

Logical-historical movement of the concept and organization of teaching: contributions to the training of teachers who will teach mathematics¹

Movimento lógico-histórico do conceito e organização do ensino: contribuições para a formação de professores que ensinarão matemática

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ABSTRACT

The present article aims to reflect on the study of the logical-historical movement of the concept as a promoter of discussions on the teaching of mathematics, running from a sharing space between students of two Bachelor's in Special Education, Mathematics and Pedagogy courses. A part of a Master's research carried out in the Post-Graduation Program in Education (PPGE/UFSM) was discussed, which was triggered by an Extension Course entitled "Fundamental Measures in Teaching: What is taught in school?" with the participation of eleven students in two three courses. The theoretical foundation of research, based on Historical-Cultural Theory and the Theory of Activity, part of the understanding of mathematics as a cultural product and gives the premise that the process of training a

RESUMO

O presente artigo tem como objetivo refletir sobre o estudo do movimento lógico-histórico do conceito como propulsor de discussões sobre o ensino de matemática, decorrendo de um espaço de compartilhamento entre estudantes dos cursos de Licenciatura em Educação Especial, Matemática e Pedagogia. A discussão parte de uma pesquisa de Mestrado desenvolvida no Programa de Pós-Graduação em Educação (PPGE/UFSM), a qual se desencadeou por meio de um Curso de Extensão intitulado "Medidas no Ensino Fundamental: o que se ensina na escola?", com a participação de onze estudantes dos três cursos. A fundamentação teórica da pesquisa, pautada na Teoria Histórico-Cultural e na Teoria da Atividade, parte da compreensão da matemática como produto cultural e da premissa de que o processo de formar-se

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professor involves the appropriation of different knowledge, including the logical-historical movement of constitution two concepts that will be taught. As research actions, guided by a referential nature, are intended to promote understanding of the two concepts involved and trigger training activities in the subjects who make up part of the training space. From the analysis of a dinner that has found the stated objective, we can show that becoming a professor who will teach mathematics requires study activity regarding the logical-historical movement of constituting two concepts that will teach, or that it can result in new meanings attributed to Your training and enable the organization of a teaching focused on the development of your students.

Keywords: Teacher who will teach mathematics; Specific Knowledge; Initial Training; Greatness and measures..

professor envolve a apropriação de conhecimentos distintos, inclusive o do movimento lógico-histórico de constituição dos conceitos que ensinará. As ações da pesquisa, pautadas nesse referencial, tiveram como intuito promover a compreensão dos conceitos envolvidos e desencadear a atividade de formação nos sujeitos que fizeram parte do espaço formativo. A partir da análise de uma cena que vai ao encontro do objetivo traçado, pudemos evidenciar que se constituir professor que ensinará matemática exige atividade de estudo acerca do movimento lógico-histórico de constituição dos conceitos que ensinará, o que pode resultar em novos sentidos atribuídos à formação, e possibilitar a organização de um ensino voltado ao desenvolvimento de seus alunos.

Palavras-chave: Professor que ensinará matemática; Conhecimento Específico; Formação Inicial; Grandeza e medidas.

1 Introduction

The path of initial education, permeated by individual and collective experiences, studies and different types of learning, gives students access to knowledge related to becoming a teacher and brings them closer to their future teaching practice. It is hoped that in this process the student will have the opportunity to give new meanings to his knowledge, from a new perspective, no longer as a primary school student, but as a future teacher, which will allow him to occupy a new space in society.

To carry out this stage of initial training, it is necessary for the future teacher to acquire knowledge that can form the basis of his or her pedagogical practice. In other words, teachers-in-training need knowledge that will enable them to facilitate the learning of their future students, which happens when they develop new psychological functions in the process of becoming a teacher. Here we are referring to the teacher who will teach mathematics and, in this sense, to mathematical knowledge.

Mathematics, as a product of human relations, was built from the needs arising from the activities carried out in the social environment, constituting itself as cultural knowledge. Thus, we understand it as a human construction

that comes from the relationships established with nature and life in society, which justifies its teaching.

