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# From the concept of Teaching Guiding Activity to Learning Triggering Situations in research on teaching and teacher training[1]

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**ABSTRACT**

The article aims to investigate how situations that trigger learning can be elaborated towards the appropriation of a mathematical concept. Thus, the study focuses on the concept of Teaching Guiding Activity as a theoretical-methodological basis for the organization of teaching and on situations that trigger learning, intentionally developed through games, virtual stories, and situations that emerge from everyday life in research linked to the Study and Research Group on Pedagogical Activity. The methodological approach is based on the gathering of fifty studies involving the concept of Teaching Guiding Activity and teacher training or the teaching of mathematics, in works related to the group's researchers or their advisees, located from the records of Lattes curricula. The analysis of the situations that trigger learning in the research reveals evidence of the general way of organizing education and training that preserves the Teaching Guiding Activity principles as the essence of the concept and the collectivity.

**KEYWORDS:** Teaching Guiding Activity. Learning Triggering Situations. Teacher training. Mathematics Education.

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*Do conceito de Atividade Orientadora de Ensino às situações desencadeadoras de aprendizagem em pesquisas sobre ensino e formação de professores*

**RESUMO**

O artigo tem como objetivo investigar como as situações desencadeadoras de aprendizagem podem ser elaboradas na direção da apropriação de um conceito matemático. O estudo centra-se no conceito de Atividade Orientadora de Ensino (AOE) como base teórico-metodológica para a organização do ensino e nas situações desencadeadoras de aprendizagem (SDA), desenvolvidas intencionalmente por meio de jogos, histórias virtuais e situações emergentes do cotidiano em pesquisas vinculadas ao Grupo de estudos e pesquisas sobre a Atividade Pedagógica. O caminho metodológico parte do levantamento de cinquenta pesquisas que envolvem o conceito de AOE e a formação de professores ou o ensino de matemática, em trabalhos vinculados aos pesquisadores do grupo ou de seus orientandos diretos, localizados a partir dos registros dos currículos Lattes. A análise das SDA nas pesquisas revela indícios do modo geral de organização do ensino e da formação que preservam princípios da AOE como a essência do conceito e a coletividade.

**PALAVRAS-CHAVE:** Atividade Orientadora de Ensino. Situações Desencadeadoras de Aprendizagem. Formação de Professores. Educação Matemática.

*Del concepto de Actividad Orientadora de la Enseñanza a situaciones que desencadenan aprendizajes en la investigación sobre la docencia y la formación del profesorado*

**RESUMEN**

El artículo tiene como objetivo investigar cómo se pueden elaborar las situaciones desencadenantes de aprendizaje en la dirección de la apropiación de un concepto matemático. El estudio se centra en el concepto de Actividad Orientadora de la Enseñanza (AOE) como base teórica y metodológica de la enseñanza y en el concepto de situaciones desencadenantes de aprendizaje (SDA), desarrolladas intencionalmente

en el uso de juegos, historias virtuales y situaciones que emergen del cotidiano en la investigación vinculada al Grupo de Estudio e Investigación de la Actividad Pedagógica. El enfoque metodológico se basa en una encuesta de cincuenta estudios que involucran el concepto de AOE y la formación del profesorado o la enseñanza de las matemáticas, en trabajos vinculados a los investigadores del grupo o sus estudiantes de posgrado directos, ubicados a partir de los registros de los currículos 'Lattes'. El análisis de la SDA en la investigación revela evidencias de la forma general de organizar la educación y la formación que preserva los principios de la AOE como esencia del concepto y de la colectividad.

**PALABRAS CLAVE:** Actividad Orientadora de la Enseñanza. Situaciones desencadenantes de aprendizaje. Formación de profesores. Educación Matemática.

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## Introduction

The understanding of the teaching and learning processes and the organization of the pedagogical activity has been, since the beginning, an object of study and investigation by the Group of Studies and Research on Pedagogical Activity (GEPAPe)[6]. In these studies, the Historical-Cultural Theory, the Activity Theory and, more specifically, the concept of Teaching Guiding Activity (AOE in Portuguese) (MOURA, 1996, 2016), are theoretical and methodological foundations to develop the investigations carried out and in progress in research on teacher education and training within the group.

