

The future teacher as a subject under training: reflections on the meaning of the teaching activity^{1 2 3 4}

O futuro professor como sujeito em formação: reflexões sobre a significação da atividade de ensino

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Abstract

This article discusses a doctoral research on the training of Mathematics teachers, analyzing how future teachers perceive themselves as subjects under training within the signification movement of the teaching activity. Grounded on Cultural-Historical Theory, it describes a formative experiment conducted with undergraduates of a Mathematics Teaching degree. From three episodes analyzed, the results highlight aspects that allowed future teachers to perceive themselves as subjects under training, such as changes in the motivations for becoming Mathematics teachers, understanding of teacher education as an ongoing process, and changes in the quality of teaching activity.

Keywords: mathematics teacher training, mathematics education, teaching activity

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Resumo

Este artigo, que parte de uma pesquisa de doutorado voltada à formação de professores que ensinam matemática, intenciona analisar como futuros professores se percebem como sujeitos que se encontram em formação, no movimento de significação da atividade docente. Fundamentados na Teoria Histórico-Cultural, apresentamos a organização de um experimento formativo com acadêmicos de Licenciatura em Matemática. A análise dos dados da pesquisa, através dos três episódios elencados, possibilitou evidenciar alguns aspectos, como as mudanças dos motivos para tornarem-se professores de matemática; a compreensão da formação docente como um processo contínuo; e as mudanças de qualidade da atividade de ensino, que permitiram aos futuros professores se perceberem como sujeitos que se encontram em formação.

Palavras-chave: *formação de professores que ensinam matemática, educação matemática, atividade de ensino*

Initial remarks

Historically, pre-service teacher education collects indicators considered unsatisfactory due to different facts, amongst which the fast training, often theoretically and practically fragile, from courses in which didactic and methodologies are merely technical discourses on teaching (Pimenta & Lima, 2012, p. 6), creating a distance between training practices and those that can be enacted in basic education (Fiorentini et al., 2002; Gatti, 2010). Many Brazilian undergraduate Mathematics Teaching degrees have been changing their curriculum structure in the last years, incorporating pedagogical practices and school placement in the first semesters, as well as participating in programs that support pre-service training, such as *Programa Institucional de Bolsas de Iniciação à Docência* (Pibid). We know the impact of these changes, especially Pibid, implemented more than 10 years ago, through the studies of Borowsky (2017) and Fraga (2017), however the discussion is still relevant considering the long way to go in the improvement of teacher education quality in Brazil.

We developed a doctoral research in Education, grounded by the Cultural Historical Theory, to contribute to the discussions on these themes and other aspects permeating the training of Mathematics teachers. Our aim was to investigate the signification process of the teaching activity in the future Mathematics teacher, in their learning movement towards teaching, in a training space to teach measurements. In this article we use data from this thesis to analyze how future teachers perceive themselves as subjects under training, in a movement to give meaning to the teaching activity. We intend to analyze moments in which participants have shown the appropriation of elements inherent to the teaching practice which, generally, are part of the process of becoming teachers.

Firstly, to contextualize the reader, we explain some theoretical fundamentals that guide this study. After, we present the methodological organization of the work and three episodes that took place in the training experiment developed during the research. Finally, we outline some considerations on the indicatives portrayed in these episodes.

Some theoretical assumption: contributions of Cultural-Historical Theory to teacher education

Our theoretical research base is the Cultural-Historical Theory (CHAT), created by Lev Semyonovich Vygotsky (1896-1934) and his followers. We are interested on works and studies grounded in CHAT because they understand human beings from the development process of their superior psychological functions, through their learning process and culture appropriation, considering education as key to the process of humanization. In this perspective, we discuss some emerging elements of their works, aiming to contribute to the reflections on our study data.

The acquisition of human aptitudes developed during time is found in the objective phenomena of material and spiritual culture, as highlighted by Leontiev (1978). To appropriate themselves of these results,

the child, the human being, should get in contact with the phenomena of the world around through other men, that is, through a communication process among them. Thus, the child learns the appropriate activity. Due to its function, this process is, therefore, an educational process.

In this sense, a humanization process takes place. It is defined by Saviani (2000) as “... the process through which men produces its existence in time” (p. 96), which happens thanks to the “production and reproduction in each particular individual of the maximum capabilities already reached by humans” (Martins, 2007, pp. 15-16). This process is developed from the appropriation of all the production and cultural expression of human work; its needs overcome the mere existence and biological survival, guaranteeing a cultural existence inseparable from school education.

As humanity evolves and progresses, the accumulation of knowledge historically produced increase and, with it, the task of educational process increasingly becomes more complex. So, school education, intentionally organized by the teacher, needs to answer the specificities of the processes of objectification of scientific knowledge and the appropriation of meaning by students.

