Brief analysis of the historical-cultural theory and activity theory in the teaching of geometry

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Gesmilher de Almeida Lopes[1] and Flávio Rodrigo Furlanetto[2]

ABSTRACT

The text presented here uses as theoretical support Vygotsky's Historical-Cultural Theory and Leontiev's Theory of Activity to organize the teaching of Geometry in the early years, as it believes that the foundations of these theories can contribute to the teaching of this axis of mathematics, enabling the learning of it in the relationship it establishes with the social contexts in which it is inserted. It establishes as a research problem to investigate: can studies related to the Foundations of Historical-Cultural Theory and Activity Theory contribute to the organization of a Geometry teaching that considers the social context in which this content is inserted? Its general objective is to study the foundations of the Historical-Cultural Theory and the Activity Theory and their contributions to the organization of the teaching of Geometry in the early years. And as specific objectives: a) to carry out a brief review of the literature related to Historical-Cultural Theory and Activity Theory; analyze the impacts of the use of these theories in the organization of the teaching of Geometry. It uses bibliographic research as a method for collecting information. It concludes that the Historical-Cultural Theory and the Activity Theory provide us with significant contributions to support the organization of the teaching of Geometry, especially in the early years, in which the teacher has the possibility to work in different ways with his students and make them active.

Keywords: Historical-Cultural Theory, Activity Theory, Geometry Teaching.

[1] Master in Basic Education
State University of Northern Paraná - UENP
[2] Doctor of Education
State University of Northern Paraná - UENP

INTRODUCTION

Starting from the theoretical contributions of Vygotsky's Historical-Cultural Theory and Leontiev's Theory of Activity, we will reflect on the organization of the teaching of Geometry in the early years, because we believe that the foundations of these theories can contribute to a teaching of Geometry concerned with the relationship of the contents to the social contexts in which the students are inserted.

Based on this, for this text, we propose to investigate: can studies related to the Foundations of Historical-Cultural Theory and Activity Theory contribute to the organization of a Geometry teaching that considers the social context in which this content is inserted?

From the research question, we present as a general objective: to study the foundations of the Historical-Cultural Theory and the Activity Theory and their contributions to the organization of the teaching of Geometry in the early years. And as specific objectives: a) to carry out a brief review of the literature related to Historical-Cultural Theory and Activity Theory; analyze the impacts of the use of these theories in the organization of the teaching of Geometry.

From this study, we intend to emphasize the importance of research that considers the use of the precepts of the Historical-Cultural Theory for the work with the teaching of Mathematics. We have delimited, among the various mathematical contents, Geometry, due to the difficulty that we have observed through our experience in relation to the learning of this content, both by teachers and by students.

To carry out this study, we will use the existing literature on the subject. We begin by selecting the readings pertinent to the Historical-Cultural Theory, seeking to triangulate the information apprehended in order to contribute to the organization of the teaching of Geometry. We will take as a basis the classic authors pertinent to the literature and contemporary authors who use this theoretical trunk in their research.

Next, we will seek to analyze authors who discuss the teaching of Geometry in order to reflect the contributions of the Historical-Cultural Theory to overcome the existing methodological difficulties in relation to the teaching of this content.

Another issue that we will observe when analyzing the theoretical frameworks that we will use for this study is to verify the possibility of working with this content not only restricted to pure geometric language, but in relation to the contexts to which this language is inserted.

BRIEF REVIEW OF THE PERTINENT LITERATURE

The Historical-Cultural Theory is founded by Vygotsky, who uses Marxist roots and the foundations of historical-dialectical materialism to create his theory. The studies of this theory consider the social environment and the relationship with the other, contrary to what other scholars,

for example, Jean Piaget, defended, who studied the individual and his development at the individual level.

Vygotsky developed his theory based on the interaction of human beings with society. He understands reality as a historical process that is constantly changing. Thus, through the interactions that individuals establish among their peers, they develop their higher psychic functions.

We know that "human learning presupposes a specific social nature and a process through which children penetrate the intellectual life of those around them" (VIGOTSKI, 2007, p.100). The author also adds that the

> Learning is not development; However, properly organized learning results in mental development and sets in motion various developmental processes that would otherwise be impossible to happen. Thus, learning is a necessary and universal aspect of the process of development of culturally organized and specifically human psychological functions (VIGOTSKI, 2007, p.103).