As research involving the concept of Teaching Guiding Activity was developed in master's and doctorate programs, as well as in teaching and extension projects involving the group members, the need to deepen the understanding of this concept was revealed propellant of new studies.

[6] Research Group linked to the Faculty of Education of the University of São Paulo (FEUSP), created in 2002 and coordinated by Professor Dr. Manoel Oriosvaldo de Moura

In this sense, the present study focuses on the Teaching Guiding Activity (AOE) as a theoretical-methodological basis for the organization of teaching and seeks to understand the principles of AOE and the concept of Learning Triggering Situations (SDA in Portuguese), intentionally developed through games, virtual stories and situations emerging from everyday life in academic research linked to the group.

Thus, this text seeks to answer the following question: How have learning triggering situations been made possible in academic research through the use of games, virtual stories, and situations emerging from everyday life, in line with the principles of AOE? It led us to the objective of investigating how the SDA can be elaborated and/or organized to appropriate a mathematical concept. With this study, it is expected to contribute to the appropriation of the AOE concept in research and to overcome possible weaknesses in the development of teaching situations based on this concept, avoiding, for example, misunderstandings of the use of virtual story as a mere use of telling excerpts from the history of mathematics or even resorting to the game as a complement to educational time or aimed at memorizing concepts.

The methodological path adopted was based on the gathering of 50 (fifty) master's and doctorate studies involving the concept of AOE in works directly linked to GEPAPe researchers or their direct advisees. The starting point for accessing the works was the connection of the works in the Curriculum Lattes of the advisors associated with the group, starting from the works supervised by Professor Dr. Manoel Oriosvaldo de Moura, leader of the group. From the titles of the master's and/or doctorate works of GEPAPe members and their direct advisees, the definition of the corpus of analysis was given by searching the titles, abstracts, and keywords from the expressions Teaching Guiding Activity and/ or Guiding Activity. The analysis was carried out through the study of the SDA present in the papers.

## From the concept of activity to the Teaching Guiding Activity

The theoretical-methodological foundations of the Teaching Guiding Activity, whose assumptions are anchored in the Historical-Cultural Theory (THC) and the Activity Theory, reveal a way of organizing teaching so that the school is in charge of school education, which is understood as an adequate space for the appropriation of theoretical knowledge by students, cultural heritage of humanity and, therefore, lead to humanization.

The concept of AOE is based on elements of Leontiev's concept of activity (reasons, needs, actions, and operations, among others) and is structured from principles supported by THC, including collectivity, historical logical movement, pedagogical intentionality, and the role of mediation in the educational process. Araújo (2019) explains the elements of the activity in two dimensions, mentioning that:

> [...] activity is characterized by two interdependent dimensions, one of execution and the other of orientation. In the dimension of orientation, we could consider the reason and the object towards which it is oriented. In a way that the reason and the object are linked to a certain need. The actions and operations configure the executing dimension of the activity, in which objectives relate to actions, and conditions relate to operations. (p. 130, our translation).

Moura, Araújo, and Serrão (2018, p. 414, our translation) point out that "[...] no individual of the species is capable of producing its existence alone", thus the child must have contact with other human beings and, when communicating with them, learn their activity properly. Leontiev calls this process education. The authors also bring Vygotsky's view that the concept, which is the object of school education, is provided by the human history that produced it, since "[...] the concept is embodied in the word and the word has a historically constructed meaning, so we must pay attention to the concept" (MOURA, ARAÚJO, and SERRÃO, 2018, p. 415, our translation).

Considering the activity structure proposed by Leontiev, Moura (1996) proposes the concept of Teaching Guiding Activity as a general way of

organizing the pedagogical activity, understood as a unit between the teaching activity performed by the teacher and the student's learning activity, since this is constituted from:

> [...] a need (appropriation of culture), a real reason (appropriation of historically accumulated knowledge), objectives (teaching and learning) and propose actions that consider the objective conditions of the school institution. (MOURA et al, 2016, p. 110, our translation).

According to Moura, Araújo, and Serrão (2018),

> The theoretical-methodological foundations of the AOE, whose assumptions are anchored in the historical-cultural theory and the activity theory, are indicators of a way of organizing teaching so that the school fulfills its main role, which is to enable the appropriation of theoretical knowledge by the students and the development of their personalities. Thus, the AOE, as mediation, is a teacher's instrument to perform and understand its object: the teaching of concepts. And it is a student's instrument that acts towards the appropriation of theoretical knowledge to be objectified by the AOE. Thus, the AOE has fundamental characteristics for teaching and is also a source of research on teaching. (p. 421, our translation).