School is a space that offers favorable elements to human development, taking part in the construction of these elements, that is, it has a central role in students’ development. Development is promoted through the creation and offer of conditions for students to appropriate themselves of the historically-build knowledge through planned, organized, and intentional mediations. As pointed out by Saviani (2000), the existence of a school is exactly guided towards “providing the acquisition of instruments that allow the access to an elaborate knowledge (science), as well as the own access to the basics of this knowledge” (p. 23).

Therefore, school education takes shape as a privileged process of socialization of historically-systematized knowledge, in which teachers plays the necessary mediation between the student and knowledge. Consequently, teaching is established as a mediator between learning and development, from the formation of concepts and the emergency of superior psychological functions. In this perspective, we highlight the importance of organizing spaces in which pre-service teachers will be able to understand such questions, which are key to their practice.

Many works in the area of mathematics education have been discussing the training of mathematics teachers, approaching their educational trajectory and teaching professionalization, as well as their identities as mathematics teachers and professionals. Supported by this theoretical reference, we have opted to have another focus based on the guiding principles of meaning of the teaching activities.

In this context, our concern was on the training of mathematics teachers that, as those from other areas, is developed and established as teachers through their work. We ratify Moretti (2007), when pointing out that, within CHAT, that men is established through work, so it is through work that teachers establish themselves as teachers, mainly through their work- the teaching activity.

Teacher work, constructed as a social practice, is an intentional movement of knowledge and relations exchange that should be seen as an essential element in the humanization process of teachers and students. Thus, we understand that pre-service training should allow future teachers to appropriate themselves of social meanings defined as key to their work. An important social meaning in the in the teaching activity is its role in this dialectic unit of teaching and learning. Their actions reach this end depending on how teaching is organized, as the teaching activity, with all its elements, is established as a learning activity for the student.

The disconnection, that often takes place in the Teaching degrees between content and pedagogical knowledge, has been a frequent problem in the organization of curricula for pre-service teachers. Libâneo (2014) points out that:

In the traditional concept of teaching, the teacher is seen as someone that transmits knowledge based on the logic of the subject taught, a common statement is that mastering a content is enough to teach a subject. Pedagogical knowledge is understood, in this case, simply as a repertoire of teaching techniques. Thus a great part of teachers ignore the fact that teachers' professional knowledge is composed by, at least, two requisites, the mastery over the subject content and the mastery over the knowledge and abilities to teach this content. (pp. 54-55)

When ignoring these two aspects, teachers risk being characterized as specialists of a subject, or even to act based on common sense. We aim to overcome this perspective, considering that the arrival in school demands much more than what is previously envired, as stated by Lopes (2009). To practice their profession, teachers need

knowledge that transcend those related to their specific subject, as the choice to be a teacher must go beyond simply practicing a profession; it should lead to a social and political engagement to “embrace a cause”: education. (p. 55)

This commitment can emerge and manifest itself in the training activity through the actions that guide them. The individual needs of future teachers, when shared, are part of their educational/training process, so that every action enacted leads to fulfill the common objective of the group: acquire the necessary knowledge for teachers' work.

We believe in training processes that value and promote social interaction, the study and problematization of multiple teaching activities and, in our case, mathematics learning. Besides this, it is key to understand mathematics as an object of teaching and learning and as a cultural product comprised of epistemology, history, creation needs, transformation, and appropriation. The teaching of mathematics, thus, is not restricted to teach any mathematics, it also involves establishing relations with this knowledge and the way to organize its teaching.

If the teaching activity is complex and being a teacher in the current social-historic situation is a challenge, the process of teacher training cannot be simple or easy.

The world dynamic imposes to school a movement that should be followed by the teacher, in the scope of personal relations with the students as well as the evolution of knowledge. Thus, the need to think about training a professional in a way that he/she is prepared not only for isolated events to be faced in the everyday life, but also to be able to follow such process (Lopes, 2009, p. 55)

School placement is an important space for the training of mathematics teachers, especially because it allows a better understanding of mathematics teaching and learning process. In this perspective, we highlight an article that helps us understand the relations established in this space. In the research based on a mapping project and a state of art of Brazilian studies on mathematics teachers, Lopes et al. (2017) map, describe, and analyze works on *Estágio Curricular Supervisionado* (Supervised School Placement), regarding their objectives, main results, and conclusions. From the analysis of 20 works on the theme (from 2001 to 2012), the authors note the increase of studies on the theme, as well as the understanding of school placement as a phase not restricted to the end of the course, but an articulator between basic education school and university, a key space to understand the complexity of the profession and the establishment of a teacher identity.

Based on this issues, in the context of our work, we try to organize situations in which the subjects had the opportunity to appropriate themselves of knowledge that can be considered key to teacher education. Our intention is that these actions can present elements related to the meaning of teachers' work and the possibility of establishing oneself as a teacher, from one's own organization.

