

The role of virtual tutors in distance education for primary teachers: Focusing on mathematics

Luciane de Fatima Bertini^I
Cármem Lúcia Brancaglioni Passos^{II}

Abstract

The present study sought to describe how questions related to the teaching of mathematics are approached and conducted by virtual tutors in a distance-learning program for primary teachers. Data were collected in an undergraduate program in education in a Brazilian public university which considers that virtual tutors should help not only with the use of the virtual environment and its tools, but also with the contents and the education of their students, i.e., future teachers. Choosing this object of study allowed using a case study, which seeks knowledge based on a specific case, represented in this study by the way the work of virtual tutors is organized. To conduct our analysis, we took into account aspects of textual discourse analysis in a qualitative approach. We found that a fairly individualized service can be provided for the needs of each student by: a) pointing the positive aspects of each activity with a view to systematizing learnings; b) expanding and complementing the ideas presented; c) problematizing and questioning; and d) approaching aspects related to mathematics contents and the effective participation of children in activities. The description and analysis of tutor interventions allowed us to verify that, in this distance-learning program for teachers, many of the virtual tutors' practices might be viewed as those of a teacher.

Keywords

Mathematics teaching – Distance education – Teacher education.

I- Universidade Federal de São Paulo,
São Paulo, SP, Brasil.
Contact: lfbertini@gmail.com

II- Universidade Federal de São Carlos,
São Carlos, SP, Brasil.
Contact: carmen@ufscar.br

O papel do tutor virtual na formação de professores dos anos iniciais na modalidade a distância: a matemática em foco

Luciane de Fatima Bertini^I

Cármem Lúcia Brancaglioni Passos^{II}

Resumo

O estudo aqui apresentado pretendeu identificar a forma como questões relacionadas ao ensino da matemática são abordadas e conduzidas pelos tutores virtuais em um curso de formação de professores dos anos iniciais, realizado na modalidade a distância. O cenário para a coleta de dados foi o curso de licenciatura em pedagogia de uma universidade pública brasileira, que considera como função do tutor virtual contribuir não apenas para o uso do ambiente virtual e de suas ferramentas, mas também em relação ao conteúdo e à formação dos estudantes, futuros professores. A opção pelo objeto a ser estudado permitiu aproximar tal pesquisa de um estudo de caso, que busca o conhecimento a partir de um caso específico, representado, nesta investigação, pela forma de organização do trabalho dos tutores virtuais. A análise foi realizada, levando-se em consideração aspectos da análise textual discursiva, em uma abordagem qualitativa. Observou-se a possibilidade de um atendimento mais individualizado às necessidades de cada estudante, por meio de: a) apontamentos dos aspectos positivos de cada atividade, buscando sistematizar as aprendizagens; b) ampliações e complementações às ideias apresentadas; c) problematizações e questionamentos; e d) aspectos relacionados ao conteúdo matemático e à participação efetiva das crianças nas atividades. A identificação e a análise dessas intervenções permitiram constatar que, nesse curso de formação de professores a distância, muitas das práticas dos tutores virtuais podem ser consideradas como de professores.

I- Universidade Federal de São Paulo, São Paulo, SP, Brasil.

Contato: lfbertini@gmail.com

II- Universidade Federal de São Carlos, São Carlos, SP, Brasil.

Contato: carmen@ufscar.br

Palavras-chave

Ensino de matemática – Educação a distância – Formação de professores.

Education in mathematics for primary teachers

In Brazil today, the training of teachers to work with primary education and early childhood education is provided by undergraduate licentiate programs in pedagogy.

Research about pedagogy courses highlight the existence of negative beliefs and attitudes in students towards mathematics (CURI, 2004; UTSUMI; LIMA, 2006; ZIMER, 2008). This has consequences regarding how teachers who graduate from pedagogy courses will teach this particular subject in the curriculum when they start teaching.

The aforementioned authors argue that such discussions, as well as the awareness of beliefs and conceptions about mathematics, should occur early in primary teachers' education, prior to their beginning in teaching, as these teachers will be responsible for the first level of school education. Moreover, any concern with the quality of education and with the guarantee that anyone can succeed in learning mathematics, which is entitled by citizenship, should take into account the quality of the initial experiences in teacher education.

With regard to future teachers' initial education in mathematics, Nacarato, Mengali and Passos (2009) point that one of the challenges lies in making beliefs about mathematics an object of reflection and, moreover, in allowing future teachers to have contact with the elements of mathematics in a way that is integrated with pedagogical issues.