The meaning of what is learned at school is given to the extent that the mathematical knowledge acquired by the subjects is used to understand different aspects of the culture to which they belong, to communicate and to deal with everyday situations. (Santos, 2008, p.35)

Regarding school education, we understand that the acquisition of knowledge by students is the result of a deliberate organization of teaching aimed at promoting learning. Therefore, it is imperative that the person responsible for this task, the teacher, has a theoretical grasp of the knowledge he is going to transmit, which leads us to conclude the importance of spaces that allow him to achieve this, especially during his initial training. However, this doesn't always happen in the context of curricular subjects.

It is in line with this understanding that this work was created, with the aim of reflecting on the study of the logical-historical movement of the concept as a driver for discussions on mathematics teaching. This is the product of a Master's research project from the Postgraduate Program in Education (PPGE) of the Universidade Federal de Santa Maria (UFSM), developed in the context of a training space created from an extension course aimed at undergraduates, focused on the thematic unit "Quantities and Measures". To achieve the objective set for this article, we will briefly present the theoretical framework on mathematical knowledge and, more specifically, on our search for the logical-historical movement of quantities and measures that underpins the actions and reflections developed, followed by the methodological paths to then discuss the apprehension of data consolidated in a scene, and finally some final considerations.

2 Theoretical background

2.1 About mathematical knowledge

By having access to historically elaborated knowledge, new generations ensure that it remains alive and accessible to future generations. This process allows people to build on what has already been consolidated, so they don't have to

constantly reinvent existing knowledge, but simply move forward and create new qualities of survival.

Part of this knowledge is mathematical knowledge, which can be understood as an instrument that allows, among other things, the solution of social problems.

In this course, mathematics surely contributed to human development reaches its current dimension and everything indicates that it will continue to be a substantial part of the production of new goods, whether material or not, created to contribute to the solution of a problem that may have social relevance, or that simply mobilizes someone. (Moura, 2011, p. 49).

Mathematics contributes to human development by enabling new interactions with the social environment and direct problem-solving, which has the potential to promote human development. Rosa, Moraes and Cedro (2016, p. 158) explain that "one of the essential elements for the development of the full potential of the individual lies in the possibility of appropriating knowledge and, in particular, mathematical knowledge".

In other words, mathematical knowledge is a human product resulting from the search for solutions to situations encountered in the objective world, and it enables the development of those who appropriate it. However, for this knowledge to promote human development, one of the challenges is to provide teaching in schools that allows students to get closer to the essence of knowledge.

To reflect on this means to understand the social knowledge that is present in the culture of each social environment and to understand the movement that human beings have gone through to universalize it, to bring it into the classroom, with a view to the learning of the students.

When learning mathematics as a language, we need to master its signs, the connections between them, and its syntax. Treating the learning of mathematics as an activity implies making sure that the child has a reason to learn it, that he or she defines the actions necessary for learning it, and that he or she uses tools that allow him or her to have access to the mathematical language and to have access to new knowledge in which it is present. (Moura, 2007, p. 62)

To think mathematically is to articulate knowledge with the social environment in which we live, linking this knowledge to the requirements of human development. The acquisition of mathematical knowledge contributes to the process of humanization, understood as the possibility of appropriating the most elaborate human culture and promoting the cognitive development of the subjects who appropriate it. Meanwhile, we understand how important it is for teachers to participate in training processes that enable them to understand the concept in such a way that they can consider the essence of the concept they are going to teach to promote psychological development, as Davidov puts it

in such a structuring of education that it is possible to regularly direct the rhythms and content of development through actions that exert an influence on it. Such teaching must actually lead to development and create the conditions and premises for psychological development in children. (Davidov, 2017, p.219)

In order to achieve the development of the maximum potential of the subject, teaching can be organized in such a way as to enable the understanding of the relationships that constitute the concepts covered. Like Sousa (2018), we advocate the logical-historical movement of concepts as a didactic perspective for teaching mathematics that promotes the development of theoretical thinking in students (Davidov, 2017). Based on this premise, we turn our attention to the possibility for future teachers to experience training from this perspective.

Aware of the fact that the subjects in the curricular matrix of undergraduate programs do not always offer this alternative, the training space to which this article refers was organized, which dealt with the thematic unit "Quantities and Measures", guided by the study presented below.

