman (1986), teachers need solid knowledge about the content they will deal with and cannot be limited to the contents of the grades they teach.

The internship experience also provided the students with an understanding of the mathematical content and where they appear in a more "diluted" way into the elementary education curriculum, especially in the first grades. An example is the multiplication table. At first, it seems to be just memorization; however, if it is conducted from the observation of the pattern of multiplication and number relationships, students will have contact with the fundamental properties of multiplication, which are part of the Theory of Numbers discipline- that is, in the first primary grades the essence of this theory is present. It is also possible to deduce from testimony of interns that they charge didactic procedures from professors in teaching degree courses.

I'm not going to teach linear transformation to a 5th grade student [...]. I have to teach him/her the basic content. But I liked the class...the teacher worked with rules, measurements. I think this was very nice to the students. The contents were: division, proportionality. I liked it very much [...]. Algebra, distributivity, number theory, no, I will get this content here given at university and teach them, but my job as a teacher would be to make a transposition of this content, teach them the best content. (E3).

But there the properties didn't have, what really the commutativity and distributivity we see in linear algebra and in abstract algebra as well. I think the other relation to it would be the number theory. (E2).

The most present content in the 5th grade is the number theory [...]. It's about division, things like that. (E1).

It was also possible to observe from the testimony of the intern students that they charge the Teaching Degree the didactic procedures.

Although the elementary education curriculum is extensive, by the fact that teachers fail to better work students' problems, teaching ends up being precarious, so I think it is necessary to focus more on the students and try to make this teaching more understandable. At undergraduation, professors should be more dedicated to the art of teaching and not just the art of what is being taught. (E1)

Elementary education should be less repetitive and have more application for the use of mathematics. In the Teaching Degree, there should have more disciplines focused directly on the teaching of mathematics in elementary education. (E2)

It should be a coherent teaching, concise with the reality of the student, aiming to the education of good citizens. (E3)

There should be a relationship, actually make the didactic transposition in teaching degree courses with elementary education. (E4)

It is very important and it should be considered, it's the way of giving content. Because the content that they will see now at 5th grade, such as: multiplication, division, proportion, are the basis to the student, he will see it again later. So, if the students don't learn the content, later it will become a snow ball that keeps growing, growing, growing. Today we see high school students who are not

able to do the basic operations, they don't know how to do the basic operations they learned in the 5th grade. (E1).

4.3 The knowledge constructed by the intern students in the 5th grade of elementary education

4.3.1. The work with whole numbers - the experience of teaching the 5th grade

Among the several activities students developed during the internship, one involved the set of whole numbers. Research in mathematics education, as those of Maranhão, Camejo and Machado (2007), Borba (2003, 2009), D' Albertas (2006), and Oliveira (2014), discusses the work with the set of whole numbers in the early primary grades because, according to Vergnaud (2003, 1996), the set of natural numbers is not enough to work with subtraction, as they are only positive numbers. Thus, researchers have been investigating strategies for resolving problem situations involving subtraction.

Intern students observed classes and students' books and noticed that children had some misconceptions about the algorithm of subtraction, such as: "9 cannot be subtracted from 2 because 2 is lower", without considering the existence condition: in the set of natural numbers, we cannot subtract 2 from 9; in the set of whole numbers, this is possible, and the result is -7.

When talking with classroom teachers, the interns questioned them about the work of the subtraction algorithm and asked to perform an activity with the students. With the support of the classroom teacher, who showed interest on the project being developed, as well as of the coordination and project collaborators, interns developed a game called "The trail", involving problem situations which would give an integer number as an answer.

In the reports, students also wrote about the application of this activity. They evaluated the presentation of negative whole numbers in the early primary grades. According to their testimony, it is possible to work with this number set, which favors the learning of that content on the 6th and 7th grades of elementary education.