This implies understanding what the role of mathematics is in today's society and how the school can contribute to the mathematics education of students. In this respect, Serrazina (2002) highlights the new demands imposed on citizens by the society of information and the changes it has brought about to the teaching of mathematics: the idea that mathematics is a set of ready-to-use rules and procedures has been replaced by the idea of a school mathematics that privileges both doing and the understanding of

the concepts, thus allowing students to explain and justify their learnings. If mathematics is supposed to be presented to primary school children in this way, so should those contents be approached in initial teacher education; after all, "the trainer who wants future teachers to consciously develop a certain didactical model should bear in mind in his practice the same principles he wishes to promote in his students" (SERRAZINA, 2002, p. 15).

Serrazina (2012, p. 267) reaffirms this as she argues that

[...] the teacher has to have the opportunity to go through mathematic experiences of the kind he is expected to offer his students, because only then he will be able to perform his duties as a mathematics teacher, i.e., to bring students to learn and appreciate mathematics.

This is seen in the results of Curi's (2004) study, which was conducted in a training course for multiple-subject teachers. In her study's final report, she recommends: it is not enough that multiple-subject teachers learn concepts, properties, and operating techniques in their training courses; these teachers (or future teachers) should also enhance their ability of solving problems, arguing, estimating, reasoning, and communicating mathematically. Those perspectives highlight the importance of the instructor's role in this process.

All considerations presented so far about the teaching of mathematics in teacher training courses and about the importance of the instructor are related to face-to-face courses in higher education institutions. However, the existence of distance-learning courses through the internet invites us to think about how the mathematics education of primary teachers takes place in this learning modality, and about the role of the virtual tutor in this process, since the interactions with students occurs through these tutors. Some of the questionings that motivated us to conduct the present study are: a) describing

how questions related to the teaching of mathematics in primary school are approached and conducted by tutors; b) analyzing the types of intervention virtual tutors perform; and c) verifying whether such interventions can help tutors' performance as instructors.

Along with these goals, this study will approach aspects of teacher education through distance learning, the role of the tutor in this learning modality, and the interactions involving the teaching of mathematics in two disciplines with mathematics contents in a distance-learning course of pedagogy.

Distance teacher education

According to the Brazilian legislation, particularly the Article 1 of the Decree 5,622 of December 19, 2015 (BRAZIL, 2005), distance learning is an educational modality in which the didactic-pedagogical processes of teaching and learning occur with the use of information and communication technologies and means, with students and teachers conducting educative activities in different places or times.

Undergraduate distance education programs first appeared in Brazil in the 1990's with the main purpose of bringing education opportunities to students in remote locations, who could not travel to the cities to attend a face-to-face course. The goal, therefore, was to democratize higher education.

Over the years, the offer of courses in this modality grew, and its initial goals suffered changes. Giolo (2008) mentions that, in some cases, this modality became the most profitable option for universities.

In this context emerged the Universidade Aberta do Brasil (UAB) system, formed by public universities with the purpose of offering higher education courses through distance learning in order to expand higher education across the country, particularly further inland. One of the public universities that offers this partnership is the Universidade Federal de São Carlos (UFSCar) – the object of the present

study – which began to offer distance-learning undergraduate courses in 2007.

The debate over distance education is an up-to-date one, and this may be the reason why no consensus exists on whether initial teacher training through distance education is viable or not. Continuing education is far more accepted in this debate. Giolo (2008) affirms that the development of continuing education for teachers already working has plenty of merits and successful outcomes. He justifies his point by arguing that teachers in continuing education have had an initial education and experienced situations of school practice; therefore, the role of distance education would be to deepen knowledge and discuss teaching practices. Divergence arises mostly when teachers' initial education is discussed.

Authors like Freitas (2007) and Giolo (2008) criticize distance education as the basic education for teachers by arguing that the locus (the academe, the school, the university) specially developed for teaching and learning would thus be despised. Moreover, in these cases, they discuss the massification of teacher education in this education modality.

This very aspect of higher education massification as something that degrades teacher education is approached by Alonso (2010). However, she focuses her criticism and discussion proposals on the idea of massification not only with distance education. She also argues that the massification process brings harm both to distance and face-to-face education, as the logic of expanding Brazilian higher education has privileged quantitative aspects – related to the number of places in college – to the detriment of qualitative aspects.

However, we do not wish to present distance education as a solution to all problems, nor to downgrade it or blame it for the difficulties faced in teacher education. This discussion should have broad perspectives, considering the different aspects and needs, in order to seek an enhancement of the various forms of education.

Teaching in distance education is one of the aspects to be discussed. The presence of various digital information and communication technologies (DICT) requires teachers to know these tools. However, as Lapa and Pretto (2010) affirm, they must learn to be teachers while using those means.