2.2 Brief essay on the logical-historical movement of quantities and measures

Different human actions and problems have led to the creation of knowledge to solve situations in the social environment. However, each people developed their own ways of satisfying them, since sharing information with other groups didn't always happen due to the objective conditions of the time.

Every piece of knowledge went through different stages until it became universal. This is because human beings had to understand the space around them and the relationships that were part of it, thus systematizing a great deal of knowledge, one of which was mathematical.

From the earliest times, quantities, and measurements were in demand because, when man began to relate to space, he was already using this knowledge.

Technology, productivity, transportation, consumer needs, and many other factors determined the type of measurement in each region. For example, in societies with vast fertile regions, the system of agricultural measurement was poorly developed, while in societies whose economy was based on mineral exploitation, units of weight or volume were more perfected than units of linear measurement. (Silva, 2010, p.14)

The different social demands made people create and improve their ways of measuring, inserting them into the context that required their use. In this sense, when studying quantities and measures, the focus should not be on their numerical results, but rather, according to Silva (2010), on knowing the path taken by measures over time, as this is how we will be able to get closer to their logical-historical movement of constitution.

Kopnin (1978, p. 183-184) explains that

Historical means the process of change of the object, the stages of its emergence and development. History acts as an object of thought, as a reflection of history, and as content. Thought aims to reproduce the real historical process in all its objectivity, complexity, and contradiction. Logic is the means by which thought accomplishes this task, but it is the reflection of history in theoretical form; in other words, it is the reproduction of the essence of the object and the history of its development in the system of abstractions. History is primary in relation to logic; logic reflects the main periods of history.

Although it is not known exactly when measurement began to be part of human action, Eves (2004) points out that the first agricultural or Neolithic revolution resulted in the organization of a community that was no longer primitive, moving from gathering food to producing it. This led man to seek new

practices, to organize himself into groups and communities, and consequently to establish rules for social coexistence.

At that time, very elaborate measures were not required, since a few indications of "more than" and "less than" were enough, as Silva (2010, p. 38, emphasis added) points out.

primitive man didn't need a very elaborate system of measurements. Their metrological needs were certainly only for some rough indications of positions, approximate distances and relationships of magnitudes such as "greater than" and "heavier than" or "less than".

These indications satisfied the context of that time, based on primitive actions, since few elements were available for their realization. However, the observation of celestial bodies and regular climatic changes resulted in progress when it came to measuring.

The records of the passage of time were crucial in the appropriation of the movement of measuring things, through the observation of daily events (dawn, dusk, shadow projections, star recognition, solar and star clock, etc.), monthly (lunar phenomena, days, months, and weeks), or even annual (seasons, behavior of the stars, etc.). (Pozebon, 2017, p. 114)

With these records, humans began to perceive the regularities of the passage of time, which led to the organization of one of the first elaborate human acts, according to Hogben (1952), the calendar. From this process, humans began to measure time, which allowed them to advance in other mathematical knowledge, such as "biunivocal correspondence and organization by groupings" (Pozebon, 2017, p. 114).

With the advances in observing the passage of time, the techniques of cultivating land and moving animals to more fertile land also led to an improvement in communication related to metrology⁵.

⁵ Metrology is the "science that brings together knowledge about the art of measuring and interpreting the measurements made". (Silva, 2010, p.18)

However, from the moment it became necessary to cultivate the land or move animals to more fertile pastures, there was also a need to communicate more conveniently in metrological terms, and it may have been at this time that the first units of measurement appeared. They were simply based on the dimensions of the human body (Silva, 2010, p. 38).

With new practices in terms of cultivation and caring for livestock, new contexts emerged and, due to its practical and symmetrical nature, the human body was used as a unit of measurement. According to Crease (2013, p. 12), "the human body was the first and oldest measuring instrument. Feet are accessible, everyone has them. Almost every civilization, at one time or another, had a 'foot' unit, often divided into 'toes'".

Various parts of the human body became units of measurement: finger, palm, hand, forearm, foot, step, to measure length; handfuls and pinches, to check volume and mass; and heartbeats and generations, to check the passage of time.

Man took himself as the standard of measure. This was the oldest and most universal system of measurement because a system of measurements defined in this way was highly convenient; everyone understood it easily and carried it with them at all times. Individual differences mattered little (Silva, 2010, p. 38).