In the group of characteristics that underlie the concept of AOE, Moraes (2008) highlights the following:

> ● the pedagogical intentionality;
> ● the triggering situation for learning is the materialization of the teaching activity;
> ● the essence of the concept;
> ● mediation is a fundamental condition for the development of the activity;
> ● the need for collective work;
> ● becomes an activity of the subject (p. 232, our translation).

In the process of preparing the SDA, the aforementioned characteristics of the AOE must be considered and taken as a starting point for the movement of study and written production of the situations.

The triggering situations for learning are those that make it possible to create real conditions for subjects to engage in learning activities, thus appropriating concepts that were built historically (MOURA, SFORNI, and

LOPES, 2017). Through them, it is possible to experience the intentional movement of the pedagogical activity, providing subjects with the construction of their theoretical thinking (CEDRO, 2008).

According to Moura, Araújo, and Serrão (2018, p. 422, our translation)

> Similar to the historical and social development, the triggering situation for learning aims to place the child in creative tension, like those who have experienced it, by solving their authentic problems, generated by practical or subjective needs. These learning triggering situations can propose a problem capable of mobilizing the individual or the collective to solve it.

When organizing situations that trigger learning, it is essential to have as reference the historical and logical development of the concept in focus, understood as a human production. In the same way, it is necessary to elicit collective actions to solve the triggering problem, since

> [...] the appropriation of theoretical knowledge is only possible through the intention of the teacher who understands the collective as a space of production and appropriation of historically produced human culture (CEDRO, MORETTI, and MORAES, 2018, p. 441, our translation).

The concept of a triggering problem, understood as a learning problem, "[...] is closely linked to cognitive action, which is mainly characterized by the way of analyzing an object" (RUBTSOV, 1996, p. 133, our translation) and to the acquisition of theoretical knowledge. In this sense, the school, an environment that promotes school education, is understood as a privileged locus for the appropriation of theoretical knowledge, so that:

> This understanding of the school as a space for appropriating the most elaborated knowledge by humanity and, therefore, for learning a particular type of knowledge, which is the theoretical knowledge, is discussed by Rubtsov (1996, p. 129) when he states that theoretical thinking is related to theoretical knowledge that "rests on an analysis of the role and function of a certain relationship between things within a system", in contrast to empirical knowledge based on the understanding between objects and their representations. (PANOSSIAN, MORETTI, and SOUZA, 2017, p. 129, our translation).

The proposition of the SDA occurs through different methodological resources, including the game, the everyday life situation, and virtual story, mentioned in MOURA et al. (2016). However, it must be understood that it is not "the" game, "the" emerging situation, or "the" virtual story alone that constitute the triggering situations for learning. For these resources to be considered potential to materialize situations that trigger learning, they need to put the student in front of a problem-situation analogous to the one experienced by man when dealing with mathematical concepts. Furthermore, the solution of this problem-situation must be carried out collectively by the students and enable the synthesis of the collective solution. It is the teacher's mediation, the way s/he will guide the SDA that will lead or not to reach her/his goal. According to Moura, Araújo, and Serrão (2018, p. 423, our translation),

> These situations that trigger learning have in common the possibility of potentially containing the problem that generates the tension that puts the subjects in activity. In the case of school education, the triggering situation for learning aims, necessarily, at the appropriation of knowledge considered relevant from the social point of view, so that the subject is provided with theoretical, methodological, and ethical tools that provide him/her full participation in the community to which s/he belongs.

Thus, the SDA are organized by essential moments for their constitution described by Araújo (2019). They are problem presentation (which involves a social need), discussion and understanding of the problem (through hypotheses, language comprehension and thought structuring, through sharing), hypothesis testing (first understanding of the studied concept, considering its conceptual connections), definition of a solution (choice of the most adequate hypothesis to the problem) and use of the solution (which generates the production of the "answer" and creation of a conceptual model).

In addition to the moments presented by Araújo, we highlight the principles of analysis and synthesis of the permanent assessment of the entire situation that triggers learning as a moment in its development.