From this perspective, learning takes place through the mediation of an adult who gathers the historical and cultural instruments socially created by humanity, so that he can help the learner in his development process. Thus, when analyzing the role of the teacher, Vygotsky places the teacher as a mediator of learning situations. With a teaching mediated by a teacher who organizes the activity intentionally, the child is able to develop his higher psychological functions better and more easily, "the child guided, helped and in collaboration can always do more and solve more difficult tasks than alone" (VIGOTSKI, 2009, p. 328).

When we analyze Vygotsky's theory to understand school education, we realize the fundamental role that the teacher plays as a mediator of the learning process. In the same direction, Oliveira (2005) corroborates that "the teacher has the explicit role of interfering in the zone of proximal development of the students, provoking advances that would not occur spontaneously" and goes on to say that "the teacher's intervention is fundamental for the promotion of the individual's development" (OLIVEIRA, 2005, p. 31).

Oliveira (2005) also adds that the teacher has the role of organizing the teaching and learning processes appropriate to their students, in order to enable meaningful learning to promote the development of students' psychic functions.

The Historical-Cultural Theory takes into account the social aspects without disregarding the biological aspects. It values scientific knowledge historically constructed over time to the detriment of immediate (spontaneous) knowledge, and it also values the formation of concepts so that one is aware of their understanding in the processes of change that drive the development of humanity. Vigotski (2009) argues for the importance of creating potentialities for them to generate learning realities.

One of the branches of Historical-Cultural Theory that has been widely used in teacher training is Activity Theory. It has as its precursor Leontiev, who was one of the authors who made up the Vygotsky, Leontiev and Luria troika. It assumes that man's development stems from the activities he performs. However, in order to better understand what Leontiev calls activity, we will now present some of his theory.

Leontiev defines activity as "the processes psychologically characterized by what the process, as a whole, is directed to (its object), always coinciding with the objective that stimulates the subject to perform this activity, that is, the motive" (LEONTIEV, 2006, p. 68).

The Activity Theory allows us to analyze the movements that those involved in the teaching and learning process perform and the main changes in their personality from this movement. In this way, knowing this theory allows the teacher to know the main activities of the students in order to organize the teaching activity, in our case, the teaching of Geometry. For example: in Early Childhood Education the child's main activity is playing, so if we want the child to learn the concepts of Geometry, we have to organize the teaching activity through games that involve the concepts of this axis of Mathematics. These activities, in addition to being playful, should generate in the child the need to learn the concepts that are intended to be taught, that is, they should form an awareness in the child in relation to the importance of learning a certain concept, in this case Geometry.

Leontiev defines that the main activity of the child is that "whose development governs the most important changes in psychic processes and psychological traits of the personality" (LEONTIEV, 2010, p.65). The author exemplifies that there are three types of main activity, toy, study and work, and at different times in our lives we will be living one or another main activity. For very young children, their main activity that motivates them is toys, for older children and adolescents study, and for adults work, these activities are the means by which the human being develops and modifies his environment.

For Leontiev (2010), the mediation between the subject and the world occurs through culturally developed objects and work tools. Using these tools, man transforms the social and work environment in which he is inserted. Geometry here can be considered as a tool that modifies and sustains human constructions, so it must be taught and learned.

The Activity Theory can be related to the school context and is directly linked to the idea of need, that is, to generate a reason in the student for him to learn. Thus, it is the motive that drives the student's action, so that he is responsible for his learning.

Every activity has the following structure:

a) Consider the activity that leads to the formation of the concept;

b) Organize the activity that the student must perform to assimilate the concepts;

c) Organize the activity, which must comprise the stages of the formation of concepts, without separating the system from essential characteristics of the process, the qualitative indicators of the activity that make it possible to describe the different states of the assimilation process, which allows to guide the process from the beginning to the end of the same subjects.

We believe that this organization makes it possible for the person who enters the activity to change the existing reality, and contribute to the historical and cultural evolution of humanity.

With this organization, we verified that the teaching of Geometry is no longer only mechanized, and starts to be humanized, in the sense of having an influence on the environment and on the learning of children, so that they can better understand the importance of the social use of Geometry.