As anthropometric measurements could be used at all times because they were practical and shared by everyone, they became important allies in solving many problems arising from social actions. However, as new interactions were established, individual measurements were replaced by collective ones.

As man evolved and formed the first civilizations, it was naturally noticed that individual dimensions were unfortunately not regular enough to have a uniform and precise system of measurements. There were tall men and short men, fat men and thin men. It was therefore impossible to have a single standard. It was then that, although less practical, the first material standards were created (Silva, 2010, p.39).

Therefore, although the different measurements based on the body's limbs were a more practical way, they were no longer enough in the face of the new interactions that were being established, and these subsidized a new social practice.

Even in prehistoric times, however, humans discovered the need to select a particular object for many purposes to define a unit of measure - a foot in length, not yours or mine; a carob bean, not this or that. This is called a standard, which is a sample of a particular quantity that we choose as the value 1 of that quantity. When a standard is created, it embodies the unit, giving it a specific, concrete identity as an artifact. (Crease, 2013, p. 22, emphasis added)

Thus, standardization, as a social issue, became part of new interactions, and anthropometric measurements had to be materialized to be used. Because of their practicality, anthropometric measurements never ceased to be used, but to standardize them, the measurements of someone in a position of power began to be used, especially in the Middle Ages with the feudal system.

In this way, quantities and measurements became a tool of power because "the possession of this standard became associated with political and social power, with the authority of kings and the grandeur of God" (Crease, 2013, p.22). In short, standard units became the measure of whoever was in power.

In Ancient Greece, measurement was considered an attribute of sovereign power. In Athens, the standards of weights and measures were dedicated to the gods and kept on the Acropolis. The Athenians even maintained a company of 15 officers, called "conservators of measures," who were responsible for guarding the original standards and inspecting or calibrating the copies. In Rome, they were kept in the Temple of Juno on the Capitoline Hill; and likewise, other important cities had their own means of preserving standards of measurement (Silva, 2010, p. 30, emphasis added⁶).

⁶ When we use the nomenclature "weights and measures", we are not referring to a specific quantity, but rather to the historical and logical movement that humanity has gone through with regard to quantities and measures.

With different standards, often varying between communities in the same city, quantities, and measures were widely used, with each community adopting its definitions. This meant that the most commonly used units were improved to meet the new requirements of those people, which were not necessarily those of others.

The local measurement systems of different societies were as original and varied as their works of art, political systems, and other forms of cultural life, and their conceptions of the meaning and purpose of measurement were equally diverse. The greater the importance a society attaches to a particular aspect of the environment - gold in West African cultures, salt in Mesoamerican communities, court ritual in China - the finer and more elaborate the measures of that aspect tend to be, and the more specified and regulated those measures. (Crease, 2013, p.27)

In this way, the different actions reflected directly on the development of the magnitudes and measures of each people. With the emergence of new practices, such as the activity of commerce, which resulted in the control of measures, together with the character of justice, new relationships with measures were being established.

In the same direction of control and power, since the first organizations in civilizations, weights, and measures have been crucial for trade, directly influencing exchange relations through the level of local commercial development, since a more elaborate system of measures could always be found where trade was also more developed. (Pozebon, 2017, p. 117)

With the growth of trade, measures began to have a direct influence on the exchanges that took place, since they had to be fair, and since this movement involved other people and peoples, it required greater care. In this way, the practices of exchange triggered various criteria that were established between social spheres so that they could take place in the best possible way. In addition, since there were more interactions between peoples, the action of transporting materials began to consolidate new practices involving measurements.

The transportation of goods generates units. Those that had to be carried on animals' backs were measured in sacks, bags, or parcels, the size of which depended on the animal, the goods being carried, and the distance. Goods transported by other means could be measured in cartloads, wagon loads, and boatloads, or in barrels or casks specially made to fit in such vehicles. The evolution of needs and technology - new markets, better transportation - reshaped the old units and created new ones. (Crease, 2013, p.68)

As the transportation of materials required new units of measurement, new forms were developed, such as the creation of the bag or package unit. Since these units depended on external conditions such as distance, how they were transported, and what was being transported, measurements changed according to social conditions, since they are the product of interactions with the social environment.