Research methodology

Aiming to understand the study object, unveiling the indicatives of the signification process of the teaching activity by future teachers, we have organized the methodological proposal of the study in the perspective of a formative experiment. The term “experiment” appears in Vygotsky’s (2003) works to indicate his studies. For the author, an experimental analysis could reveal the essence of the formation process of concepts, more specifically through the investigation done in steps that consider the subject’s thought movement. Based on this proposal, Libâneo (2007) present a formative experiment as a pedagogical intervention through a certain teaching methodology, aiming to provoke changes and grounded on the teaching action in the learning process.

Our formative experiment was developed through 16 meetings during a semester, with 10 undergraduate students from the Mathematics Teaching degree at *Universidade Federal de Santa Maria*, in the subject *Estágio Supervisionado de Matemática no ensino fundamental*. With the collaboration of the two professors of the subject, the study consisted on different actions: study and discussion on the syllabus of the subject, readings and theoretical discussions on learning for mathematics teaching, as well as the organization, planning, and development of teaching activities about the concept of measurements with the pre-service teachers. We highlight that these actions coincided with the period that these undergraduates taught in middle schools.

We tackled different themes during these 16 training meetings, from which we highlight: teaching learning; school placement as a space for teaching learning; teaching organization; mathematics as a cultural and human product; specific and pedagogical knowledge; teachers’ teaching object; logical-historical movement to establish mathematical knowledge; and planning and evaluation in the teaching- learning process.

When this study was done, the school placement of the Mathematics Teaching degree in this university took place in the last year of the course, after all the pre-requisites subjects in the curriculum. The placement on elementary and middle school was held in the penultimate semester, and the high school one in the last semester. To enroll in the school placement subject, students had to had finished the pedagogical, content, and didactic subjects, such as Didactics of Mathematics I and II, Mathematical Education I and II, and Teaching Laboratory in Mathematics, in which they could had some observation and punctual activities in schools.

We used observation, field notes, audio and video records to register the research moments and show the expression and manifestation of learning, as well as the changes in the quality of the training process of the pre-service teachers. After collecting and registering of the data, we used episodes (Moura, 2004) and units of analysis (Vigotski, 2000) to organize, systematize, interpret, and analyze all information.

About the episodes, we think they are revealing of the nature and quality of actions. They are established by “written and spoken phrases, gestures and actions that compose scenes that can reveal the interdependence among the elements of a formative action” (Moura, 2004, p. 276). They can also be defined as moments in which situations of conflict can appear, which can lead to the appropriation of new knowledge, to the learning of a new concept.

The episodes selected evidenced the units of analysis. We understand them as logic units of the scientific-theoretical thought, as a way to apprehend the movement from a concept to another, a way to deeper interpret the study object. When using unities of analysis, we are grounded on the method developed by Vygotsky (2000) in his investigation, in which the

The analysis decompose in units the complex totality. We understand by unit a product of analysis that, contrary to the elements, has all properties that are inherent to the whole and, simultaneously, are living parts and indecomposable if this unit. (p. 8)

In this direction, to fulfill the objective of the research, the formative experiment was organized to provide the conditions for undergraduates to appropriate themselves of relevant knowledge to develop the teaching activity, understanding it as the main activity of the teacher, from a shared space of teacher learning.

Reflections with pre-service mathematics teachers: perceiving themselves as subjects under training

The data analysis for the doctoral research allowed us to create four units of analysis: (i) the future teacher as a subject under training; (ii) school as a social place for teachers' work; (iii) the mathematical knowledge as a guide to organize teaching; and (iv) sharing as a way to promote change in the quality of actions. These units converge with the reflections pointed out by Lopes (2018), which highlight some guiding and core principles to the discussion on teacher

training. These principles are based on the results of studies done by GEPEMAT⁵ on teaching and learning processes of school mathematics.

In this article we present the unit “the teacher as a subject under training”, whose focus centers in the analysis of the way future teachers perceive themselves as subjects under training. To do so, the three episodes selected portray moments in which students statements show the appropriation of elements inherent to the teaching practice which, consequently, establish the process of becoming teachers.

When approaching the role of the future teacher in the context of our original research, it is important to understand the reasons- in the perspective of Leontiev (1983) – subjects manifest regarding their choice for Mathematics Teaching degree. This understanding took place during the meetings with students. However, here we present only one excerpt in which are clear some indications based on the reflection from the discussion of a questionnaire applied to students in our second meeting.

Episode 1: The ways to the Teaching degree: initial expectations with the Mathematics undergraduate

We first applied a questionnaire to better know the undergraduates. In this episode, we bring the answers of the subjects for the question: did the Mathematics Teaching undergraduate degree corresponded to the initial expectations? Briefly comment your experiences during the course. Besides writing, they answered it out loud and shared their experiences. The conversation bellow is part of this episode.