GEOMETRY TEACHING AND TEACHER TRAINING

By analyzing the teaching of Mathematics with a more specific look at the content of Geometry, we verified its importance for learning. As shown by the data from the latest external evaluations on Mathematical Literacy of the Basic Education Assessment System (SAEB, 2017), with regard to the level of mathematical proficiency of students in the fifth year of Elementary School, they show that on a scale of 0 to 500, the average in Brazil is 218.3. In this sense, it can be seen that the country presents weaknesses in relation to the teaching of mathematics, as the national average does not reach 50% of the scale established as a parameter of analysis. One of the mathematics contents present in this assessment is Geometry.

In this sense, Pavanello (1995) defends the importance of teaching Geometry, so that learning can occur in accordance with the needs of today's society. We realize that in the Brazilian context, the teaching of Geometry deserves more attention and especially studies focused on it, so that we can reflect and find solutions to have a Geometry teaching that helps our students in the future. We believe that this path can be grounded through a theory that considers the student as an integral part of society and not only as a receiver, but as the author of his own history.

In this context, we realize the paramount importance of teacher training for working with Geometry, especially in the early years, because in most classrooms at this level of schooling we find multipurpose teachers who teach not only Mathematics, but also other subjects in the curriculum.

Nor can we fail to consider the results of research and external evaluations with regard to the teaching of Geometry. There is no way to say that the problem of teaching Mathematics is only supported by the figure of the teacher, but also by the policies of teacher training in the early years of Elementary School, in addition to the investments that are destined to education in our country.

There is a need for both initial and continuing teacher training that considers the importance of learning Geometry.

> The reason for teaching Geometry in the early years of Elementary School is due to the fact that geometric resources offer a more utilitarian character in solving everyday problems, in some professional activities and in other areas of knowledge, in addition to being important for the development of specific skills and competencies (PONTES, CAMPOS, 2018, p. 59).

However, for this to happen, it is necessary to invest more in the training of teachers who teach mathematics, so that they can work with these mathematical contents in a more meaningful way for their students, who take into account their knowledge and praxis.

Pavanello (1995) discusses the importance of teacher training to work with Geometry, and greater investments in teacher training are necessary, so that we can advance in the teaching of mathematics, and break the stigma that mathematics is a "boring" discipline, but give its true importance to being a discipline that helps and interferes in the daily life of human beings.

We see and know that mathematics and geometry are present in our lives, we cannot leave aside their paramount importance for the intellectual growth of humanity and its transformations.

ANALYSIS OF THE IMPACTS OF THE USE OF HISTORICAL-CULTURAL THEORY AND ACTIVITY THEORY IN THE TEACHING OF GEOMETRY

The Historical-Cultural Theory and Activity Theory help us to understand how learning occurs and its importance for society and for the individual. We will analyze the impacts of the use of these theories in the teaching of Geometry, and thus, verify their contributions.

In the course of our studies, we found that the Historical-Cultural Theory and the Activity Theory help to create a society focused on the learning of historically created contents, in order to establish relevance to the current society and assist in the processes of change.

> Historical-cultural theory, by defending mathematical knowledge as a human production, attributes a social value to knowledge that is not restricted to the production of knowledge. In fact, mathematical knowledge is already given, it is, in this sense, ready-made knowledge. However, the child, by appropriating the social meaning of this knowledge, also attributes to it a personal meaning. This makes this knowledge done and being done (ARAÚJO, 2015, p.6).

By understanding geometry as an area of mathematics, we know that it also has its social value. And in this sense, we found that these theories contribute to the teaching of Geometry, because we know that this content is often left aside or simply worked without contextualization with the students' social practice. For this reason, we will analyze the impact of working with the teaching of Geometry through the Historical-Cultural Theory and the Activity Theory.

By analyzing the article by Pavanello (1993), "The abandonment of the teaching of Geometry in Brazil: causes and consequences" we found that this abandonment is more evident in public schools in Brazil, especially after Law 5692/71, a condition that brought serious consequences to the learning of Geometry contents. The author also mentions that the problem related to the teaching of this mathematical content is a global issue.