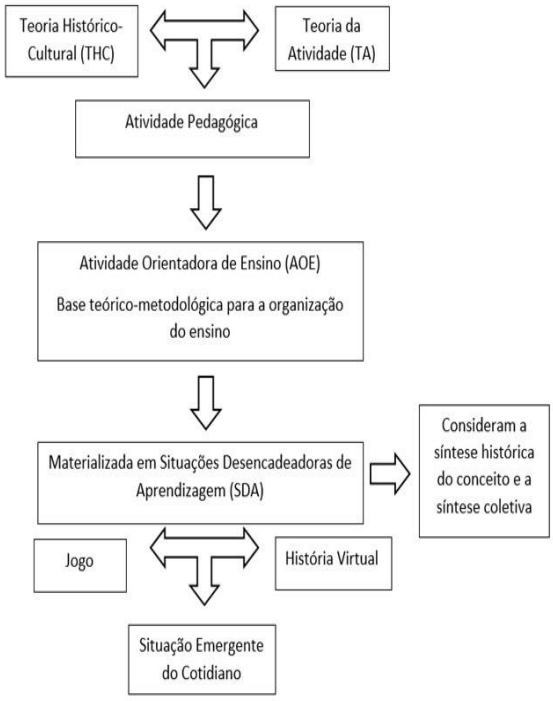
In order to establish possible referrals, the teacher needs to be in teaching activity, to mobilize their students in a way that also enables them to be in activity. This organization, since the presentation of the problem, should be adequate to the level and interest of the students, allowing them to place themselves as part of the context presented by the SDA. Through this awareness of the problem, the student can find the reason to seek the solution, through discussions, testing, and definition of the solution, as it is only by sharing these principles that creative tension drives the learning activity.

This movement of the pedagogical activity, made possible by the situations that trigger learning, happens intentionally for the appropriation of concepts. In this sense, "appropriating a concept is, therefore, appropriating a historically elaborated activity that gave rise to that concept" (NASCIMENTO and MOURA, 2018, p. 56, our translation).

Understanding the concept of AOE involves understanding a general way of organizing teaching, which is why AOE is defined as a theoretical-methodological basis for teaching. That is, it is not simply about structuring a certain teaching methodology - methodological basis, but a way of organizing teaching that considers school education as a locus of human formation and appropriation of the historically constructed knowledge - theoretical basis, all based on the Historical-Cultural Theory (THC) and the Activity Theory (TA).

The following figure schematically represents the place of situations that trigger learning in the Teaching Guiding Activity:

**FIGURE 1:** The triggering situation of learning in the AOE




**Source:** Elaborated from the AOE structure (MOURA, 2016).

## Methodology

The research data were collected from the works produced at GEPAPe, under the supervision of Professor Dr. Manoel Oriosvaldo de Moura and his advisees who also worked to guide research involving the AOE. Access was given through the search for research in the Lattes curriculum of researchers, based on research supervised by Moura, followed by the consultation of works supervised by his former advisees associated with the research group. After locating the research registered in the Lattes curriculum, the selection was based on those involving the term AOE in the abstract and/or in the keywords, with access to the full

text of these works. A total of 50 (fifty) papers[7] were analyzed, being 40 (forty) of master's[8] and 10 (ten) of doctorate[9].

The research was initially based on two stages: a) survey of research oriented by MOURA, between 2002 and 2019, with the AOE in the title, abstract, or keywords; b) survey of research guided by the advisees of MOURA, between 2002 and 2019, that have the AOE in the abstract or keywords. Then, there was the analysis of research involving the survey of:

- Research involving training (initial or continuing) and teaching (Child Education, early years, final years of Elementary School and High School);
- Learning triggering situations present in the research as games, situations emerging from everyday life, and virtual stories;
- Mathematical knowledge present in situations that trigger learning in the axes Numbers and Operations, Algebraic Thinking, Geometry, Quantities and Measures, Statistical Education.

The organization of these categories of analysis made it possible to present an overview of research involving the concept of AOE and the elaboration of situations that trigger learning for the teaching of mathematics, presented below.