1. **Maria:** “So, I was a bit frustrated in the beginning...because I left high school and came straight to the university here, I guess most here did, right....so, I ended up flunking some subjects, I had a lot of problems with math, I still do, but I made an effort and could make up for lost time. I thought about giving up. Up to the 3rd semester I didn’t know if that was what I wanted, I did a psychological follow-up, a vocational test, and the result was mathematics. Entering in the ‘Pibid Matemática’ project has also helped me continue in the course”
2. **Catarina:** “My impression was a bit different. I think it was good that they had placed differently Teaching and Bachelor, I think it was interesting to have a contact

⁵ *Grupo de Estudos e Pesquisas em Educação Matemática* (GEPEMAT/UFMSM), in English: Study and Research Group on Mathematical Education

with Teaching since the beginning...I didn't have much problem with the mathematical content; It thought about giving up sometimes, because we didn't really know what we wanted, but ended up staying, and I don't regret it. I was a TA of PIC for a semester and of trigonometry for a year and a half and, until now, those were the most profitable experiences of my undergrad"

3. **Alaídes:** "I had a really hard start. The course often didn't correspond to my expectation, but it wasn't a disaster. I flunked some subjects in the start, many teachers from the math course told me to give up"
4. **Breezy:** "What an incentive!"
5. **Professor Ane:** "Teachers of the mathematics course?"
6. **Alaídes:** "Many....then, in the middle of the course, I started to give private classes, I started to observe some subjects, then, I got more motivated and wanted to stay in mathematics...Then, after, further on, a friend invited me to teach at Alternativa [a preparatory course for low-income groups], where I had the best experiences possible, and also the worst, but that's when I noticed the result of being a teacher, that I really wanted the mathematics course"
7. **Professor Lis:** "It was worthwhile continuing in the course".
8. **Luiza:** "The first semester was very hard for me, I had many gaps from elementary and high school. I thought many times about giving up".
9. **Julia:** "It was difficult for me too".
10. **Luiza:** "We started together [Luiza and Julia], we cried a lot".
11. **Julia:** "Yeah, we did well on high school, on elementary and middle school, then, here, we'd get a 3.3 in a test, my goodness! It was hard...we always studied a lot, so it was a great shock in some subjects. But, also, another point is that some subjects in the course are too focused on the theoretical part and, often they don't link a certain content to the class, with the students".
12. **Antônia:** "Well, I think there is kind of lack of concern with school, few contact with the school community. I think that, in many subjects, they could work this a bit more, to make connections, give suggestions, or approach some questions on how to take this to school"
13. **Agatha:** "I'm similar to Antonia and Catarina, we entered together, I also had a shock when leaving home...What helped me a lot during undergrad was to join PET [teacher assistant program], it has helped me a to get more motivated with the course, because I was full of doubts in the first semester. In the first year, I was really in doubt if that was what I wanted, after I stabilized and, last year, I started to teach at Alternativa, and this has flourished the teacher in me"

In this first episode, we are presented to the experience of students in the first semester and during their Teaching degree. In the conversation above, we can see their experiences and distresses which point out three main aspects: the difficulties faced in the beginning of the course, the actions that led to their continuation, and the intention to work as teachers.

Most undergraduates said they liked teaching and always leaned towards the mathematics area. However, they all revealed having some degree of difficulty during their course. In general, among the most noted aspects, there were frustrations in the beginning of the course, with failures and difficulties with the mathematical contents, the adaptation to the university and the city, as well as doubts on continuing the course.

Contributing to our analysis, Dias and Souza (2017) highlight that, when glimpsing the reality of the Teaching degrees, it is possible to see that freshmen do not know their future profession and, therefore, their motives would converge with the choice. However, when reflecting more carefully we can, as pointed out by the authors, they

discuss the provisional aspect of their choices and the possibility that they had been taken, for example, by the proximity of their house to the university, the influence of friends or families, or even, because they had good grades in a certain subject during basic education. In these cases, doing the admission exam for a Teaching degree is led by an understandable reason, not an effective one, as the reason for the choice does not match the purpose aimed by the course (p. 187)

The conflict that takes place between the expectation and the reality of the training course is one of the causes of doubt regarding students' continuation, motivated by the characterization of the divergence between the initial motivation of entering the course and the social objective towards which training is guided. However, along the way the course could present new elements to the students, transforming their motives, especially by understanding the different mathematical demands from those they faced during basic education.