And so, Barbosa (2012) criticizes the methods adopted by teachers and their ineffectiveness in teaching Geometry from LDB 9394/96. For the author,

> Although many educators claim that spatial reasoning and geometry are related, school practice seems to indicate that we are not aware of how complex are the relationships that are established in our minds and in those of our students, when dealing with spatial figures, with relationships between figures and their representations. Despite living in a three-dimensional world, most of the geometric visual material presented to children is two-dimensional. It is necessary for both the teacher and the student to resort to spatial reasoning to represent the real world (BARBOSA, 2012, p.3).

The above quotation is in line with the theories presented, as they indicate the need to contextualize Geometry with the instruments that will be presented to students, with the objectivity of truer and not just superficial representations. Knowing that the child needs representation and especially to get into activity, as Leontiev defends, so that there is learning.

We also verified that the theories presented establish parameters so that we can have a higher quality teaching of Geometry and in order to insert the theoretical activities in the daily practice of the students, so that there is social praxis. In order to transform the teaching of Geometry into a teaching that provides a solid foundation in relation to its learning and with significance, we must:

> Assuming education as significant implies understanding what will be relevant to the set of subjects in the educational process. Assuming that the objectives are relevant requires that content be chosen that translates into educational action and the creation of activities that enable children to develop. In mathematical terms, we could say that it is the development of historical logical thinking of arithmetic, geometric and algebraic meanings (ARAÚJO, 2015, p. 9-10).

This statement allows us to analyze the educational action around mathematics, so that we can organize our classroom practices that are focused on Geometry, so that these practices can contribute to the development of students.

Knowing that the main objective of the school is teaching and learning, in a way that enables the student to be socially inserted, it is necessary that we can plan a teaching that contributes to understanding and comprehending Geometry and its particularities. To learn the content, a logical and historical movement of the concepts is necessary. Souza and Moura (2016, p. 541) report that logical and historical works have as their "main function to assist the thinking of both those who teach and those who learn to move in the sense of finding truths that are relative", in this case, in relation to the contents of Geometry presented.

FINAL THOUGHTS

By analyzing the Activity Theory and the foundations of the Historical-Cultural Theory, we realize that they contribute to a significant learning, since they have as a principle to relate the contents to be taught with the social contexts in which they are inserted. Thus, it enables its use in the teaching of Geometry, so that it has a meaning and a real understanding and according to the needs of children, a condition that allows the teaching of mathematics not to be carried out in a mechanical way.

A teaching of mathematics that takes into account mechanization, does not perform its functions of teaching and learning in the student and does not elevate the psychic functions of the students. In this teaching model, it is believed that learning occurs only by working on mechanical tasks, which have as their main means the repetition of activities.

And in our case, in the specificity of the work with Geometry, it becomes even more serious, because most of its activities do not take into account three-dimensional figures and that the contents are not used in the student's daily social life. With this, we realize why there is a lack of interest of children to learn Geometry, because as they do not know the usefulness of the content for their lives, they are unmotivated in the execution of activities and often leave aside the learning of mathematics.

We have to have as a guideline that the teaching of Geometry must be anchored in the social practices of the students. By using methodologies that take into account social practice, students begin to like and identify with Geometry and are able to verify that in their neighborhoods, all houses, streets, electric power poles, among others, required geometric knowledge of plane and spatial geometry for their construction.

When we talk about the need for greater investments and training of teachers who teach Geometry, we have to be based on the figure of the student and the importance of Geometry in their lives. We need greater investment, both financial and research, in this area so that we can move forward and improve existing indicators. Today's society cannot live without Geometry, so it is important to continue training teachers who teach Geometry so that we can improve their practices in the classroom, and improve student learning.

Another issue is the use of geometric language and the relationship in which this language is inserted. We need to support our students about geometric language so that they can, in the future, be able to solve problems involving this language. However, for this to happen, it is necessary that we as teachers also appropriate geometric language, so that our work occurs without making conceptual errors.

In this context, we can consider that the Historical-Cultural Theories and the Activity Theory help us to better understand the student and the social context, as they consider that the starting point

is reality and the understanding of reality from the organization of activities that help students to form a synthesis thought in relation to the content.

With this study, we verified that the theories, Historical-Cultural and Activity Theory, provide us with significant contributions to the teaching of Geometry especially in the early years, in which the teacher has the possibility to work in different ways with his students and make them active.

We conclude that the theories studied contribute to the organization of a teaching of Geometry that considers the human being its historical and cultural constructions, providing students with a learning that contributes to their cognitive and social evolution.

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