The UAB system¹ establishes as duties of the tutor:

- Mediating the communication of contents between the teacher and the students.
- Monitoring students' activities according to the schedule of the course.
- Supporting the teacher of the discipline in developing teaching activities.
- Accessing the virtual learning environment (VLE) regularly and responding to students' queries within no more than 24 hours.
- Establishing permanent contact with students and mediating students' activities.
- Collaborating with the course coordinators in assessing students.
- Participating in the training and refresher activities promoted by the education institution.
- Completing and submitting monthly reports on students' activities to the tutor coordinator.
- Participating in the assessment process of the discipline under guidance of the professor in charge.
- Providing operating support to the course coordinators during face-to-face activities at the centers, particularly when tests are applied.

With regard to these duties of the virtual tutor, Alonso (2010, p. 1330) questions: "If the tutor is the one who monitors the student, works with the student on a routine basis,

1- List of duties available at: http://uab.capes.gov.br/index.php?option=com_content&view=article&id=50%3Aautor&catid=11%3Aconteudo&Itemid=29. Access on: August 15 2013

participates in the assessment processes, in the course, etc, [...] the question is: in what do these duties differ from those of a teacher?"

This concern is very much present in the Brazilian educational scene, particularly as it involves wage and labor issues. In the organization of the UAB system, all professionals working in the courses are paid by means of grants. This, however, does not guarantee an employment relationship, which would ensure them a few labor rights. Moreover, these conditions prevent their years of service from qualifying as teaching years. According to Lapa and Pretto (2010), this contributes to the 'precarization' of teaching.

In this form of organization, the service performed in these activities is eventually characterized as extra labor, which often results in excessive workloads for these professionals. It is also noteworthy that, in the UAB system, tutor grant amounts are approximately 30 percent lower than the amounts paid to professors in the content researcher-professor and researcher-professor categories.

Data collection and methodology

Data were collected and analyzed in a qualitative perspective. They have the characteristics of a qualitative research as listed by Bodgan and Biklen (1994): the natural environment as the direct source of data and the researcher as the main subject; the descriptive character, since the data collected are in the form of words, and the investigation's written results contain citations; the investigators are mainly interested in the process, rather than simply in the results or products; rather than using data to confirm previously built hypotheses, they are used to build abstractions; and the vital importance of meaning, considering the different perspectives presented by the subjects.

The place of our data collection was the licentiate course in pedagogy – its distance

learning modality – at UFSCar, with focus on the mathematics education of future primary school and early childhood teachers.

We chose UFSCar due to the specificities of their distance education programs in terms of tutorial work. At this institution, the tutor role is a well-defined one, and the institution views tutors as also responsible for contributing to the education of students – i.e., future teachers – in the program, not only concerning the use of the virtual environment and its tools, but also in terms of the contents and the education of the students as teachers. Although the university is part of the UAB system, its virtual tutor model is different than that of other institutions in that it provides one tutor for every 25 or 30 students in each discipline, working in a single discipline per module, whereas in the rest of Brazilian universities, the tutor monitors a group of students in all disciplines occurring concomitantly, or assists a larger group of students in a single discipline.

Moreover, the UFSCar model also differs in terms of the selection and organization of virtual tutors for the disciplines involving mathematics contents. Tutors in these disciplines are selected for having a distinct background – a pedagogy degree and an undergraduate licentiate in mathematics – and a distinct experience as a teacher both in terms of their period in teaching and the levels taught. Where possible, these tutors work in pairs, which are formed by a pedagogue and a mathematician. Likewise, an effort is made to ensure that one tutor in the pair has some primary teaching experience. This form of organization is intended to provide knowledge exchange between tutors concerning: mathematics contents; its teaching in primary school; how children learn mathematics; the reality of schools, etc.

In the distance education pedagogy program at UFSCar, the disciplines with mathematics contents are: “Languages: Mathematics I (LMI)” and “Languages: Mathematics II (LMII)”. Considering the goal of this study, we chose to analyze the interactions

involving the teaching of mathematics in primary school, and to follow virtual tutors working with a same class in both disciplines. For the excerpts of virtual tutors’ accounts about their actions, their real names were replaced by fictitious ones of their choice.

The Virtual Learning Environment (VLE) used by UFSCar is *moodle*; it consists of a collective environment and study rooms. In the LMI and LMII disciplines that we observed to collect data for this study, students were organized in three study rooms, two of which had two groups each, while the other study room had just one group. Each group had around 25 students under the supervision of a virtual tutor. Tutors’ pair work was guaranteed by their combined work with the study rooms.

The tutors in this study had an education comprising different licentiate degrees (pedagogy and mathematics) and their teaching experience varied: some had experience in primary school teaching; others had taught in middle school (6th to 9th grade); others still, in higher education. Tutors’ teaching period also varied significantly: from one month to 20 years (Table 1).