In this way, external conditions led people to use different units of measurement, as each person used what was closest to them or transformed materials to fit their reality. Although the different units and measures used initially responded to the specific actions of each people, as trade and population intensified, this became unsustainable. A common language was needed to facilitate and harmonize this process. It was then that standardization became a social necessity for peoples.

The creation of a universal system of measurement was no accident. At the end of the 18th century, with the advance of trade and industry in Europe, it became necessary to establish a universal language of measurement designed to harmonize production and trade. (Lanner de Moura, 1995, p. 45)

Trade and industry brought new actions that led to the standardization of quantities and measurements, but at the same time, many movements were taking place. In addition to conflicts, politics, and power relations, science was advancing and searching for increasingly effective measurements.

Scientific thought also changed dramatically. Until almost the end of the Middle Ages, Aristotle's view of the universe was that it was a cosmic ecosystem, with very different regions - primarily the heavens and the earth - containing different kinds of things for

which different measurements were appropriate. Localities required local measurements. Science was qualitative; rules were generalizations of how nature usually works, as we humans usually experience it (Crease, 2013, p. 72).

This view of science ceased to be represented by rules and began to be regulated by laws produced not by general aspects but by measurements, making it a quantitative science. As a result, a new idea was introduced into studies because "this new world is measurable, calculable, and universal. Nothing is final, the world is open-ended, and everything can be measured and remedied with infinitely greater precision" (Crease, 2013, p. 73).

As new contexts emerged, measurements and units changed and influenced this whole process. Quantities and measures, therefore, can be understood as a product of the movement of humanity, re-signifying themselves according to the transformations people made in the social environment. In short, various actions have led to the use of new units of measurement.

In the logical-historical movement of quantities and measures, while some systems have not been perpetuated, many others have made it possible to satisfy social needs and have transformed the quality of human life. Regarding the appropriation of this knowledge through schooling, it is worth highlighting the importance of the teacher's knowledge as a condition for its adoption as a didactic perspective for teaching. That's what we'll talk about next.

3 Traced paths

With the aim of reflecting on the study of the logical-historical movement of the concept as a driver of discussions about the teaching of mathematics, we present data from an extension course entitled "Measures in Elementary School: what is taught in school?", registered at the Education Center Project Office (GAP/CE) of the Federal University of Santa Maria (UFSM). It took place from August 2019 to May 2020, with face-to-face, distance (not face-to-face) and remote (synchronous, via Google Meet) meetings since part of it took place during the Covid-19 pandemic.

The extension course focused on the thematic unit "Quantities and Measures" and tried to trigger learning based on the actions of future teachers. Eleven students of special education, mathematics and pedagogy, who were in different semesters of their studies, participated. Each subject was identified by pseudonyms, an analogy to the names of stars.

Moments were organized to encourage reflection among them and the meetings were based on different actions, such as studying and discussing texts, analyzing videos and producing materials. Audio and video recordings of the meetings were used to produce the data, as well as the diaries kept by each of the participants and by the researcher. These data were organized into scenes that, as Moura (2000) states, try to represent the totality of the phenomenon. For this article, we have used a scene to stimulate some reflection on our objective. In this way, the brief logical-historical movement of magnitudes and measurements presented was a snapshot of the entire study carried out in the extension course, which is an important point for understanding the scene presented in the next sub-item.

3 Data capture: reflections on mathematical knowledge

During the development of the training room, different types of knowledge were deliberately listed to be covered in the meetings with the future teachers who will teach mathematics, in an attempt to bring them closer together. It is very difficult to measure how much they have delved into the theory presented and the methodology considered as the basis of research or the specific mathematical concepts, but we intended to provide new opportunities for reflection on the organization of teaching, with the main point being to get closer to the historical synthesis of the concept through an understanding of its logical-historical movement.

The moments were deliberately organized to trigger new understandings of the knowledge worked on during the meetings. We started from the premise that for the acquisition of knowledge to lead to the development of the future teacher, the way is to understand the phenomenon through relationships that bring it

closer to the concept. Vygotski (1982, p.165) points out that the development of thought is established through the connections and relationships that constitute it, and that thinking

[...] he groups his perceptions of objects into complexes; with this he begins to integrate scattered impressions and takes the first steps to generalize isolated elements of experience. The concept, in its natural and developed form, presupposes not only the union and generalization of isolated elements, but also the ability to abstract, to consider these elements separately, outside the given real and concrete connections.