## The panorama of research involving the AOE

Of the group of papers analyzed, 34 of them are focused on teacher training and 16 on teaching, and were published in the period from 2002 to 2019. No works before 2002 involving the AOE were found. The

[7] The gathering totaled 53 (fifty-three) works, but only 50 (fifty) were located in full and, therefore, composed the analysis.
[8] Authors of the dissertations: Aguiar (2018), Amaral (2018), Amorin (2015), Barros (2007), Bellini (2017), Bemme (2015), Binsfeld (2019), Branco (2018), Brito (2017), Carvalho (2017), Cedro (2004), Durgante (2019), Euzébio (2015), Ferreira (2017), Fraga (2013), Fraga (2016), Gabbi (2018), Giacomelli (2019), Hundertmarck (2017), Lemes (2012), Locatelli (2015), Lucion (2015), Marafiga (2017), Milani (2016), Moraes (2017), Moraes (2018), Perlin (2014), Pozebon (2014), Ritzmann (2009), Romeiro (2017), Santos (2016), Silva (2008), Silva (2012), Silva (2014), Silva (2018), Silva (2019), Teza (2018), Trindade (2017), Vaz (2013), Zeferino (2016).
[9] Authors of the theses: Araújo (2015), Borowsky (2017), Costa (2016), Fraga (2017), Gladcheff (2015), Migueis (2010), Moraes (2008), Moretti (2007), Sarmento (2019), Virgens (2019).

following data indicate the frequency of these works in each of the two categories – training and teaching.

**TABLE 1**: Research involving AOE in training and teaching.

| | | |
|---|---|---|
| TRAINING | Initial | 13 |
| | Continuing | 21 |
| TEACHING | Child Education | 1 |
| | Early Years | 8 |
| | Final Years | 5 |
| | High School | 2 |
| TOTAL | | 50 |

**Source:** the authors (2020).

In the search for the materialization of the AOE in the triggering situations present in the researches, it was possible to list in the papers the use of games, virtual stories, and emerging situations, and in some of them more than one of the resources is adopted, as follows:

**TABLE 2**: Types of SDA in the papers.

| | |
|---|---|
| Game and Virtual Story | 16 |
| Virtual Story | 15 |
| Game | 07 |
| Situation Emerging from everyday life | 01 |
| Game and Emerging Situation | 01 |
| Virtual Story and Emerging Situation | 01 |

**Source:** the authors (2020).

In the papers, it was possible to recognize the mention of 62 virtual stories, 55 games, and 3 situations that emerge from everyday life. Of the virtual stories, the most repeated in the works were: “Caitité Letter”,

"Cleópatra" and "O Curupira", and the main common themes among them: "Egypt", "Sítio do Picapau Amarelo", and "Povo Papuas". In the games, "Bowling", "Pick-up sticks", and "Battleship" were the most mentioned. In emerging situations, all have different titles and themes, which is justified by the very nature of the situation that comes from different contexts of the realities to which they refer.

Regarding the mathematical concepts present in the SDA, there is a greater concentration of situations related to the mathematical knowledge axis "Numbers and Operations". Taking the organization of mathematical knowledge as a reference, we identified the following:

**TABLE 3**: Axes of mathematical knowledge in the SDA.

| | |
|---|---|
| Numbers and Operations | 22 |
| Quantities and Measures | 13 |
| Statistical Education | 07 |
| Geometry | 06 |
| Algebraic Thinking | 05 |

**Source:** the authors (2020).

In order to discuss how the SDA have materialized in academic research through games, virtual stories, and situations emerging from everyday life, in light of the AOE principles, the final stage of this study seeks to illustrate how these SDA have been explored, in order to promote the conceptual appropriation of mathematical knowledge, having as a reference the learning of the concept and the collectivity as founding elements of the theoretical-methodological basis of the AOE.

Thus, from the group of triggering situations present in the analyzed papers, it was decided to bring some indications of the way of teaching organization present in the situations themselves and in the

proposed referrals both in works aimed at teacher training and in works aimed at teaching.

## The movement of triggering situations

In order to reveal evidence of the movement of organization of mathematics teaching present in the triggering situations in the papers, some situations were chosen to illustrate the discussion, which is presented below. The choice was made based on two central criteria: SDA more present in the papers or SDA described in more detail in the works.

## Illustrating situations involving the Virtual Story as SDA

In order to illustrate the movement of virtual story as a triggering situation for learning, three virtual stories present in the academic papers under analysis will be presented below: Pastor Linus, Verdim and his friends and Caitité Letter, showing the way in which they are presented, based on the AOE assumptions.