Data in this study comprise all interactions recorded in the virtual learning environment for the LMI and LMII disciplines monitored by tutors Amanda, Felipe, Fernando, Helena, Letícia, Mariana, and Marcelo, as well as the interviews conducted with these tutors. Therefore, following a qualitative research principle according to which the natural environment offers a direct source of data (BOGDAN; BIKLEN, 1994), such data were collected from the virtual learning environment because, in this case, it was where the interactions occurred.

The object of study and the form of data analysis we chose allowed us to approximate our research to a case study (ANDRÉ, 2005), i.e., the seeking of knowledge based on a specific case, which, in this case, involved the selection and organization of a group of virtual tutors in certain disciplines of a primary

Table 1: Summary of virtual tutors' characteristics.

Tutor	Education	Teaching Experience
Amanda	Licentiate in mathematics Master's degree in education	8 months Middle school
Felipe	Licentiate in mathematics Master's degree in education	Just started Middle school
Fernando	Licentiate in mathematics Master's degree in education Ph.D. in Education (in course)	5 years Middle school
Helena	Licentiate in mathematics Master's degree in education	20 years Middle school
Leticia	Non-degree teaching certificate Licentiate in mathematics Master's degree in education	10 years Primary school
Mariana	* CEFAM , pedagogy degree Master's degree in education	5 years Primary school 1 year: Higher education
Marcelo	Pedagogy degree Master's degree in education	1 year Higher education

* Centro Específico de Formação e Aperfeiçoamento do Magistério.
Source: the authors' own research.

teacher education program, more specifically disciplines with mathematics contents.

The decisions on how to conduct our analysis were made during the collection and analysis of data. As Bogdan and Biklen (1994) affirm, in a qualitative investigation, data are not collected to prove predetermined categories, but rather abstractions are built over the course of data collection and analysis.

The process of data analysis was conducted in the perspective of textual discourse analysis, which, according to Moraes (2003), involves seeking new insights about phenomena by examining textual material referring to them. Thus, we conducted a constructive effort to expand our understanding of virtual tutors' work in their interventions involving the teaching of mathematics, attributing meaning to the theoretical sources used in the study, since "the validation of the understanding achieved occurs through theoretical and empirical interlocutions" (MORAES, 2003).

Still according to the perspective of textual discourse analysis, our analysis process sought to build a structure of categories in

order to express the key elements that form the studied phenomenon (MORAES, 2003). Moreover, in line with another characteristic of qualitative studies, as highlighted by Bogdan and Biklen (1994), we present a descriptive analysis based on the reproduction of a few citations of the collected data.

We identify the citations by indicating the origin of the information (an interview, forum, feedback, narration, summary, assessment activity, textual production, internal email, or personal email). The data gathered at interactions with students in the activities of the disciplines were identified as follows: the letter "A" refers to the activity and is followed by the unit number (in Roman numerals) and a hyphen, and by the Arabic numeral corresponding to the activity within the unit. For example, the first activity in Unit 3 is expressed as "AIII-1". We also indicated, where necessary, whether data were part of the interactions of discipline LMI or LMII.

The activities, which are designed and proposed by the professors in charge of the disciplines, were organized in study units based on what is proposed in each discipline's

textbook. Thus, discipline LMI was organized in four units; LMII was organized in five. The activities concern the theme approached in the textbook's respective unit.

Tutor interventions involving the teaching of mathematics

According to the Pedagogical Project of the course, disciplines LMI and LMII are aimed at:

1. Knowing and analyzing the school reality with regard to the processes of teaching and learning Mathematics;
2. Describing and analyzing the situation of mathematics teaching in primary school;
3. Knowing and analyzing the methodological alternatives for the teaching of mathematics that consider the school reality in primary school. (UNIVERSIDADE ABERTA DO BRASIL, 2010, p. 98-99).

The three goals above show a direct relationship with the teaching of mathematics, and they affect the interventions performed by virtual tutors, who, at various times, approach questions related to it.

Discussions about the teaching of any mathematics content involved not the correctness or incorrectness, but rather the suitability of each affirmation, decision, or action concerning a given teaching conception.