It is through the appropriation of the concept that the subject will establish new reflections, making connections and generalizations of isolated elements, but perceiving them as a whole. By establishing these relationships with the concept, the subject appropriates and develops new qualities resulting from the attribution of new meanings to what is already known, which, in the case of future teachers, could have an impact on the organization of their teaching.

In this way, the observation of the actions carried out made it possible to identify indications that the future teachers, during the meetings in the training room, attributed new meanings to what was worked on, based on the study of the logical-historical movement, as will be seen in the scene. Next, we'll discuss the reflections of future teachers on mathematical knowledge.

Chart 1: Scene 1 - Reflections on mathematical knowledge

Scene 1 - After several study meetings, the participants were asked to write letters to an imaginary recipient, in which they had to express themselves about the knowledge they had acquired so far in the extension course. At the next meeting, a reflective session was held, and they were asked about mathematical knowledge because, in the letters, they made several mentions of it but did not justify the relevance of appropriating it.

1. **Researcher:** When thinking about mathematical knowledge, what points should be emphasized? In your letters, you emphasized the importance of mathematical knowledge, writing that it allowed you to rethink your training, your role as a teacher. But what are these points that could be emphasized?
2. **Horology:** For me, understanding the concept of magnitude and measurement, the difference [between them], being clear about it, taking it to any kind of measurement. The question of mass and weight is the classic example of understanding the difference. I think in this sense of the concept of quantity and measure.
3. **Ursa Major:** I feel that as a mathematician, my mathematical side seems much cruder when I'm teaching, right, so I bring up the difficulty of thinking about initial training for someone who

hasn't seen these concepts, thinking about how to teach someone who doesn't know anything. So how do you think about the difference between magnitude and measurement for children who have no basis in mathematics?

4. **Apnus:** And I think the historical part also helped us to rethink, especially when it came to planning. I think the historical part of the concept of measurement is fundamental for us to understand the mathematical concept behind it.

5. **Pisces:** Studying the concepts was really cool, the whole idea of how to adapt to bring it to special education, my background. All these concepts, the mathematical ideas, like my colleague said, maybe I don't have all the knowledge of someone who is studying mathematics, but how am I going to adapt it for another child who also has difficulties if I don't have the knowledge?

6. **Pyxis:** Taking ownership of the knowledge allows you to think about the practical side of mathematics—the real representation that children see of reality, you know. Take the mathematics out of the paper and show where it is in reality, like the question of distance that we gave as an example. That's it, I think it's essential.

7. **Researcher:** And as you think about these points, does your understanding of mathematical knowledge and how it was formed over time influence the way you plan? How does it influence your future practice?

8. **Sagitta:** Knowing this mathematical knowledge is important because, to teach something, we need to be confident and know how to explain it. The mathematical knowledge we learn in the early years and in high school ends up influencing us, but it's just the basics; we need to go deeper to think about the student.

9. **Delphinus:** We have seen the importance; why is it important to know mathematical knowledge? It's important for the teacher to do this study, to know the mathematical concepts, to be able to organize his teaching, and to have more possibilities to organize his teaching. Anyone who doesn't have mathematical knowledge won't be able to organize their teaching, so they need to know these mathematical concepts well in order to organize their teaching. Furthermore, when they think of a problem situation, they must think of a situation that includes the concept they are teaching. This is the importance of the historical movement: to know mathematical knowledge is to have ways of organizing teaching.

Source: Author's collection, recorded on audio and video (25/05/2020)

During the training session, the discussions about quantities and measures, their approach in the school context and the importance of their appropriation by teachers who teach mathematics were guided by the study of their logical-historical movement. This organization, aimed at a didactic perspective for teaching (Sousa, 2018), is evident in the statements of the participants.

The scene shows that the relevant points for future teachers who will teach mathematics were presented in different ways, confirming that approaching the concept by discussing its logical-historical movement triggers different processes that can lead to the attribution of different meanings to what is already known.