Leontiev (1983) highlights two types of motives that can be related to entrance and continuation of the subjects in the Teaching degree:

some motives, when stimulating the activity, give them a personal sense; we will call them sense-forming motives. Others, coexisting with them, assume the role of propelling factors – positive or negative – we call them motive-stimuli.⁶ (p. 166)

The distancing we found between expectations and reality highlights the subjects' motives when entering the Teaching degree. The overcome of the difficulties found and the change of motives only understandable as sense-forming (Leontiev, 1983) can take especially take place when mobilized by such actions as those described by students.

Among the elements that triggered the change of motive, we have identified that, during the discussion summed up on episode 1, all students pointed out that the actions taken during the university time had incentivized their permanence in the course, strengthening their option for the course or, at least, the wish to finish it

All students' experiences, since basic education and mainly during the Teaching undergraduate, fomented their intentions towards the work they will develop. The link among these experiences is the fact that they allow students to see themselves in the teachers' role, interacting with the students, planning, organizing, and evaluating their actions. The experiences they had with the professors of the course, negative or positive, establish standards for their own actions. The influence of their participation in projects and tutoring have also strengthened and guided their first pathways.

Once more, Dias and Souza (2017) helps us to ground students' highlights, as

when pre-service teachers become teachers and start to work in school, all elements of their experiences as students in basic education and the specific knowledge from their university education acquire new meanings. The action in school allows the manifestation of new relations between what they have learnt in the university and school reality. (p. 198)

The concerns of pre-service teachers with their first meeting with the classes involved an overcoming of their difficulties during their school life, mainly the development of “different activities”, to teach clearly, and to establish a good relationship with their students, teachers, and school personnel.

⁶ In the original: “unos motivos, al estimular la actividad le confieren a la vez un sentido personal; los denominaremos motivos dotantes de sentido. Otros, coexistentes con ellos, asumiendo el papel de factores impelentes – positivos o negativos – en ocasiones extraordinariamente emocionales, afectivos, están privados de la función de conferir sentido; los denominaremos convencionalmente motivos-estímulos”.

Pre-service teachers' intentions to establish some relation with schools reinforce the movement of understanding themselves as future teachers, though still under training, mainly when they state they want to contribute with students' learning, with the transformation of their life conditions, to approximate and make mathematical knowledge accessible to all students. We understand that these are important relations towards the commitment to teachers' activity.

We notice pre-service teachers' intention towards the development of their students' potential, in the direction pointed out by Vygotsky (2001), that “ an education guided towards a development stage already reached is ineffective from the perspective of children's general development, it is not able to guide the development process, but goes through it” (p. 114). In the author's perspective “the only good education is the one that anticipates the development” (p. 114), what highlights the relevance through which school contents should be organized, so as to promote in children what is yet not formed, reaching higher levels of development.

That said, we present a second episode, which portrays one of the actions developed – Reading of a text – and the discussion among pre-service teachers on teachers' activity. The intention is to portray a recurrent moment throughout the formative experience: the study of theoretical texts and articles that guided discussions on the elements surrounding teachers' activity.

Episode 2: Discussing on teachers' activity: seeing themselves in the text

We present a small excerpt of a conversation in which pre-service teachers highlight the main ideas of an academic article and relate it with their experiences. The article presented an analysis of the training process experienced by a student, Allan, during his school placement, and his displacement from student to teacher

1. **Agatha:** “I like it a lot, reading this text, I identified myself more with this text than the other, because by reading all that Allan said, we keep thinking ‘this could also happen when I'm in the classroom’, so, I liked this text a lot, it was a fruitful reading”
2. **Antônia:** “I think it was an easier reading than the other, because it is closer to what we are living too, though the text is longer, it flows better...what does the text bring us?”
3. **Dionfantina:** “Another issue is to prepare us to situations that don't happen as we planned, not always”.

4. **Professor Ane:** “It won’t always happen as we’ve planned, right?”
5. **Alaídes:** “What called my attention is that he thought the class was wonderful, and when he went back to the group, it wasn’t so...you can always think that the class was good and, after, think on how the class was”
6. **Professor Ane:** “Yes, and maybe this possibility he had to reflect with his colleagues made him start to think differently”
7. **Professor Lis:** “His ‘reflection’, in fact, was not only think about it, as if the class was good or not, but he reflected on the sense of searching to resignify, to discuss about it. So, he could reach this conclusion that, in fact, it was not as good as he thought”
8. **Professor Ane:** “What other ideas were there in the text??”
9. **Antônia:** “I highlighted the part, don’t know where, that the knowledge, the experiences we have in school placement is not only what happens inside the classroom, it is in the dialogue with other teachers, your insertion in the school community as well”.
10. **Professora Ane:** “This is nice, you learn with a colleague, with the other”.
11. **Alaídes:** “Planning your class and not keeping it only to you, talk with the workmates, other teachers, reflect on what can be improved. Another question was when he didn’t know the meaning of algorithm”
12. **Maria:** “Something that called my attention was when he [Allan] makes a mistake on the concept of matrix in front of the class. But, during the break, the main teacher said that ‘teachers don’t err’, only make mistakes? But then he thought ‘no, they do err, and I should say that to my students’. I thought this was very interesting because there is this idea that the teacher is perfect, that knows everything, that can make mistakes and this is not true, we need to assume our mistakes!”
13. **Professor Lis:** “And this creates, from my own experience, a relationship of trust with the student as the student no longer sees the teacher in another level, a didactic contract is established”
14. **Professor Ane:** “It strengthens the trust, because the student thinks ‘if he teaches me something wrong, he will take a step back, then I can trust that what he’s saying is really true””

