WHAT DOES SCHOOL WORK REVEAL ON THE TEACHING OF GEOMETRY IN YEAR 2 OF THE PRIMARY SCHOOL?

O QUE AS TAREFAS ESCOLARES REVELAM SOBRE O ENSINO DE GEOMETRIA NO 2º ANO DE ESCOLARIZAÇÃO?

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ABSTRACT

This paper aims to investigate the organization of the teaching of Mathematics in Year 2 of the Primary School, and discusses the manner geometric concepts are taught at this level. Methodology comprises documental characteristics in which sources were school tasks in the students´ exercise books and textbooks. Ten exercise books of ten groups in Grade 2 from five schools in Maringá, Brazil, and a textbook used in the schools of the municipality formed the sample. Theory and methodology were foregrounded on the Cultural-Historical Theory, Activity Theory and Teaching Guided Activity. Analysis showed that the contents of Geometry were not given priority at the start of the schooling process due to the few school days devoted to the subject matter. Data revealed that the teaching of geometric concepts is mainly characterized by naming and memorizing the geometrical figures through repetition, association, sensorial observation and empirical knowledge of objects, without exploiting scientific concepts. School work included the reproduction of pre-established models without positing any conditions that would trigger any type of investigation, analysis, hypothesis and comparison. These would have made possible inferences on geometric concepts and the development of the students´ theoretical thought.

Keywords*:* Teaching organization, Geometry, school work, Cultural-Historical Theory.

RESUMO

Este artigo tem como objetivo investigar a organização do ensino de matemática no 2º ano do Ensino Fundamental, buscando compreender como os conceitos geométricos são trabalhados neste nível de escolarização. A metodologia utilizada foi de caráter documental, tendo como fonte as tarefas escolares contidas nos cadernos e livro didático dos estudantes. Compuseram a amostra desta investigação dez cadernos de dez turmas de 2º ano de cinco escolas de Maringá e o livro didático adotado por este município. Os fundamentos teórico-metodológicos resultam da Teoria Histórico-Cultural, Teoria da Atividade e Atividade Orientadora de Ensino. Na análise, constatamos que os conteúdos de geometria não são priorizados no início do processo de escolarização, devido aos poucos dias letivos dedicados a esses conteúdos. Os dados revelaram que o ensino dos conceitos geométricos se caracteriza, principalmente, pela nomeação e memorização das nomenclaturas das figuras geométricas pela repetição, associação, observação

sensorial e conhecimento empírico dos objetos, não sendo explorados os conceitos científicos. As tarefas exigiram a reprodução de modelos preestabelecidos, não sendo propiciadas situações desencadeadoras que viabilizassem a investigação, análise, levantamento de hipóteses e comparações, que possibilitassem aos estudantes inferir sobre os conceitos geométricos desenvolvendo seu pensamento teórico.

Palavras-chave*:* Organização do ensino, Geometria, Tarefas escolares, Teoria Histórico-Cultural.

1. Introduction

This article is the product of a research on the organization of the teaching of Mathematics in Year 2 of Basic Education, by investigating students´ school work to find out the manner geometric concepts are studied at this schooling level (Locatelli, 2015).

The source of this investigation is the 'school work', since it represents the materialization of the activities that teachers and students develop in the classroom. It also reveals the aims, contents, concepts and the organizational form of the teaching of Mathematics, especially geometrical concepts.

Students´ learning is the main focus when teachers plan and suggest a certain task. Their aims and their teaching and learning concepts are implicit and provide relevant indexes on their pedagogical practice. School work, in this investigation, comprises all registers proposed by the teacher and developed by the students in the classroom, or rather, the solution of mathematical problems, exercises, evaluations, text production, sketching and others.

The term 'school work' commonly employed in the classroom is different from the concept proposed by Davidov (1988, 1982) on the 'study task'. Although the former contains the aims that should be reached, mere mechanical and memorization activities are frequently required. In fact, they are restricted to empirical aspects such as handling objects, observation and repetition of exercises that the author considers an obstacle for the development of the students´ theoretical thought. Consequently, not all tasks in the classroom may be called study tasks. Study tasks are those tasks that are meaningful for students. In other words, the tasks that make possible the re-elaboration of one´s way of thinking and that trigger learning and development (Davidov, 1988).

In the wake of such definitions, the authors analyzed tasks in the exercise books and in textbooks of Year 2 students as their source, since they display teaching organization, the appropriation process of concepts and the cognitive development of the children. This is the reason why current research may be labeled documental.

The samples comprised ten Math exercise books (two exercise books from each school) of ten student groups in Year 2 of Basic Education in five schools from different places in the municipality of Maringá (PR, Brazil), and the respective text books used by the teachers.

Since the school´s main function is the appropriation of scientific knowledge and the development of theoretical thought by the students, this research is foregrounded on the Cultural-

Historical Theory, Activity Theory and Teaching Guided Activity which will be a great help in the understanding of the development of human psyche in social relationships.