In the early primary grades, I do believe that students are capable to assimilate. What happens is that many teachers might be afraid of working with the whole numbers. It may be a psychological barrier that students will not accept the whole numbers, which is normal. Mathematicians themselves had difficulty accepting the whole numbers, some only accepted them after years of study. So you want a child to accept negative whole numbers immediately, of course he/she will not, he/she will only accept them as they face them daily, just as was the activity of associating credit and debit. (E4)

The intern E4 pointed to two important questions. The first is that teachers may be afraid of working with the whole numbers. However, we can assume that they do not work with them because textbooks used in the early grades do not bring situations involving this content or because teachers do not always master them. The second question is that the intern refers to the history of mathematics to justify teachers' fear. It took a long time until the set of whole numbers was adopted, and it only happened because it facilitated business transactions in the past. Again, one can observe that, in the learning process, students retrace the path trodden by humanity to learn, and recounting the history of mathematics contributes greatly to the understanding of the discipline, according to Valente (2013).

Interns also reported that classes had different reactions. In a 5th grade classroom, the activity was performed easily; while in another class, students had more difficulty.

If you pay attention, this did not happen in the other class, after we explained, no one talked about owing, the idea of debt. (E2)

This is an important observation, because the interns performed the same activity in two 5th grade classrooms and realized that students had different reactions, which led to discussion about the didactic contract. Usually, by this contract signed with the students, there is only one answer to the problem presented and a number, which, in the case of early primary classes, is limited to the set of integer numbers, and students are not encouraged to use their own strategies for solving problems.

It is the didactic contract. They are so accustomed to a didactic contract, for example, only using the natural numbers. When you bring something new in the primary grades, up to 6th grade, it is still possible to remedy the problem. But I believe that when correct concepts are not considered, everything becomes easier. Today, we used letters with a class that is not used to using them, and they did not show this psychological barrier that we were expecting. But I believe that if we were dealing with older students, we would have had more difficulty, since that would probably be fossilized. This is definitely the time to change their old habits, because we realized that they are more open now, because later they will be more closed. (E4)

The interns also learned, from this experience, that the teachers play an important role, especially at the beginning of the lesson. The way they will conduct the activities will set the tone of the work.

The teacher who is responsible for the class must understand, he/she has to be noticeable in the first class or classes. (E1)

The time to conquer students are the first contact with students of each year, understand the first moments of each year, and that the teacher has to show that he/she's willing to work in a different way, because he/she will be able to conquer students, because if he/she changed his grade he/she does not know it, he/she will go through something unknown, so he/she's willing to learn something new. On the other hand, when the teacher spends an entire semester on that boring method (E2)

The interns learning experience leads us to assume that, by the time they will be teaching and having the opportunity of working with the 6th grade, they will be able to mobilize the plural and heterogeneous knowledge (TARDIF, 2002), gathered during their academic training. By this experience, they will be able to teach mathematics in a more meaningful and interesting way for their students and overcome possible shortcomings arising from the process of their schooling in the early grades.

4.3.2. Impressions of a future Math teacher

According to the reports of students majoring in mathematics, the research performed in the 5th year of elementary school was significant, even if students end up not working at this educational level. In their remarks, different aspects of teaching were mentioned: mathematical content, teaching methods, student behavior, teachers' knowledge, among others.

At one class, there were a considerable number of repeat students. The intern E1 noted that students were resistant to learning mathematical content, and attributed their difficulties to the teaching didactics of the former teacher.

In the classroom with 5th graders, where most of them were repeat students, there was a greater difficulty for understanding the mathematical contents. Possibly because they were conditioned to the didactics of the former teacher. As they were repeat students, they thought they would learn everything the same way, and since they did not learn this content, they might have believed that they would go through the same content in the same way that they did not understand. But each teacher has his own teaching method, his way of teaching, his didactics [...]. I noticed that these students are actually blocked for Mathematics [...] They seem to have a visor. (E1)

The intern observation is about the assessment of students, their difficulties and how they can be worked. According to his analysis, these students are resistant to learning mathematics. As a rule, mathematics is already seen as “being difficult, and only intelligent people are able to learn it”. The student who usually has knowledge gap in the discipline, may, in turn, become more refractory to the learning of mathematical content. Thus, it is the teacher’s responsibility to adopt practices that enable to conquer these students and redeem the learning of mathematics. Therefore, besides having sound knowledgeable about the discipline content, they must also have knowledge about the teaching of the discipline content and students (GDMUNSDÓTTIR and SHULMAM, 2005).