Considering the perspective of textual discourse analysis (MORAES, 2003), we identified four categories of analysis, which allowed discussing the actions of the virtual tutors as educators in a distance-learning pedagogy course relatively to the teaching of mathematics as they conducted interventions involving: praising; complementing; questioning; and the sharing of their own teaching experiences.

a) Interventions involving praising

When students, whether in their readings or other experiences, made a remark that tutors

considered suitable to the teaching conception presented in the textbooks of the disciplines or in the activities conducted, they intervened by agreeing with the student or praising his/her participation. Both interactions transcribed below are examples of this type of interaction. The first refers to posts by a student and a virtual tutor in a forum proposing discussions based on these three questions: 1) What is measuring to you?; 2) Why do we measure something?; and 3) What is measured? The second interaction was the result of texts produced by students – motivated by students' reading of the item "The three types of knowledge according to Piaget", from the discipline's textbook – which should present three examples of mathematic logic knowledge and relate them with everyday classroom situations:

[...] concomitantly with the Greek culture, other cultures also developed measuring skills and units, like the Egyptians, the Babylonians, or still our older (not primitive) forebears, when you mention the development of agriculture, that was how our forebears consolidated their homes, rather than continuing nomads, as they discovered the power of seeds and that they could cultivate them, then, over time they realized the need to separate the holes in the ground, learn better ways of planting, the amounts of watering, and later the storing, and so on until the consolidation of our contemporary age. And as everything went on evolving, each age, we progressively acquired and designed new techniques!!! Obviously without despising previous ones which took "millions" of years, or will still do! [...] Therefore, we should value the knowledge our students bring, which is part of popular knowledge and should be valued and respected, while we show them the other type, the formal type from the cultural elite, yet without despising the knowledge of these primeval peoples. (Student 1, forum, AII-1, LMII).

I agree with you that using history can be a strong argument to justify the use and necessity of the [measuring] standards ever created. (Helena, feedback excerpt, AII-1, LMII).

I saw in classroom a second example [of the use of mathematic logic knowledge]. The teacher showed students various colorful geometric shapes at random (some colors repeated) and, starting with the explanation of the concept of categories and classification, she had students form groups and present to the class, explaining the criteria established. In this activity, they came up with classifications based on color, number of sides, and other classifications relating the geometric objects to some object in the classroom and so on.

In this exercise, in addition to establishing relations, students also work on the question of differences, based on criteria from their own background. (Student 2, textual production, AIII-2, LMI)

I really like the example you saw, where the teacher asked students to, based on geometric shapes, design their own classifications. (Fernando, feedback excerpt, AIII-2, LMI).

In both cases, the tutors highlighted aspects they considered important to the teaching of certain contents. In order to organize and systematize learnings, they indicated clearly in their feedbacks what aspects they agreed with and what considerations added quality to students' production. Here, as in the interventions involving mathematics contents, the informative dimension of praising (ZABALZA, 2004) emerges with the purpose of showing what is expected from students.

In her post, tutor Helena highlights the importance of using the history of mathematics

to teach that discipline, since in addition to helping to understand contents, it also helps to understand its historical origin. Those aspects are highlighted in the LMII textbook: "the topic of quantities and measurement is a subject in which the historical approach to teaching mathematics can be used to show aspects of how this knowledge is built" (ROMANATTO; PASSOS, 2011, p. 47). Moreover, the guidelines in the National Curriculum Parameters (PCN) define that the work with quantities and measurement in class is very opportune for the teaching of mathematics with a historical approach (BRAIL, 2001).

By making such remarks, tutors give their approval to what students propose, while revealing the teacher's importance in the process of learning a certain content and how it is understood by primary students. As highlighted by Curi (2005), it is necessary that the teacher know in depth the concepts of the area he/she is teaching, as well as its historicity, its articulation with other knowledge areas, and its didactic treatment.

Likewise, tutor Fernando emphasized the importance of students having an active role in mathematics classes by making use of their knowledge to explore mathematic objects, which is in line with what the LMI textbook proposes: that the student be free to think and draw his/her own conclusions, since "logic-deductive thinking should be preceded by opportunities for intuitive, imaginative, creative, original ideas, suggesting, trial and error" (PASSOS; ROMANATTO, 2010, p. 33).

In presenting the importance of children's active role in exploring mathematic objects, it is worth highlighting that teachers should be capable of "representing mathematic ideas by making a correspondence between concrete, iconic, and symbolic representations, according with the level of development of students and the mathematic objects or processes involved" (SERRAZINA, 2007, p. 16). As we saw earlier, she argues that the instructor should exercise the same principle he/she wants to develop in students.

b) Interventions involving supplementation

In addition to highlighting what is considered suitable, other interventions can help to expand and supplement the ideas presented by students. One example is the participation of tutor Leticia in a discussion forum where she dialogued with posts by two students about contextualization in the teaching of mathematics. The students had written about their experiences with mathematics as school students. Then they were asked to study the textbook's first unit, titled "The Nature of Mathematic Knowledge", which approached: discussions about mathematic knowledge; what mathematicians do; aspects of mathematics education; and philosophy of mathematics and of mathematics education. The forum proposed for students to expose whether their conception of mathematics matched that of the text studied, and to establish relations between mathematics conceptions and a teacher's work:

I don't know if I should be glad, but I think that because I attended a non-degree teaching school, and mathematics had little space in that course, that spared me of these contents that are dissociated of everyday life. The memories I have are from my primary and high school days, and in that period I didn't feel the need, as I do now, to find a reason for everything. (Student 3, forum, AI-2, LMI).