Episode 2 portrays an important moment that got stronger during the formative experiment: the studies and readings that grounded the discussion of the pre-service teachers on their own experiences. We understand, as Leontiev (1983), that needs create human activity,

when these studies arose from the need to organize teaching, they could be indications of the establishment of the teaching activating in future teachers.

Students' identification with the text, due to their training moment and the proximity with the theme approached, mobilized a reflection on some aspects, sometimes unexpected, that permeate teaching practice, the relevance of group discussion, and the learning that takes place in school. The understanding of the elements that permeate teachers' activity as a human process is one of the important elements to form teachers' personality. Martins (2007) highlights that personality is a psychological formation established as a result of the transformations of activities grounded in the relationship of the individual with the social and physical environment.

Any educational project must recognize the importance of teachers' personalities, paying attention to the fact that one of the demands to develop human capabilities is the appropriation of culture (material, scientific, and theoretical- technical), a preliminary condition to interpret reality, to overcome appearance towards the essence, and to establish the more conscious relations with oneself and the world (Martins, 2007).

We highlight Alaídes's lines 5 and 11 when noticing that Allan "*thought the class was wonderful, and when he went back to the group, it wasn't so*" and also the importance of "*talk[ing] with the workmates, other teachers, reflect on what can be improved*", what shows the need to discuss and reflect in groups, as well as the certainty that this exchange encompasses the learning with the other and, in the case of pre-service teachers, with their colleagues, the professors-advisors, main teachers, and other school personnel.

Moura (2004) defends that education is a collective work of teachers, and that the educator establishes him/herself exactly in the collective school space, that is, in the process of sharing mainly with colleagues and teachers the responsibilities, reflection on the classes, on teaching mathematics, aiming the common goal that unites them: the commitment with public education.

When understanding the collectivity that permeates teachers' work, pre-service teachers can organize and guide their actions from common objects, following this movement of entering school, as well as when starting to work, the experiences lived as a student and the knowledge that are part of their training acquire new meanings (Dias & Souza, 2017). The work in school enables the manifestation of new relations between the school context and the appropriate knowledge at university.

Finally, corroborating with the author's idea, we highlight line 9 in which Antônia noted a part of the text that says "*that the knowledge, the experiences we have in school placement is not only what happens inside the classroom, it is in the dialogue with other teachers, your insertion in the school community as well*". The possibility of learning about the school with other school subjects can be explained in what Vygotsky (2000) calls "Zone of Proximal Development (ZPD) – the distance between the real development level (that encompasses the psychological functions already developed) and the potential development level (that characterizes the future developmental steps of the subject). Learn with more experienced teachers, with the coordination, the parents, and the community in general, acting in the ZPD, is what allows a more detailed understanding of teachers' work, to get closer to all, as

the specificities of each school, the particular way in which the relations among the components of the group are established and enacted, the interaction that has been woven between them, directly influence the life of the student and the classroom. (Pimenta & Lima, 2012, p. 25)

Our intention with the texts selected for the formative experiment was to provoke reflections on the types of knowledge related to teachers' activity. We understand that dialoguing with the theoretical reference and the most important aspects in this formative moment is needed in the process of leaning theoretically about the reality. Through this practice, it is possible to establish theoretically the relations with experiences or expectations, as well as appropriating new knowledge, be them mathematical ones or on the process of teaching and learning.

In this sense, we highlight the possibility that pre-service teachers, in this moment and in others during the formative experience, perceive themselves as subjects under training as they were actively playing a role in the process. This fact implies that they understood themselves as subjects in this activity. To be in an activity (Leontiev, 1983), the individual must act actively, mobilized by a particular need, in this case, towards the appropriation of key teaching knowledge.

In Vygotsky (2001) words, learning is "a necessary and universal aspect of the development of culturally organized psychological functions and specifically human" (p. 103), resulting in a unity between the learning processes and the internal development. The understanding of this unity by the teacher allows that the activities he/she planned enable the conversion of a process into another.