The guiding issue in this analysis was: To what extent do school tasks trigger mental activities that would make possible the appropriation of different mathematical concepts and the development of theoretical thought in students?

To tackle the issue, this work has been organized in three sections: the first section deals with the relevance of the teaching of geometry and the development of students´ Higher Psychological Functions; the second section comprises the procedures for analysis foregrounded to assess school tasks; the third section contains an analysis of the tasks in the students´ exercise and textbooks to discuss which contents and concepts of Geometry were highlighted, or rather, what the tasks revealed on the organization in the teaching of Geometry.

2. The teaching of Geometry and the Development of Higher Psychological Functions

School performance of Brazilian students is a great concern due to results in macro-assessments such as the tests by the Brazilian Assessment System in Basic Education (SAEB). The above situation makes one think on the factors that affect the quality of schooling education, among which public policies for education and teachers´ formation and work should be highlighted. In the specific case of Mathematics, results are mainly due to the lack of appropriation of mathematical concepts by the students.

Concern on students´ low performance, especially in Mathematics, and the need for discussions on the teaching and learning processes have been the object of several studies by different researchers in Mathematical Education, especially Miguel, Fiorentini and Miorim (1992), Pavanello (1993) Lorenzato (1995), Moura (1996), Lanner de Moura (2004), Cedro (2004), Damázio (2000), Moraes (2008), Nacarato (2009) Moretti (2011), Rosa (2012) and others. The above authors researched the teaching and learning process, the appropriation of concepts and the organization of the teaching of Mathematics.

It is important that the teaching of Mathematics in a highly complex world furthers students´ intellectual development so that that may solve problems, deal with information for decision-taking on several themes, make inferences, have the ability to communicate to do collective work critically and independently. In other words, the development of teaching should make people appropriate themselves of scientific concepts and employ them as a tool within their social relationships. The humanization process is the insertion of people within their life history.

According to official reports by the Brazilian Ministry of Education and Culture (MEC), there are several mathematical concepts that students have not been able to learn adequately, because the teaching of Mathematics is still focused on numbers and operations. Concepts of greatness, measurements, geometry and statistics are discarded as second rate (Brasil, 2013).

Research by Pavanello (1993) showed that, historically, the teaching of Geometry has not been appreciated in the classroom, especially in the first years of schooling. Lorenzato (1995), who underscores that the lack of teaching geometry is frequently related to the teacher´s theoretical deficiency and gaps within teacher formation, corroborates this fact. The authors above underline that, frequently,geometric contents are either not discussed, or they are delayed to the end of the term, or they comprise mere tasks proposed by textbooks, which do not often adequately exploit the concepts.

Since the above mentioned research occurred more than twenty years ago, in the wake of the need to discuss the teaching of geometry, this paper investigates the organization of the teaching of Mathematics, mainly Geometry in Year 2 of Basic Schooling.

Geometric concepts are relevant parts of mathematical knowledge since students develop specific psychic functions that make them understand, describe and represent in an organized way the space they live in. Working on geometrical concepts provides forms of highly elaborated knowledge on space and shapes (Lanner, 2004).

Students, therefore, develop such psychic abilities as space perception, capacity of describing, representing, measuring and shaping objects in space, or rather, the analysis, synthesis, abstraction and generalization of concepts are required so that the students´ theoretical thought could be formed and developed (Lanner, 2004).

According to Lorenzato (1995), several psychological research works reveal that the learning of geometric concepts is important for children´s cognitive development, since many classroom situations require space perception, such as reading, writing, the solution of algorithms, measurements, positioning, series and sequence organization, and others.

Lanner de Moura (2004) reports that teachers should exploit the production of concepts, since the understanding of knowledge as a specifically human and historical factor is relevant for the organization of pedagogical work. In fact, the relationship between the four axes of mathematical knowledge is established, contributing towards the formation of geometrical thought and the comprehension and control of space by students.

Pavanello (1993) verified that scanty or inadequate geometrical exercises have caused severe liabilities in student formation. Frequently, teaching has not capacitated students with the space perception, which is important for the understanding and localization in space and in the materialization of several professional activities. The author underscores that geometric exercises should not be restricted to the perception of physical, empirical and observable space, but should enhance the development of students´ ability in the abstraction and generalization of concepts.

> "Geometry is a seminal field for the development of the capacity of abstraction,, generalization, projection and transcending that which is immediately linked to the senses – one of the aims of Mathematics – providing conditions so that the successive levels of abstraction may be reached" (Pavanello, 1993, p.3).

However, the author enhances that frequently its teaching is developed intuitively and experimentally, and merely restricted to the recognition of geometrical shapes and forms such as the rectangle, the square and the circle.