Hi, [student's name], you are right. Not everything has a reason in life. [...] But then I wonder: is it enough to work with students towards having them learn the practical use of mathematics in everyday life? The Guide's idea is for our students to learn how mathematics is produced. [...] Obviously, there is a direct link between doing mathematics and its applicability in everyday life, but I believe the comprehension of its production is wider,

more abstract, I don't know if I'm right (Student 4, forum, AI-2, LMI).

Well... As [student's name] remarked, we can't always contextualize mathematics contents with everyday life. There is a difference between learning with a purpose and contextualizing. It's important to highlight that current discussions about the teaching and learning of mathematics the way we advocate it are based on a pedagogical practice that enables students in math classes to think and act mathematically. Therefore, we gear our teaching so that learning can make sense to students, allowing what [student's name] has just remarked, i.e., doing mathematics. (Leticia, forum, AI-2, LMI).

Tutor Leticia's post contributed for discussions in the forum as it presented justifications for the student's affirmation, expanding the opportunity for learning while encouraging participants to continuously seek and identify the conceptions underlying their ideas and practice. This attitude indicates that Leticia intends to make those future teachers capable of rendering the content accessible to a wide range of students

Such an attitude is in line with that of Serrazina (2012), as this author suggests that primary mathematics teachers should, early in their teacher education: learn to value and give a sense to mathematics; pay attention to students' progressive understanding of mathematics; and promote both written and oral communication by listening to students, valuing their reasoning, and helping them to become increasingly capable of structuring a mathematic thinking.

c) Interventions involving questionings

There were also times when tutors questioned and problematized students' positions or ideas concerning the teaching of mathematics.

Below we present excerpts of two interactions illustrating this type of intervention. The first involved writing a text where students were to comment the suggestions listed in the textbook section titled “The Teaching of Arithmetic: A Few Suggestions” in order to relate them with the concern for an understanding learning of the operations. The second interaction occurred as a result of texts written by the students relating: the study of the textbook section titled “Operatory Techniques (Algorithms)”; the content of a video where the teacher of the discipline discussed the operations’ algorithms; and data resulting from an interview conducted with primary teachers about the teaching of simple addition and subtraction:

Working with math, if it is to be meaningful, it has to be contextualized and differentiated so the student can learn it satisfactorily, one strategy being to adopt typical actions from children’s universe, like playing. It’s through their playing that you can see the construction of mathematics knowledge through understanding and solving problem situations that the students experience [...] (Student 5, text production, AIV-4, LMI).

[...] I’d like to make a few remarks. The first refers to “playing” as you highlight it in your text. One must be careful about that word, since activities with games and hands-on material can sometimes be interpreted by students as just a game, however, it’s important to highlight that these activities should be guided, i.e., they should have a specific goal when you propose them. I can’t see much sense in a game for its own sake, since there has to be a purpose. Students also need that perception, and it’s our job to demonstrate it. (Leticia, feedback, AIV-4, LMI).

When the teacher started addition with carrying, she came up with the following

rule: two people can’t fit in a small bed, so one kicks the other up. As I read the study guide, with the graph paper to set up additions, remembering that in each square there can be only one number, I realized that the teacher came up with a similar rule, but with other words. [...] The teacher told me that whenever there’s carrying in addition, the children laugh and remember the kicking up. (Student 6, textual production, AIV-2, LMI).

[...] when the teacher says “whenever there’s carrying in addition, the children laugh and remember the kicking up”, conceptually, is it possible to make that assertion? [...] One has to be careful, because certain attempts to contextualize can end up making learning even more difficult. (Fernando, feedback, AIV-2, LMI).

This kind of intervention reveals a concern for the student’s understanding of what is being studied and discussed about the teaching of mathematics.

In her feedback proposal, tutor Leticia draws attention to the necessary caution in using didactic resources to teach mathematics. Her intervention is in line with the conception presented in the textbook of discipline LMI, particularly where it deals with the principles guiding the teaching and learning of mathematics:

Didactic resources such as games, books, videos, calculators, computers and other material have an important role in the teaching and learning process. However, they need to be integrated in situations leading to the exercise of analysis and reflection and, ultimately, to the basis of mathematics activity (PASSOS; ROMANATTO, 2010, p. 27).