Horologium's speech 2 shows that he was concerned with understanding mathematical concepts, such as the difference between magnitude and measure, and between weight and mass. This leads us to conclude that by giving new

meanings to already known terms, they have come closer to the concepts in question by coinciding with the mathematical meaning.

Therefore, the knowledge that future teachers have access to during their training can influence their future practice, as long as the goal of the organization is related to the student's learning, which we understand happened at Horologium as a result of his participation in the training room.

For a process to be formative, it must ensure that teachers understand that the actions they organize can promote the development of their students' education. It is therefore a question of learning to promote pedagogical actions that allow the development of qualities to their full potential, either by selecting contents to be appropriated or by organizing situations that trigger learning and put students in a position where they have to seek solutions to a problem that is materialized in the appropriation of the knowledge necessary for it. In other words, the organization of teaching must lead to the appropriation of knowledge historically elaborated by humanity (Lopes, 2018, p. 119).

In order to organize teaching that focuses on knowledge that has been historically universalized by humanity, it is important for the teacher to begin to study it. Based on this premise, we highlight statements 8 and 9 of Sagitta and Delphinus, respectively, which point out the importance of the teacher's mastery of the concept to be able to teach it. In other words, the organization of teaching will only include the knowledge necessary for the student's development if the teacher, with his theoretical background, in his teaching activity, enables actions that enable the student to engage in study activity.

Formation of study activity is the management by the adult (teacher, psychologist-experimenter, parents) of the process of formation of school study activity; full management of the study process always presupposes: elaboration and improvement in the schoolchild of each component of the study activity, its interaction, gradual transmission of isolated components of this activity to the child to perform them autonomously without the help of the teacher, etc. (Davidov; Markova, 1987, p.325, faucet two authors).

Since it is the teacher's organization of the lesson that will guide the study activity, it is important that the teacher take on his role as a designer of this activity. In turn, when Delphinus, in speech 9, pointed out that knowing mathematical knowledge means having possibilities for organizing teaching, we can infer that the participant understood the importance of study and its impact on the organization of teaching, which allows her to create new directions for the student's study activity.

It is through her knowledge of what is to be taught, and here we emphasize the logical-historical movement of the mathematical concept, that the teacher will be able to organize actions that can trigger learning. This requires looking at those who are part of this process because, as Ursa Major said in talk 3, it is difficult to trigger concepts in students in the early years of elementary school that are often taught only through formulas. However, although the participant showed this uncertainty, perhaps a reflection of her first degree in mathematics, she saw the possibility of working from this perspective, despite the difficulty.

Ursa Major's position brings us back to Vygostki (1982), who states that children of school age can already appropriate the knowledge historically established by humanity with a view to their development. In this context, we emphasize that the organization of the teacher's teaching and its mediation during the learning process must consider the development of the concept of social character

[...] occurs in the conditions of the process of instruction, which constitutes a unique form of systematic cooperation of the pedagogue with the child. During the development of this cooperation matures higher psychic functions of the child with the help and participation of the adult. (Vygostki, 1982, p.183).

It is the teacher's mediation in the student's learning process that will help him get closer to the concept because only intentionally organized teaching can work in such a way as to develop new psychic capacities. We understand that the practice of a teacher who knows the logical-historical movement of the concept involves actions that have the potential to mobilize the student to understand the concept being addressed in a more complete and not just superficial way, which, as a result, promotes psychic development. Furthermore, when Ursa Major, Speech

3, argues that considering teaching young children is a difficulty, we can infer that she understands that the way teaching is organized affects their access to knowledge; otherwise, she wouldn't have this concern for her future practice.

Similarly, the concern with organization in order to achieve learning is present in the speeches of Apnus (4) and Pyxis (6), when both indicated that knowledge of the history of the movement of the concept is a way for the teacher to understand it and bring it closer to the child's context. By understanding the human process of producing knowledge, the teacher can take ownership of it and, as a result, make it possible to organize situations that, in turn, will trigger the student's search to solve the problem it contains. Panossian, Moretti and Souza (2017, p. 16), based on Rubtsov (1996), state that.

[...] the historical and logical movement of the concept allows the essence of the concept to be placed as a necessity for the teacher in his movement of formation and appropriation of specific knowledge and also as a necessity for the student in the learning problem [...].