In the last episode, we present pre-service teachers' reports reflecting on some of the experiences lived in the elementary/middle schools they were placed. Thus, the lines from the third episode come from the last meeting of the formative experiment, when we evaluated the semester through a group dynamics.

Episode 3: The trajectory of school insertion: positive aspects of school placement

In this episode, nine pre-service teachers in the meeting presented their perspectives on the first question of a group dynamics called *It's good that....*, which approached the positive aspects during the school placement.

1. **Alaídes:** "It's good that everything worked out despite my initial fear, my nervousness. It's good that the school received us with open arms, made us comfortable. It's good that the school and the students became my friends, will be my friends in the future, I liked them a lot. It's good that I've learn a lot from my students, I think I learned more than I taught, I leaned to know them, to know their problems outside school, to not impose my class, basically this".
2. **Julia:** "It's good that the school was welcoming, that the students accepted me well, and I think they liked the classes...I think I've improved my explanations on the blackboard, because, before, I explained very fast, and as the classes moved on, I tried to control this, to explain more slowly, and I also had no serious problem during the classes."
3. **Luiza:** "My class welcomed me well, I had no problem with the students, parents, etc., the main teacher always made me at ease, advised me, and motivated me, the classes here were always very interesting, they helped me grow as a teacher, I could help my students to develop a little and I also could be a bit less shy and not be so embarrassed to teach them"
4. **Maria:** "It's good that I could enter in the class and give the content planned. I noticed that many students could learn with my explanations and that was good. It's good that I could get to know a little bit each student and, as much as possible, I could help them".
5. **Agatha:** "It's good that I could explore, even for a bit, some different proposals, or, sometimes, introduce something a bit different, some materials, like Tangram, and protractors that were a bit out of their routine. It's good that I could do that, to a certain point. It's good that I could build a friendship with the students and the main teacher too, with the school in general".

6. **Catarina:** “I think the welcoming at the school was good, despite everything, and the trust that Carlos [main teacher] placed on me, made me calmer during the class, I also think it was good to know students’ different realities, and I also had a positive feedback from students regarding the teaching methodology and how clear the explanations were. When I said I would stay only until winter vacations, they were sad. That is it for me a positive side because they liked me and my class, so, for me that was good.”
7. **Dionfantina:** “ I write here that I choose the school well, that everything I did was valid, was welcomed, I’d like to stay with the class until the end of the year, with its noise, easy talk, and joyful laughter”
8. **Sales:** “It’s good that I could be placed in a great school, I met teachers-colleagues that like what they do, I could teach and learn many good things, I made many friends, I discovered there are many parents really concerned with their children and education, and I had the opportunity to know more about each students, then I could teach them better”
9. **Breezy:** “It’s good that school received me with arms open, they gave me a lot of support, I could understand my students’ reality, why they were there. It was an experience that helped me see teaching from a different perspective, more humane, always concerned, and to understand students’ reality. It’s good that I could meet wonderful people, that added much to my life, the students I became friends forever, the teachers, the coordination”.

Analyzing the last moment with the pre-service teachers at the university that semester is important as it allows us to resume aspects that were seen in the first meetings and can indicate that these students perceived themselves as future teachers under training. By focusing on their positive moments during the semester, two points can be noticed on their words: the relation they established with the school and students, and the personal development they noticed during this period.

All reported they were welcomed in the schools and the classrooms, many could establish close friendly relations with the main teacher and students. We highlight line 8 by Sales, who pointed out the care and concern of many parents towards the education of their children; and the lines of Alaídes (1), Maria (4), Sales (8), and Breezy (9) who mentioned that the approximation with students’ realities, they family and social contexts, gave them better conditions to plan and teach mathematics. As Pimenta and Lima (2012) emphasized,

when moving from the university to the school and back to the university, pre-service teachers can establish a network of relationships, knowledge, and learning, not aiming to copy, to simply criticize the models, but understanding the reality to overcome it. (p. 111)

The experiences and relations established with the students and the school community could also help overcome the moments of nervousness and shyness, as seen in the words of Alaídes (1) and Luiza (3). The undergraduates highlighted that they had improved their attitudes during the semester, they could follow the plans (Maria, line 4) and explore some “different proposals” (Agatha, line 5).

As stated by Dias and Souza (2017), the relationship between school and university should allow educational institutes to fulfill their social role. Furthermore, learning about teachers’ work during the school placement demands being aware of peculiarities and interconnections with school reality (Pimenta & Lima, 2012).

Teachers’ activity involves many aspects, subjective and objective conditions, directly related to work actions, such as the practice, school planning, class preparation, teachers’ remuneration. The understanding of teachers’ work as a whole demands the discussion and analysis of these properties as a whole, according to Vygotsky’s contributions (2000), in an articulate, non-fragmented way, encompassing isolated elements.