In the virtual story of the concept entitled Pastor Linus, the author presents the triggering problem as follows:

> Long ago, shepherd Linus counted his sheep, keeping a stone for each animal. One day, he showed his neighbor Petrus the number of sheep in his flock. Petrus warned his friend that if the flock increased considerably, he would carry a lot of stones, and ended up creating a problem for Linus: "How can you count the same amount with fewer stones? (MORAES, 2008, p. 256, our translation).

It is observed through the triggering problem that the student is motivated to meet a need. For the resolution of the proposal, the student is invited to work individually and sequentially collectively and cooperatively, as described by the author Moraes (2008):

> 1. Distribute to the groups, seventeen pebbles or units of the golden material that represent the number of sheep Linus had;
> 2. Ask students to solve the problem, individually, through a drawing;
> 3. Discuss the solutions created in groups of three or four;
> 4. Choose a solution for each group that covers all counting cases;
> 5. Ask the groups to present the solution to the class on the projector;
> 6. Choose one of the creations to be used by the class to perform different counts. Example: count the quantity 23 from the creation of the class, the number of students.
> 7. Register the year 2006 with the chosen count (p. 256, our translation).

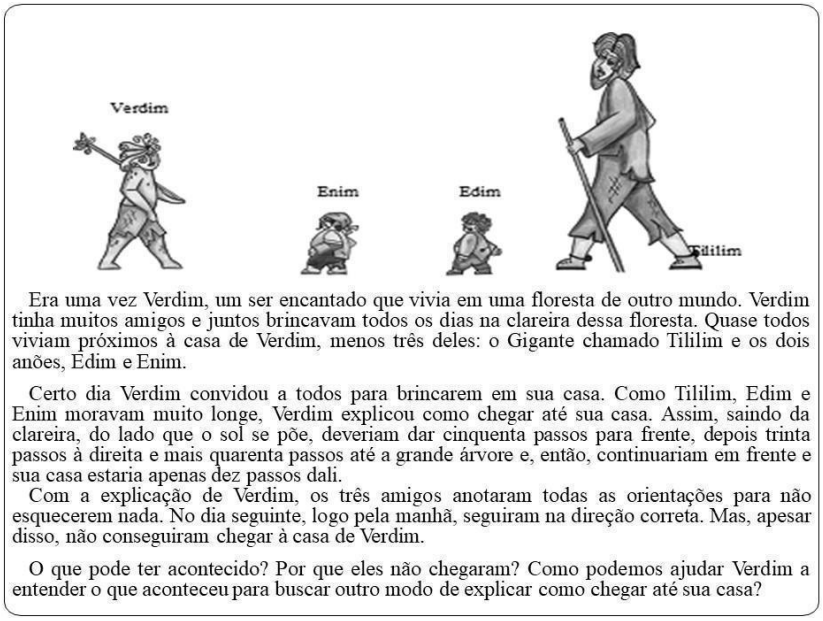
In the aforementioned research, the movements of the development of the activity are presented in the search for meeting the objective of developing the basic concept.

An important aspect that announces the assumptions of the AOE is the presentation of the proposal together with a triggering problem, a characteristic that is specific to virtual stories and other forms of structuring SDA that involve the game and emerging situations.

Below we highlight the example of the virtual story "Verdim and his friends". This triggering situation for learning is inserted in Araujo's research (2015) and was carried out in the teacher training process proposed by the Education Observatory Project (OBEDUC), entitled Mathematics Education in the Early Years of Elementary School: principles and practices of the organization of teaching[10]. The story is presented in the following figure:

[10] Network project developed from 2011 to 2015 and composed of Higher Education teachers, undergraduate students, teachers, supervisors and/or coordinators of Basic Education, formed by the following IES: USP (São Paulo); USP (Ribeirão Preto), UFG and UFSM, with the support of CAPES. Check at http://www.labeduc.fe.usp.br/?post_type=labs&p=1295.

**FIGURE 2**: Verdim and his friends.




**Source**: ARAUJO (2015, p. 123).

The virtual story "Verdim and his friends" was intentionally presented to the participants of this training aiming to make them aware of the humanity's need to create a standard measurement unit. The concept of measurement was worked based on the following triggering problems:

> - What might have happened?
> - Why were Verdim's friends unable to get to their houses?
> - How can we help Verdim find out what happened and thus find another way to explain to his friends how to get to his house? (ARAUJO, 2015, p. 122, our translation).