The teaching of Geometry should develop such cognitive aspects as perception, memory, logic thought, language and reasoning. The students have to raise hypotheses, presume, presuppose and deal with experiments through observation, building and disassembling of figures and mediation that prove or not presuppositions, the socialization of procedures and the results obtained. Generalizations and abstractions that occur are relevant aspects for the development of geometric thought (NCTM, 1996).

In her analyses and definitions of mathematical concepts, Talizina (2000) underscores that the contents of a concept represent a system of basic traits of a determined class of objects. According to the author, concepts may be divided into two groups: absolute and relative concepts. The former combines objects within a determined class, according to their specific characteristics that indicate the objects´ essence. Relative concepts combine objects in specific classes by means of the traits related to other objects.

An exercise that merely exploits the empirical aspects of geometric shapes by dealing with essential concepts relevant for the development of the mental image do not help students to differentiate tridimensional shapes from bi-dimensional ones. For instance, they called the cube a square and the pyramid a triangle (Brasil, 2014).

Although the importance of Geometry is acknowledged in the first years of Basic Schooling, its teaching conditions should improve since it is often presented as a type of knowledge unlinked to the other mathematical axes. Teaching should not be limited to the recognition of geometrical shapes but should also involve localization and spatial movement (Brasil, 2014).

The importance of the organization of the teaching of Mathematics, specifically Geometry, should be understood within this context so that planned activities trigger mental actions that would make students appropriate themselves of knowledge and acquire psychic development.

3. Procedures

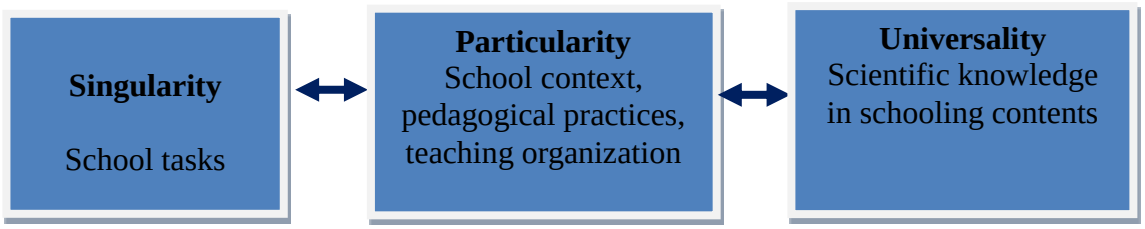
Historical and Dialectic Materialism is an asset for the comprehension and explication of how the relationship between teaching and learning, materialized in school tasks, may promote learning and the development of students´ theoretical thought. These presuppositions are essentially formed by dialectic logic that foregrounds analysis and the interpretation of the world. In fact, they reveal the epistemology for the understanding of the object analyzed (Martins, 2005). In the case of current research, this boils down to the organization of the teaching of Geometry in Year 2 of Basic Education.

The above referential provides important theoretical props to discuss school tasks within the singular-particular-universal dialectic relationship since the categories are a means to understand the educational process.

In current research, the singular comprises school tasks since they are the materialization of teachers´ intention and students´ actions. The tasks are mediated by the particularization of the teaching organization inserted within the school milieu conducted by capitalist society that produces and requires certain practices to comply with social demands. Social organization interferes and reflects the teaching concepts and the teachers´ pedagogical activities. The universal relationship comprises historically elaborated human knowledge. In the case of the school, they are formed by theoretical knowledge (scientific knowledge) expressed by the contents of school curricula taught in the classroom, mediated by the particularity of teaching conditions provided to students so that they would appropriate such knowledge. Consequently, singularity (school tasks) is built and developed within the dialectic relationship between the particular (school context, teaching organization) and the universal (theoretical knowledge). In other words, the particular is the mediating factor between students and knowledge (Asbahr, 2011).

Figure 1 synthetizes the relationship between singular-particular-universal.

Figure 1- Dialectic relationship between singular-particular-universal within the organization process of teaching and Mathematics:



Studies on singularity – school tasks in Geometry by students in Year 2 – were undertaken by analyzing the following factors: which geometric concepts were discussed and in what way; which mental activities could be enhanced by the tasks; what are the possibilities that students have for the analysis, synthesis and abstraction of concepts through generalizations, rational operations which are the bases for the appropriation of scientific concepts and for the formation of theoretical thought by students.

According to Davidov (1988), the operations mentioned above are systematically constructed and do not develop spontaneously. The development of theoretical thought is a process that produces abstractions that integrate and synthetize concepts, or rather, they refer to the ability in establishing a general relationship from specific knowledge and applying this relationship to other issues.

> The content of theoretical thought involves mediated, reflected and essential existence. Theoretical thought is the idealization process of one aspect of the aim-practice activity, the reproduction of the universal forms of things. Reproduction occurs in people´s work activity as a special aim-sensorial experiment. Therefore, the experiment increasingly acquires a cognitive characteristic and enhances people to mentally perform the experiments over time (Davídov, 1988, p. 125).