The school placement moment, as pointed out by Pimenta and Lima (2012), even if temporary, can be considered an exercise of participation, conquest, and negotiation of the place the pre-service teacher will occupy in the school, involving the relationship with students, coordination, with colleagues-teachers, or the school community.

The undergraduates’ words show a concern with students’ well-being and learning. About this, we emphasize Moura (1996), when stating that

The first action of the educator is to transform teaching/learning into a meaningful activity. To do this is to give an opportunity to the student to take the action of learning as a need to integrate and accessing new types of knowledge. Furthermore: that the child or the learner realize knowledge as a reference to the humanization process, whose first step is the understanding of the collection of knowledge produced as a humanity heritage. (p. 34)

We consider that the undergraduates followed this direction, even those who were not completely on board with teachers’ work, considering that some pointed out as a goal for the following semester, besides those previously highlighted, to plan and develop actions that

promote the learning of mathematics among their students and socially contribute to their growth and the transformation of their life conditions. We noticed, in this case, that the senses attributed to the teaching actions coincide with its social object, through conditions that enable to place the subject in activity, in the perspective of Leontiev (1983), bringing indication of meaning in teachers' activity.

Final remarks

When analyzing how future teachers perceived themselves as subjects under training, in the movement of signifying teachers' activity, we assume that the spaces in which these pre-service teachers participate – especially, the school placement – need to enable the appropriation of knowledge that allows new types of leaning towards the (re)construction of teacher practice, towards new qualities in the pedagogical practice.

In this sense, the three episodes presented refer to the important relations we believe to be established through the words of the undergraduates in a formative experiment in the context of school placement. The data indicate that the formative trajectories of participant undergraduates had similar pathways, from particular reasons to look for teaching, the initial expectations with the course, facing challenges during the trajectory, going through actions and experiences that mobilized their permanence of professional choice, mainly the initial contact with the school environment.

There were different initial motives of their choice for Mathematics Teaching degree, even if related to the affinity with teaching and mathematics, however, they were distant from the aims of the course in the university. The difficulties and challenges which emerged from the contrast with the new reality were overcome, though not immediately, through actions that, we believe, mobilized the transformation of their motives to become teachers, especially the relation with the contact with students, with the process of teaching organization, and situations that demanded them to assume their position as subjects under training.

Different motives can regulate the activity of undergraduates' training. However, we mean here the main motive, which should coincide with the object of the activity. It is the transformation of this motive that previously could have been just a stimuli for most

undergraduates, into the main generator of meaning that gives a new quality to the formative process.

The main generator of meaning can be understood as an objectified need, which guides the subject in the problem-situations permeating the activity (Leontiev, 1983). The concept of motive involves all aspects that mobilized the subject to take actions to reach his/her objectives, what materializes teachers' activity when this reason is truly a generator of meaning.

With new motives guiding undergraduates' training activity, other elements have also appeared to be important to the process of learning to teach. The movement to appropriate themselves of new types of knowledge— from practical or theoretical experiences, as mentioned by the undergraduates- permeates teacher work during all life, it only starts at university. The understanding that training is a process in movement is, therefore, key for the teacher to continue looking for better conditions to guarantee changes in the quality of teaching.

Besides this, we reinforce the undergraduates' commitment with students' learning and the responsibility with public education in the current conditions, which show that they understand themselves as training teachers. Libâneo (2004) highlights that changes in the ways to learn also affect teaching, thus “what is expected from students' learning should also be expected from a training program for teachers” (p. 3), one in which undergraduates seen themselves as subjects in the process, participating, discussing, and proposing ways for their map, and not experience the course as an imposition.

We believe that the elements highlighted in this work allowed future teachers to perceive themselves as subjects in a formation movement and part of the process. By recognizing this position, they take on responsibilities involved in teachers' work, as well as have the right to appropriate themselves of all the knowledge needed to fulfill a teachers' activity.

We have seen changes in the undergraduates' motives to become mathematics teachers; the understanding of teacher training as a continuous process; and changes on the quality of the teaching activity. From this, the data analysis indicated that, when perceiving themselves as subjects under training, future teachers appropriate themselves of knowledge on teaching which allows them to give meaning to the teaching activity that coincide with its social meaning, committed to students' learning.

Understanding the elements that permeate the process of giving meaning to the teaching activity allows teacher trainers/professors to organize, with intention, the spaces that portray guiding principles of learning how to teach during this pre-service moment. Simultaneously, this process allows teachers, or future teachers, to be aware of the social meaning of their work, from innumerable specificities.

We emphasize that the results refer specifically to the actions held in the context of our formative experience, representing only an initial step. Thus, there are other issues to be discussed and that can lead to other studies. It would be especially important to research issues related to teachers' appropriation of the contents to be taught and the mathematics learning of basic education students.

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