In this sense, when Apnus (4) highlighted the knowledge of historical synthesis as important for teachers to understand mathematical knowledge, we can conclude that this point became significant in her training and may be a way she will use to organize her future teaching practice. This suggests to us, in line with the other participants, that they understand the logical-historical movement of the concept as a way of organizing teaching.

3 Final considerations

When they enter initial teacher education, future teachers already have mathematical knowledge from their undergraduate education. However, even if this knowledge is related to what they are going to teach, the way in which it is presented to them is not sufficient, since it is based on the perspective of their time as students and in the context and didactic organization in which it was learned, often prioritizing formulas and memorization without connections to its historical or social constitution. By giving new meanings to this mathematical knowledge, the subject will have better possibilities for development.

In this way, by aiming to reflect on the study of the logical-historical movement of the concept as a driving force for discussions about the teaching of mathematics, we highlight both the need for the teacher to move towards the study and the organization of teaching that results from this movement.

In the scene shown, we have the participants' perception of the need for the teacher to embark on a journey of study, considering that this is not just any study, but a process of understanding the logical-historical movement of the constitution of the concepts they will cover in their classes. We noticed in the demonstrations that considering the logical-historical movement as a guide is a process that allows us to give new meanings to what was already known, or to go beyond the superficial and empirical understanding of a mathematical concept.

In this sense, our second conclusion shows that the formative process that involves this study movement presents conditions for organizing teaching that privileges the processes of historical constitution of mathematical knowledge, with all the determinations and syntheses that make up our current curriculum loaded with social meaning. From the pedagogical practice resulting from this organization of teaching, we highlight that there are conditions for students to understand the movement of the constitution of concepts, which allows them to access mathematical knowledge in its essence, promoting their psychic development.

Although the teacher training process is continuous, we emphasize the relevance of this reflection in the initial training, with the aim of mobilizing future teachers to understand the complexity of their profession, as well as the knowledge requirements that determine their teaching activity. The responsibility for organizing the classroom lies with the teacher and the presentation of concepts, in our case mathematical concepts, based on an understanding of the process of their constitution is the possibility of guaranteeing students access to this knowledge. Thus, if the teacher has access to the logico-historical movement of the mathematical concept, he or she has the possibility, by organizing the teaching, to fulfill his or her social function of bringing the student closer to the most elaborated culture through the appropriation of the concept in its entirety (essence). And this is the right of the student.

Movimiento lógico-histórico del concepto y organización de la enseñanza: aportes a la formación de profesores que enseñarán matemáticas.

RESUMEN

Este artículo tiene como objetivo reflexionar sobre el estudio del movimiento lógico-histórico del concepto como motor de discusiones sobre la enseñanza de las matemáticas, resultante de un espacio de intercambio entre estudiantes de las carreras de Licenciatura en Educación Especial, Matemáticas y Pedagogía. La discusión forma parte de una investigación de maestría desarrollada en el Programa de Postgrado en Educación (XXXX/XXXX), que fue desencadenada a través de un Curso de Extensión titulado “Medidas en la Educación Básica: ¿qué se enseña en la escuela?”, con la participación de once estudiantes de los tres cursos. El fundamento teórico de la investigación, sustentado en la Teoría Histórico-Cultural y la Teoría de la Actividad, se sustenta en la comprensión de las matemáticas como un producto cultural y la premisa de que el proceso de convertirse en docente implica la apropiación de diferentes conocimientos, entre ellos el lógico-histórico. movimiento de constitución de los conceptos que enseñarás. Las acciones de investigación, basadas en este marco, tuvieron como objetivo promover la comprensión de los conceptos involucrados y desencadenar actividad formativa en los sujetos que formaron parte del espacio de formación. A partir del análisis de un escenario que cumple con el objetivo planteado, pudimos demostrar que convertirse en un docente que enseñará matemáticas requiere de una actividad de estudio respecto del movimiento lógico-histórico de constitución de los conceptos que enseñará, lo que puede resultar en nuevos significados atribuidos. a su formación, y posibilitar la organización de una enseñanza orientada al desarrollo de sus alumnos.

Palabras clave: Profesor que enseñará; matemáticas; Conocimiento específico; Formación inicial; Cantidades y medidas.

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