According to the Cultural-Historical Theory, the concept of activity was crucial in the methodology of current investigation, especially in the identification of factors in students´ materialized tasks.

Human activities are the relationships between human beings and reality, guided by motives and aims that should be reached through planned actions. Mental processes (the higher psychological functions), therefore, are constructed within social interactivities and, consequently, internal mental activities arise from and within people´s practical activities during their lifetime. Through the effective activity on objects belonging to nature and through people´s communication, human beings appropriate cultural goods, or rather, scientific knowledge developed throughout history (Leontiev, 1978).

Foregrounded on studies in Cultural-Historical Theory and in the Activity Theory, Moraes (2008) reports that pedagogical activity may be understood as a special human activity in constant movement, and its social, economic, historical, political and cultural aspects should be considered.

Research by Davidov (1988) on the Activity Theory provides several items for the discussion on the organization of teaching through study activities as school children´s main activity.

Study activity consists of tasks (linked to aims) that require a series of actions developed through specific activities with their respective (practical and intellectual) operations that trigger the formation of theoretical thought through reflection, analysis and mental planning. Study requirements and motives are acquired by students since the basic content of study activity is theoretical knowledge (Davídov, 1988).

Study activity may enhance the internal motives so that knowledge appropriation may occur. Teachers´ main function within this perspective is the development of teaching that would promote internal motives, more precisely, investigations that launch the process.

Since the bases for the development of conscience and psychic capacities are linked to the development of study activities, Davidov (1988) underscores that the activities proposed by the teacher should cause needs in the students for the appropriation of determined theoretical knowledge. They should thus understand the motives that make them undertake certain tasks. In other words, they should be the agents of their own activities and aware of the actions they undertake. When students are in activity, the development of theoretical thought is a great possibility.

When the Cultural-Historical Theory and the Activity Theory are taken as references, the teaching organization (as activity) should be guided by the concept of students´ integral formation. The above idea re-dimensions school tasks beyond the execution of repetitive or mechanical exercises. Rather, they are a way to organize and work out scientific concepts by

promoting the learning and the development of the students´ higher psychic functions. It is thus necessary to consider the different school disciplines as a product of human activity, since knowledge should be foregrounded on scientific concepts. Similarly, teaching should be organized to develop in the children the need for the appropriation of these concepts, without being restricted to perceptual (empirical) learning (Davídov, 1988).

Based on the Cultural-Historical Theory and the Activity Theory, Moura (1996, 2001, 2010), Moraes (2008), Cedro (2004), Moretti (2011) and others researched teaching organization, especially Matematical Education, and discussed the possible contributions of these theories to define aims and strategies for activities to be developed in the school. Teaching Guidance Activity (TGA) was employed for the theoretical and methodological bases for teaching organization. According to Moura (2001, p. 155):

> Teaching Guidance Activity is structured to favor agents´ interaction, mediated by meaning-negotiated contents to give a collective solution to a situation-problem. […] The teaching guidance activity has one requirement: teaching; it has activities: it defines the way or procedures of how to place knowledge with the educational space; it selects auxiliary teaching tools: the methodological resources proper to each aim and action (books, chalk, computer, abacus etc.). Finally, the processes of analysis and synthesis throughout the activity are instances of permanent assessment for teacher and learner.

The above author underlines that TGA is the teachers´ and students´ formation unit. Its basic reference is the concept of activity forwarded by Leontiev (1978), since it organizes teaching by identifying and intervening in students´ and teachers´ activities during the educational process. Moraes (2008), corroborated by Moura (2001), defends that the main TGAs are:

> [...] pedagogical intentionality; the existence of a learning-causing condition; the concept as the formation nucleus for theoretical thought; mediation as the basic condition for the development of the activity; collective work as production contest and knowledge legitimation (Moraes, 2008, p.102).

Consequently, according to the presuppositions of the Cultural-Historical Theory, the Activity Theory and TGA, the teaching organization requires the teachers´ dominion of the scientific knowledge to be taught. They should have an in-depth knowledge of the essential characteristics of teaching activities, they should understand which mental actions are employed by the students when they undertake the activities and how the appropriation process of knowledge occurs. In other words, the teachers should know how children develop their higher psychic functions: perception, logic memory, voluntary attention, thought and others. The above knowledge provides teachers with several aids to organize teaching and follow the entire process towards the students´ human development (Moura, 2010).

4. What do tasks show on the organization of Geometry teaching?

The questions below were asked when the activities developed by students were analyzed: What time was allotted for the teaching of Geometry? Which geometric contents were given priority? What were the main characteristics of the tasks undertaken? Did the tasks provide the formation

of theoretical thought? Did the task focus on the learning of concepts? Was there any link between Geometry and other mathematical axes?

In the case of time allotted to the study of geometric concepts, a survey was undertaken on the amount of tasks developed to verify the period in which contents related to Geometry were performed during the scholastic year.