The tutor’s concern is also expressed in the literature of mathematics teaching. Pinillo

and Magina (2004), for example, mention the necessary caution with certain myths in the teaching of mathematics, including the use of technologies and concrete materials when taken as the only sources to understand mathematics, or when their mere use is considered sufficient to ensure understanding.

Nacarato (2005) stresses that hands-on material could be the interface between the teacher, the content and students, so as to facilitate the relationship between the latter and knowledge at precise points in the construction of concepts. The author argues, moreover, that the role of a teacher trainer should be to promote reflection about these aspects, problematizing the use of didactic material in mathematics classes.

Tutor Fernando's intervention reveals a concern for valuing, in mathematics teaching for children, the understanding of concepts and the opportunity for the student to conceptually explain and justify his/her learnings – aspects also highlighted by Serrazina (2002) as key in today's school mathematics – without using comparisons with actions unrelated to the concept studied, such as explaining the algorithm of addition with carrying by comparing it with kicking something up.

Again, we can see how the interventions of these tutors are aligned with the textbook conceptions, as the latter affirm that “mathematics learning is linked to understanding, i.e., apprehending the meaning; apprehending the meaning of an object or event presupposes seeing it in its relationships with other objects and events” (PASSOS; ROMANATTO, 2010, p. 26). Understanding is also advocated by Serrazina (2002) as she emphasizes the fact that, more than acquiring procedures, the learning of mathematics should be guided towards the understanding of the concepts.

It was our intention to show the connections between the conceptions expressed in the tutors' actions, in the textbooks, and in research of mathematics education. Such connections indicate that tutors keep up to

date with today's perspectives in the teaching of mathematics and identify themselves with the discipline they work with. This aspect is presented by Mill (2012) as key to work quality in team teaching. The author uses the term 'team teaching' [T.N.: *Polidocência*.] considering that in distance education, teaching is collectively exercised by a team that is both collaborative and fragmented, since different roles – planning, executing, and managing disciplines – are carried out by different workers. And, in this scenario, the tutor has a key role.

d) Interventions involving the sharing of tutors' teaching experiences

Experiences from these tutors' professional practice were also approached at certain points in their tutoring. This is yet another way in which tutors intervene by proposing actions or problematizing the teaching of mathematics. An example of this is tutor Felipe's participation in the discussion forum about solving problems involving fractions, based on the textbook section titled “Beginning the Study of Fractions,” and on students' solutions for four questions involving fractions. Felipe mentions episodes of a TV series:

Here I am again, dear students! Hehe. As I told you before, I'm really into media and arts, so I'm posting here the episode of a series aired by TV CULTURA that I really love, it's called *Cyberchase* and it has won several awards in the US for its pedagogical content about the teaching of mathematics. The episode I picked deals with fractions, please have a look because it's really worth it, it is clarifying. The characters are engaging and they always use the solution of a math problem to help the motherboard. [He posts the links to the episodes].

P.S.: Today, I created and used this activity with my 7th grade students based on one of the episodes of the series to start studying

negative numbers, and they loved it, many are already watching it on TV. (Felipe, forum, AIII -2, LMII).

One of the students praises Felipe's attitude, as a primary teacher, of using videos, and adds that they motivate learning while creating a nice atmosphere in class, to which the tutor replies by clarifying what his goals were in using them and how he usually proceeds:

Your students must love working on mathematics with you, they can learn and relax. That is what I understand by working with technology for the good of education. Who would have an indisciplined attitude in a class starting with that motivation? Even I felt good watching those cartoons. Thank you for the opportunity you gave us, I'll try to put it to use. (Student 7, forum, AIII-2, LMII).

I'm in the beginning of my teaching career, I confess it's been hard, but I won't give up using my pedagogical background, I believe I can demystify that idea that mathematics is boring, useless and incomprehensible [...] when I use technologies, media and concrete material in my classes, I always have a goal, in the case of that video, I created a few questions related to the concept of negative numbers and had students write a summary in order to enter the content next. I believe we cannot use any material in class without a goal, isolatedly, otherwise we're just using a material for its own sake. (Felipe, forum, AIII -2, LMII).

Although it is not an experience with primary school students and contents, the tutor refers to it to propose a way of working with videos in the mathematics class, including by indicating procedures to be used. The tutor's concern, as a primary teacher, for organizing his work – as well as his interventions – according

to goals that guide his classroom activities is also visible in his tutoring as he makes interventions aimed at problematizing the use of technology in the teaching of mathematics. This type of intervention, unlike all other types presented in this item, was used few times and only by four of the tutors participating in the investigation, namely: Fernando, Mariana, Felipe e Leticia.