The experience with this teaching situation, in a process of teacher training, allowed us to collectively discuss some concepts described by the researcher, such as activity, action, meaning, sense, role of mediation, and the genesis of mathematical concepts and how these concepts relate to teaching. From the perspective experienced with teachers, it is expected to create conditions for teachers to recognize this general way of organizing teaching when thinking about their pedagogical practices.

The "Caitité Letter" is a SDA in the form of a virtual story, whose triggering problem "[...] refers to discovering the price of a donkey that was written in an unknown numbering system" (BEMME, 2015, p. 156, our translation). In this way, it aims to work on the fundamental concepts of a numbering system, placing the subject in front of the need for these concepts. The story is mentioned in many papers and is authored by Moura, who developed the concept of AOE. Bemme (2015) mentions in his research that his collaborators, teachers in initial training, failed in the first attempt of resolution, when trying to transpose the data from the letter to base ten. This led them to question whether the numerical writing on the letter was in base 10, and therefore:

> [...] it triggered a discussion about what constituted the basis of a system and its relationship to the quantity of symbols. These reflections led to the solution of the problem, which, in fact, was not simply centered on discovering the value of the donkey, but on the organization of the numbering system in which this value was written. (BEMME, 2015, p. 156, our translation).

Thus, they needed to reflect on the organization of the Decimal Numbering System in a way different from what is normally considered when teaching.

Moraes (2008) presents part of the researchers' intervention through questions based on the structuring elements of the activity, which helped students in solving this same problem. The author emphasizes that the questions must be formulated in a way to mobilize the participants' thoughts, putting them in motion, but without solving the problem for them. The following is an excerpt from this mediation:

> Co - What is the need to solve this problem-situation? (Silence). Have a look at the context of the letter, it is necessary for university students in São Paulo to discover the logic of the Caitités' numbering system. So, there is a need here for university students and, at this moment, for us. How can we discover this logic?
> Co - How many symbols do Caitités have to represent the different numerals? Is there logic for the representation? If there is logic, how does it express itself for the representation of any numeral?
> Ma - So, let us see where we start? (MORAES, 2008, p. 144, our translation).

In Branco's research (2018), the importance of the collective in this process is also pointed out, emphasizing that the participants of his research requested that the activity be done in groups, and presents the opinion of a participating teacher:

> We think better as a group. We can exchange experiences and hear each other's opinions. Alone you reduce the possibility of solving this dilemma. Furthermore, we feel more secure when we are among colleagues (Rute, E4, A, apud BRANCO, 2018, p. 78, our translation).

Another teacher also emphasizes that the situation is very difficult to be carried out individually by them - teachers, and even more so by their sixth-year students.

Virgens (2019) alludes that the Caitité Letter can raise "[...] a need related to the logic of organization of the numerical system that could trigger the learning of our own numbering system" (VIRGENS, 2019, p. 134, our translation). This form differs from other approaches where some old numbering systems are presented with their composition rules and seeks to identify the numbers written in these systems, the "[...] 'conversion' of numbers from 'our' system to these others, or vice versa, or the use of these numbers from other systems in current contexts, as in the case of the Roman numeral system" (VIRGENS, 2019, p. 134. our translation).

## Illustrating situations involving games as SDA

To illustrate the movement of the game as a triggering situation for learning, excerpts from three games mentioned in the papers were selected: Point-to-point, Bowling, and Pick-up Sticks. The discussion that follows seeks to reveal manifestations of how working with each of these games, in light of the AOE assumptions, enables the appropriation of concepts.

In the game "Point to Point", the rules presented in Aguiar (2018) indicate that:

> 1. In each round, the player must choose a natural number from 6 to 19;
> 2. The player must communicate the chosen number to the other participants and then roll the dice;
> 3. The number chosen must be mentally divided by the number obtained when rolling the dice;
> 4. If the division is exact, the player does not score a point and if it is not exact, that is, if there is any remainder, s/he gets one point;
> 5. The winner is who accumulates the most points at the end of ten moves. (p. 113, our translation).