Table 1- Period in which Geometry tasks were undertaken:

		Number of tasks developed in each month											
School	**Source**	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
School A	**Exercise book 1**	-	-	9	-	-	-	-	-	-	5	-	14
	Exercise book 2	-	-	17	-	-	-	-	-	-	10	-	27
School B	**Exercise book 3**	-	-	-	5	2	-	-	-	-	-	3	10
	Exercise book 4	-	-	-	5	4	-	-	-	-	-	1	10
School C	**Exercise book 5**	-	-	-	-	7	-	-	-	-	-	-	7
	Exercise book 6	-	-	-	5	-	-	-	-	2	-	-	7
School D	**Exercise book 7**	-	-	-	8	3	-	2	-	-	4	-	17
	Exercise book 8	-	-	-	30	-	-	5	-	-	-	-	35
School E	**Exercise book 9**	-	-	-	-	-	-	-	20	-	1	-	21
	Exercise book 10	-	-	-	-	-	-	-	10	-	6	-	16

Source: Year 2 Students´ exercise books

Data show that geometric contents were performed in detached periods in all the groups analyzed. Tasks were more frequent at the end of the first (May and June) and second (November and December) terms, with contents placed at a lower rank. According to Lorenzato (1995), teachers´ excuses for not undertaking Geometry tasks in the classroom include lack of time, excess of Math lessons and lack of dominion of concepts related to Geometry. Since most groups of the same school undertook tasks in Geometry at the same period or very close to the same period, it may be inferred that contents were planned only for the end of each term and not bi-monthly.

Perhaps one of the reasons that teachers do not give priority to tasks involving concepts of Geometry is the manner mathematical concepts are organized within the Curriculum of the Municipality of Maringá (2012). Current authors discovered that the four Math axes (Numbers and Operations, Greatness and Measurements, Geometry and Treatment of Information) are given

separately, with a sequence of contents which are specific to each axis. Since the Curriculum lacks any articulation between the axes, teachers develop each item separately, hierarchically and linearly, following the Curriculum´s order. In other words, teachers first teach Numbers and the four basic operations, followed by Greatness and Measurements. Later on, they deal with Geometry and Treatment of Information. Consequently, they frequently do not exploit all the contents programmed for the year.

In the case of geometric concepts, data indicate that school tasks focus on geometric tridimensional (geometric solids) and bi-dimensional (plane figures) figures and, in a smaller number, figures that exploit concepts on spatial localization, as the table below reveals.

Table 2- Geometry contents in school tasks.

School	Source	Contents			Total
		Spatial localization	Geometric shapes		
			Geometric solids	Plane shapes	
School A	Exercise book 1	-	14	-	14
	Exercise book 2	-	18	9	27
School B	Exercise book 3	-	6	4	10
	Exercise book 4	-	7	3	10
School C	Exercise book 5	1	3	3	7
	Exercise book 6	-	5	2	7
School D	Exercise book 7	5	5	3	13
	Exercise book 8	5	26	4	35
School E	Exercise book 9	-	21	-	21
	Exercise book 10	-	16	-	16
General total		10	121	28	

Source: Exercise books of Year 2 children

Since fewer tasks on Geometry were extant in the exercise books of schools B and C, the students´ thought development was restricted by this type of teaching. Exercise book 5 did not reveal any tasks on geometric solids, whilst Exercise book 6 did not display tasks related to spatial localization. The Exercise books of schools A and E included reports of tasks on geometric solids.

Three out of the ten exercise books analyzed tasks related to contents involving spatial localization. In fact, space is a basic subject matter during the whole schooling process, since the exploration of space should lead students to understand basic place relationships using their own body, and other objects or persons as reference points. Children should appropriate the concepts of direction involving laterality (right and left), anteriority (in front of, before, prior) and posteriority (towards the front, back and behind) and height or depth (high, over, on, above, below, at the bottom of, to the bottom) (Paraná, 2003). However, teachers remarked that concepts related to spatial localization were considered less relevant during this schooling stage.

However, according to Lanner de Moura (2004), the number of tasks is not always synonymous to quality. In other words, repetitive tasks do not guarantee the appropriation of concepts. Consequently, current authors listed tasks according to dates given in the exercise books so that the type of tasks proposed and other aims could be discussed.

Table 3: Main tasks developed in Geometry:

✓ Handling of boxes to classify objects that "roll down" and "do not roll down";
✓ Illustrations of objects found in the classroom that remind one of solids;
✓ Identification and illustration of the geometric solids, cube, parallelepiped and sphere;
✓ Identification of the cylinder by the wrapping of the pick-a-stick game;
✓ Identification of the sphere by listening to the poem "The sphere";
✓ Recognizing the names of solids (crosswords);
✓ Recognizing vortexes, surfaces and sides of a cube and parallelepiped;
✓ Construction of a figure with plane shapes, taken from the literature;
✓ Identification of names of plane figures by the shape of logical blocks: square, rectangle, circle and triangle.
✓ Spatial localization by low plane
✓ Illustration of the classroom from different angles.
✓ Identification of plane figures by the hopscotch game.