Each teacher "has his own teaching method", because each one builds their teaching profession anchored in a plural knowledge (TARDIF, 2002). For the intern E1, having this perception may encourage her future teaching career, since she understands that

when the teacher explains, the former teacher might have explained in a way, and the new teacher explains in a totally different way, using other procedures. (E1)

If she comes to work with 6th graders, this intern will be able to redeem this experience and seek educational alternatives that may allow “students to take off their visors”, because she believes that some students are resistant to learning mathematics because they are conditioned to pedagogical practices performed by the 5th grade teacher. All this can mobilize her to search for alternatives.

The 5th grade was wonderful for us [...]. We were able to see the teacher’s didactic: ah, certain content should not be taught this way, and it is possible to realize that it must be taught in a different way over time. The teacher we observed was very good. (E1)

In her remarks, she also alludes to the positive attitude of the teacher towards the students, attributing it to his experience. Over the years, the improvement of teaching practices is common.

He always provided students with activities after the content, focusing very well on problems, always focusing on problems, uh... With addition, subtraction, working operations. And... he made sure to correct all students’ notebooks’ to be sure they were doing the lesson. He used to answer to student’s questions individually at his desk, and this was great for me. I found this very interesting ... (E1)

Doing an internship in the 5th grade invited reflections, thoughts, observations that might assist her in her future teaching practice. It is noteworthy the fact that she considered positive the teacher's attitude of working with students' difficulties individually, correcting their notebooks, an attitude that may serve as a model for this intern. As a rule, the 6th grade mathematics teacher treats students in a more collective way considering that they have already built basic mathematical concepts, which, in most cases, does not correspond to reality.

5. The possibility of a change in the training of mathematics teachers

The analysis of the reports presented in this paper indicates that it is possible for students majoring in mathematics to develop activities in the early primary grades, especially in the 5th grade. These intern students developed plural knowledge that will possibility contribute to their teaching.

Considering that the internship is a field for research and the resolution CNE/CP n° 1/2002, item III, privileges research, this experience helped students to observe and teach together with the classroom teacher as well as with the responsible for the internship discipline, and, therefore, they could create situations in which they could think about the actions developed in a real space, that is, the school.

At first, this idea raises doubts among undergraduate students and some professors, since in the early grades mathematics is taught by the educator. However, it is common to hear from future math teachers that they dislike the discipline, that have had a bad experience with this subject, and some of the times, state that they chose the course because they thought that there would be no math in the curriculum. But the disturbing thing is that prospective teachers had at least seven years of mathematics in basic education, and the content they will teach they learned in Middle School. So, how can they not like it or not know math? The answer may lie in the training of these teachers, who during their initial training did not have the opportunity to study the mathematical content and procedures of the early grades, which could greatly facilitate their teaching practice. Among elementary or high school students there are probably future educators who will redeem, at some point, this learning (CARVALHO, 2009).

The internship in the primary grades also caused a movement in pedagogy course. Students currently seek the disciplines Knowledge and Methodology of Mathematics Teaching I and II, offered in pedagogy courses as elective disciplines. Such a movement was not planned, and it was considered a great gain for this teaching degree course. It creates an environment for experience exchanging among Bachelor's Degree students in Mathematics.

From that experience, students were more interested in teaching courses that are offered in the Bachelor's Degree since they were able to establish relationships between the mathematical content and the classroom routine. The other internships in Middle School, mainly in the 6th year, had a greater meaning for students who had the experience, because it was observed that they started to understand that the 6th year student is the same student of the 5th year, i.e. they had math classes, and, if he had not learned certain content, it was the teachers' responsibility to teach them.

Currently, in the Teaching Degree in Mathematics at UFAL, interning in the early grades, especially in the 5th year, is part of the training of future teachers, what will possibly mobilize differentiated knowledge in their practices; however, further research is necessary.

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