The tutors also sought to identify themselves with students' difficulties. They used their teaching experience to show they had faced similar difficulties to those the students were facing. One example of this is Leticia's interaction with one of the students in response to texts where they narrated their experiences as mathematics students, involving memories of the contents, methodologies, assessments, their relationship with teachers, and their feeling about mathematics:

Today, as a teacher, I can say I was taught the traditional way, i.e., there was no understanding of the concepts involved in the operations. I only came to understand the reason of "carrying" in addition when I had to teach my own students, just like the "borrowing" in subtraction. (Student 8, narrative, AI-1, LMI).

I'd like to remark, also, that as I read your text, I identified myself a lot with your history, because it wasn't until I started teaching that I came to understand certain elements of mathematics. (Leticia, *feedback*, AI-1, LMI).

Therefore, when the tutor identified herself with difficulties in the process of learning mathematics, there, too, she showed an intentionality based on her teaching conceptions. This excerpt indicates her concern for the practice of those who will teach mathematics in the future. Implicit in this discourse is the necessary articulation between the content and the way to teach it. There is an accord between tutors'

interventions and Curi's (2005) remarks about a teacher's necessary knowledge, which includes knowing the didactic treatment of the content to be taught.

Tutor Leticia's feedback reveals a stance typical of a professional in continuous education because of the complexity of practice, represented, in this case, by her work with the discipline's contents. By sharing her own difficulties as a teacher, she offers a contribution to students' education. After all, she is approaching something that, according to Bolzan, Isaia and Maciel (2013), is one of the main focus in teacher education: the willingness to continue learning in the various work contexts.

Due to the complexity of team teaching and of tutoring in this context (MILL, 2012), such willingness to continue learning is also in line with virtual tutors' work reality. According to Mill (2012, p. 47), distance teacher education has been occurring through meta-education, i.e., one learns virtual tutoring by being a virtual tutor; one learns it over one's work trajectory, through "trial/error/reflection/success".

The question of teaching was present in tutors' work, in the discussions proposed by students, and in tutors' sharing of their own experiences. However, that question also pervaded these tutors' participation in conducting the disciplines and their concern for their own education; such aspects revealed that they exercised autonomy.

A few considerations

Most times, these tutors' practice privileged discussions about aspects related to the teaching of mathematics. This kind of intervention – conducted by all tutors – occurred throughout their work with the disciplines, involving different contents approached in the various study units.

The analyzed data revealed a continuous concern with problematizing and with bringing students to reflect about their own conceptions

of mathematics teaching. The study material and the activities proposed, both of which designed by the teacher in charge of the discipline, brought to light many interpretations, and students' writings revealed their different conceptions. From that point on, the tutor's work proved fundamental, as he/she is the one interacting with students, being, therefore, in the position to conduct discussions in a more individualized way according to each student's stances and needs.

Many tutor actions observed in this study are linked to the role of a primary teacher trainer. This was seen when tutors: developed interactions with students; indicated the positive aspects of each activity in order to systematize learnings; proposed ways to extend and supplement the ideas presented; showed a concern for bringing into the discussions about teaching practice various aspects related to mathematics contents and the effective participation of children. In these occasions, the tutors were able to propose discussions about the current trends in primary mathematics teaching.

Tutors' collaboration to the mathematics education of future teachers was favored by the fact that they had specific qualification to work with the discipline. Therefore, they were able to bring into discussions subjects such as: the importance of founding the teaching of mathematics not only on procedures, but rather on the understanding of the concepts; problematizing the notion that using hands-on material, games, and technology can by itself guarantee the learning of mathematics; problematizing the idea of *contextualization* in the teaching of mathematics; the importance of valuing children's own production where it can help understanding and reasoning in their interactions; and the teacher's key role in interactions and in systematizing learnings.

The teaching experience a few tutors had in primary education also contributed to their work as trainers, allowing them to propose a few discussions based on their own experiences – and not only on what was being studied –

and to propose reflections about practice while relating it with theory.

A key element to the quality of discussions about the teaching of mathematics – and, therefore, the education offered – in this distance pedagogy course was the active participation of the tutor as a teacher trainer.

This study leaves room for further reflection. Questions remain about, among others: the way in which virtual tutors' education (both initial and continuing) occurs; the definition of the tutor's role in team education; and the presence of the mathematics language in distance education.

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Luciane de Fatima Bertini holds a Ph.D. in education from the Universidade Federal de São Carlos; she teaches at the exact and earth sciences department at the Universidade Federal de São Paulo.

Cármen Lúcia Brancaglioni Passos holds a Ph.D. in mathematics education from Unicamp; she teaches at pedagogical practices and theories department and at the post-graduation program in education, both at Universidade Federal de São Carlos.