Source: Exercise books of Year 2 children

The above list of tasks corroborates results previously elaborated. Or rather, the focus on the teaching of geometry in the sources under analysis comprised tasks that involved the recognition

of names of geometric solids. The above presupposes that if students appropriate the name of a certain geometric solid, its concept is known.

5. Analysis of tasks and a synthesis on the organization of the teaching of Geometry

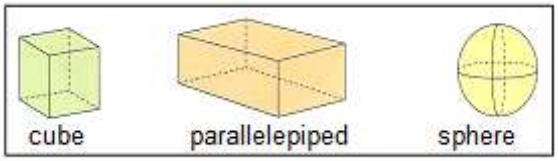
Discussion on the tasks proposed by teachers and developed by the students raised several points on the organization of the teaching of Mathematics, especially on Geometry, in Year 2 of the Primary School.

Contents on geometric knowledge are not a priority in the first years of schooling, revealed by the number of tasks in the exercise books. In fact, they do not cover 10% of total Math tasks developed. Data also demonstrated that the organization of the teaching of Geometry is mainly characterized by tasks that require naming and memorization of nomenclatures of tri-dimension and bi-dimension figures (solid and plane geometric figures) through repetition and association. In fact, children had to merely associate the geometric figure to previously presented examples, as the tasks below show.

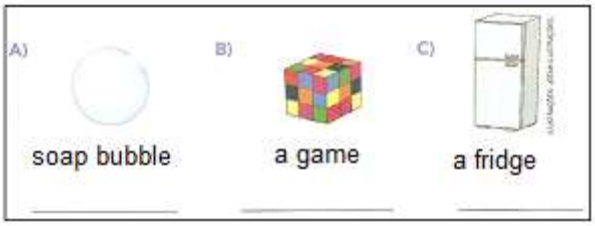
CUBE, PARALLELEPIPED AND SPHERE

TASK 1: HOLD A DIE, A TOOTHPASTE BOX AND A BALL. LOOK AT THE SHAPE OF THESE OBJECTS. HANDLE THEM AND OBSERVE THEIR PARTS.

- SEE THE FIGURES BELOW AND THE NAME OF THE GEOMETRIC SOLIDS.



TASK 2: FILL IN THE BLANKS WITH THE NAME OF THE GEOMETRIC SOLIDS ACCORDING TO THE OBJECTS BELOW:



Source: Dante, 2011, p.44.

It has been suggested in Task 1 to handle and observe the features of a die, a toothpaste box and a ball. The names of the solids (cube, parallelepiped and sphere) are given to the children. The task is complete when the children observe empirically the objects (handling of the boxes). There is

no registry on the directions or on which elements should be observed and compared in the objects.

Although the task suggests comparing the figures with the real objects, the characteristics of each one are not explored at any time, nor are their differences problematized. The task requires merely the memorization of the names of the solids.

Vygotski (2000) states that memorization is the mother of learning but only when it is the result of development and not of the mechanical mode, with due interrelationships of conceptual links.

In the previous tasks, if the teachers´ intervention process fails to organize teaching activities that would enhance analysis and synthesis, it will be greatly difficult to interfere in the students´ proximal development zone. In fact, it merely exploits the knowledge that they already have. The possibility of going beyond it is limited, since it merely enhances previous knowledge and not knowledge that should be learned. The task merely underscores external factors and the external aspects, but not the basic traits, of the objects.

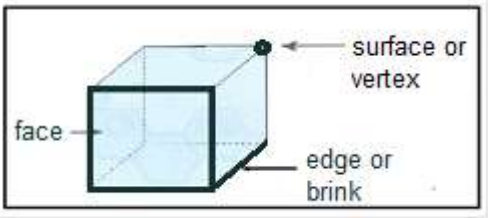
In the case of Task 2, all objects are geometric solids. However, the bubble and the fridge are empty figures. The task as it stands may lead students to appropriate concepts inadequately, since only the external traits of the figures are taken into account within an associative mode.

Analysis of the tasks revealed that the repetition of the same task model, prevalent in the textbook, would lead towards learning. The above is evidenced by the reiteration of commands for the solution of similar tasks.

The tasks investigated did not reveal explicitly which geometric concepts were being implied and thus limited the students´ abilities to establish links between the concepts (Vygotski, 2000). Although only a single task referred to factors that compose geometric solids (surfaces, vertexes and sides), the task was limited to naming.

The task given below provided the students with the figure of a blue cube and demonstrated the factors that compose it (surface, vertexes and sides). The situations in which the children would understand the definition that characterizes these factors were not reported. The children were then asked to give the number of surfaces, vertexes and sides of the figure, as below.

TASK 3: OBSERVE THE FIGURE BELOW AND LEARN THE NAME OF THE PARTS OF THE CUBE.



- FILL IN THE BLANKS WITH INFORMATION ON THE CUBE:
  A) NUMBER OF VERTICES: _____
  B) NUMBER OF EDGES: _____
  C) NUMBER OF FACES : _____

TASK 4: ANSWER:

a) DESCRIBE THE EDGES OF THE CUBE:_____
b) LET´S COMPARE: IS THE NUMBER OF SURFACES BIGGER OR SMALLER THAN THE NUMBER OF VERTICES?_____

Source: Dante, 2011, p.47.

The aim of the tasks is limited to quantification and not to geometric concepts inherent to the cube´s elements and its external traits. It is evident that students had to follow the 'model' to answer the questions, without any discussion on the scientific concepts that characterize the solid.

Foregrounded on Vygotski and Davidov, Talizina (2000) states that a concept´s definition provides a certain point of view to valorize objects with which students inter-relate. When the concept of surface, vertex and sides is defined and contact is maintained with different objects that fit in such definitions, the scientific concept is gradually built in the students´ mind as a generalized image of objects of a determined class.

> A definition is not the final stage in the assimilation of a concept. It is merely a first step. The following step is the inclusion of the concept´s assimilation in those activities that students undertake with the corresponding objects with whose aid the concept of these objects is formed in their minds (Talizina, 2000, p.27).

According to the author, the definition of a concept cannot be the final step in the process of its assimilation. Definitions should be discussed during the development of the school tasks. However, not a single task could be detected that would help the students to define concepts. Tasks were restricted to the forwarding of new terms.

It should be underscored that most tasks involving handling of geometric figures gave priority to empirical observation only and failed to analyze the main characteristics of the figures or to establish the relationships of common factors between one figure and another, which would make possible the appropriation of concepts and the formation of theoretical thought. Tasks provided only certain isolated and specific factors, or rather, they impaired students from developing their capacity for theoretical generalizations and conscience-raising (Davídov, 1988).

Some of the tasks analyzed, especially those proposed in the textbook, asked the children to classify objects that 'roll down' and those that do not. The manner of referring to the characteristics of round or polyhedral objects limits the understanding of the concepts that characterize the classification of geometric solids since it does not exploit the concepts´ essence.

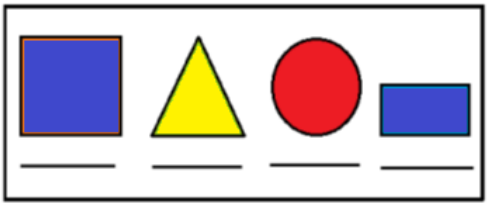
Conceptual errors on geometric tri-dimension and bi-dimension figures could be pinpointed in certain tasks. Some teachers only used logical blocks to represent plane figures such as the square, the rectangle, the triangle and the circle. There was no entry on the relationship between tri-dimensional and bi-dimensional figures. The above may be exemplified below.

TASK 5: COLLECTIVE TEXT PREPARED BY STUDENTS OF YEAR 2 IN SCHOOL E.

LOGICAL BLOCKS

LOGICAL BLOCKS ARE USED TO LEARN GEOMETRIC FORMS: THE SQUARE, THE TRIANGLE, THE RECTANGLE AND THE CIRCLE. BLUE, YELLOW AND RED. SIZE: BIG, SMALL, MEDIUM; THICKNESS: THICK AND THIN.

TRACE THE LOGICAL BLOCKS AND WRITE THE NAME OF THE GEOMETRIC BLOCKS:



Source: Exercise books of Year 2 students.

The collective text, reproduced in the previous task, showed that logical blocks were employed. The names of the plane figures that represent the faces, colors, thickness and size of each logical block were exploited. The task begs the question: Is the teacher of the class aware that logical blocks are geometric solids or does she treat them as plane figures?

Such doubts were due to the fact that the first phrase of the collective text underscored: *"Logical blocks are used so that we may know the geometric forms: square, rectangle, triangle and circle".* The statement suggests that only plane figures (square, rectangle, triangle and circle) are employed. The task did not establish the relationship between logical blocks and geometric solids (cube, parallelepiped, cylinder and prism) and failed to explore the fact that the contour of one of the faces of the solids was the result of a plane figure.

When the tasks were analyzed, it became evident that, first, children did the tasks suggested by the text book involving the identification of the geometric solids (cube, parallelepiped and sphere) and then they "constructed" the cube and the parallelepiped according to the annex in the book. Further, they prepared a collective text on the tasks developed (Task 6).

TASK 6: Collective text prepared by Year 2 students in School E (exercise book 9):

"WE WORKED OUT PAGES 47, 48, 49 AND 50 OF THE MATH BOOK ON GEOMETRIC SOLIDS".

"THE TEACHER BROUGHT SEVERAL GEOMETRIC SOLIDS. SUCH AS: A DIE, A SHOE BOX AND A BALL. WE CUT THE FIGURES AND PASTED THE CUBE AND THE PARALLELEPIPED ON SEPARATE SHEETS OF PAPER".

TASK 7 – TAKE A GLANCE AT THE CLASSROOM AND WRITE THE NAMES OF SOME OBJECTS THAT HAVE THE SAME GEOMETRIC FORMS AS THE CUBE, PARALLELEPIPED AND SPHERE.

A**) SPHERE**: CLOCK, FAN
B) **CUBE:** DIE
C) **PARALLELEPIPED**: DOOR, BLACKBOARD AND WARDROBE.

TASK 8: COLLECTIVE TEXT “ending the task undertaken”

“We have seen that:”

- **FACES**: are the sides
- **VERTICES:** are the edges
- **EDGE**: joins the vertexes

Source: Exercise books of Year 2 students.

Although the “collective text” elaborated by the students does not represent geometric contents, it was included to show the sequence in which the Geometry task was undertaken in the classroom. One may verify that the teacher´s interest in registering the task – children´s involvement with the different geometric figure – triggered the students to establish a relationship between the solids studied and those in the classroom space. However, it seems that the teachers did not know the concept of a sphere. Task 7 evidences this fact: the list of objects in the classroom that reminds one of solids included the clock and the fan as spheres!

It should be underscored that these objects represent a cylinder rather than a sphere. A mistake on the concept of the sphere occurred in 6 out of the 10 exercise books analyzed. The above data show that lack of precise scientific knowledge on Geometry causes the teachers to commit mistakes or forward mistaken examples and, thus, restricting or making impossible children´s knowledge.

The above conceptual mistake confirms the hypothesis at the start of current research and the statements by Lorenzato (1995) and Grando (2008) that frequently teachers do not have a complete dominion of concepts and present them in a mistaken way or they simply do not work on them in the classroom. They also confirm the statements by Davidov (1982, 1988) that the essence of absolute and relative scientific concepts (Talizina, 1988), should be exploited so that the students may appropriate them.

However, Tasks 6, 7 and 8 demonstrated that the predominant activity comprised the handling of the figures that represent solids so that they could be classified according to their shape (cube and parallelepiped) and the labeling of their main elements (faces, vertexes and edges). There is no sign of any discussions by the students that would provide the discovery of the reasons that made them develop the activities suggested, or rather a situation-problem that would be related to the activities developed during the whole process that establishes conceptual links.

Data show that the teaching of geometric concepts often occurs alone, fragmented and linear, revealing the teachers´ limitations of theoretical knowledge, especially with regard to the logical-historical aspects of the concepts. Mathematical concepts are thus compartmentalized, without any articulation among the different mathematic axes or with other areas of knowledge. According to Pavanello (1993), Lorenzato (1995), Andrade (2004) and Grando, Nacarato & Gonçalves (2008), compartments still occur in school curricula.

5. Final considerations

This analysis demonstrated that the tasks analyzed were different from the assumptions of the Cultural-Historical Theory, Activity Theory and Teaching Guided Activity, since they focused on the logic of terms and not on the concept presentation. Conditions that would trigger a type of learning that would make students infer the concepts of the geometric figures studied and provide the development of the concepts of space and form. In other words, there is no evidence of a task that would focus on the essence of concepts to develop the students´ geometric thought.

Current authors discovered that teaching organization was restricted to the exploration of specific tasks, highly criticized by Davidov (1988), since they lead students to learn merely the specific characteristics and their training for a solution. These tasks limit qualitative changes in the students´ mental actions, or rather, they do not give priority to the way they think and analyze the geometric figures through the internalization of the relationship between tri-dimensional (whose essential properties are height, width and depth) and bi-dimensional (height and width only) figures.

According to Bernardes (2009), students´ conceptual appropriation occurs when the schooling context supplies these conditions, or rather, when teaching conditions (specific) are intentional and make possible the appropriation of scientific knowledge (universal). However, the tasks analyzed reveal that such appropriation by the students was practically impossible.

Data retrieved from current investigation furnishes discussions on the contributions of the adopted theoretical bases as an alternative for going beyond a sort of teaching that still underscores empirical knowledge, memorization and the repetitions of commands to the detriment of concepts. Pedagogical actions should provide students with the dominion of scientific knowledge so that they would objectively intervene in their physical and social milieu (Rodrigues, et al., 2010).

When a set of repeated and mechanical tasks focusing on the naming of geometric figures (nomenclature) and materializing in specific actions is analyzed, it is urgent that teachers have consistent theoretical aids for the elaboration of teaching activities as a way of acting intentionally in the learning-teaching process with the student and the teachers as active agents of the process (Davídov, 1988).

Several challenges exist and they have to be overcome. It is highly important that teachers have good working conditions coupled to a formation that makes possible the organization of learning that would develop the students´ highest intellectual abilities through the appropriation process of theoretical knowledge.

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