In the aforementioned paper, the game is approached in a process of training teachers in service. The experience of the game is intended to mobilize teachers towards a general way of organizing the teaching activity that triggers conceptual learning. Thus, when starting the moves, both the students and the teachers choose the numbers randomly and as the moves follow and they interact with each other, they recognize some qualities of the numbers and modify their choices from 6 to 19. At the end of the game, the researcher proposes some triggering questions and ends with the central triggering problem, as can be seen:

> 1. When choosing numbers from 6 to 19, which ones have the least chance of scoring when rolling the dice? Comment on how you got your answer.
> 2. Which numbers from 6 to 19 are most likely to score when you roll the dice? What characteristics can be identified in these numbers?
> 3. To be successful in the game, are there better numbers to choose when playing? Which? Why? Record how you got to this conclusion. (AGUIAR, 2018, p. 113, our translation).

The collective discussion of the triggering questions associated with recording the perceptions with the most successful numbers in a table allows teachers to identify that numbers divisible only by 1 or by itself, from 6 to 19, are the best, that is, the prime numbers. From this understanding, new learning can be triggered, such as the study of the chances of success when rolling the dice.

In the game of Bowling, the author Carvalho (2017) aims to "[...] reconstruct the idea of the positional decimal numbering system (SND)" (p. 150, our translation). For the development of the game, the pins were numbered from one to ten, and each pin would have a point value added to the number of pins dropped, distributed in a table presented to the students. During the activity, the students followed their scores through a record sheet (CARVALHO, 2017).

Three rounds of the game were conducted, and the mobilization of the group of students began with:

> [...] the students were informed that they should carry out the counting of the points of all participants and convert the score into caps, transferring the accumulated points in the boxes (of the units, tens and hundreds) in the 'one point - one cap' relationship. Soon, the students realized that this would not be possible, as there were not enough caps for all points (CARVALHO, 2017, p. 152, our translation).

Here, the essence of using the game as a triggering situation for learning is pointed out. From the orientation given to the students, the discussion is developed in a conversation circle to solve the conflict that is presented. The teachers who mediate the situation encourage the students to think about how they can use the caps to represent the points. In this movement,

> [...] teachers highlighted the men's movement to organize and count large quantities, as well as the problems they went through until reaching the numerical organization we have access to today, the SND. (CARVALHO, 2017, p. 152, our translation).

In Cedros's (2004) research, the Pick-up Sticks game "[...] was used to develop the conceptual nexus of two of the quantity control movements: the idea of organization in groups and of division" (p. 106, our translation) with students from the fifth grade of Elementary School of a School of application from USP, associated to the Math Club, in the form of a didactic experiment.

In this experiment, the SDA, materialized in this game, was organized as one of the teaching activities developed and analyzed in the Math Club as a

learning space. The Pick-up Sticks game followed its original rules, only the score was changed. The focus was on the records made by the students in each move.

In the experience with the game, the researcher emphasizes that it is:

> [..] a moment of interaction with students, in which the teacher's mediation aims to demonstrate the importance of making records, of establishing the relationships involved in the activity developed with the Pick-up Sticks game. In the teacher's interaction, we evidence the attempt to provide autonomy to children through the development of a critical context. It occurs when the teacher makes it clear to the children that each one must register independently. (CEDRO, 2004, p. 106, our translation).

We highlight here one of the characteristics that underlie the concept of AOE: the mediation between the teaching activity and the learning activity. Cedro (2004) emphasizes that "After this moment of interaction between teacher and students, we noticed in the records the positive influence of the teacher's mediation" (p. 107, our translation). Through these records, the author found the multiplicative idea when recording the points obtained in the match, reaching the goal by working with the game.

## Illustrating situations that emerge from everyday life as SDA

Followed by illustrations involving virtual stories and games, two situations that emerge from everyday life are presented below, in order to illustrate its movement as SDA. In this scenario, the SDA entitled Measurement Problems and Trip to Mata are presented and discussed.

Costa (2016) presents a measurement problem in the form of situations emerging from daily school life, presented by a teacher participating in the research, and which is described below:

> The physical education teacher needs to know their size in ascending order and their height, to do some activities that need them to be in ascending order, boys and girls. How can

> we define who is in front, who will be last, and who will be in the middle? (COSTA, 2016, p. 122, our translation).

The author points out that, as it configures itself as a real situation for the children, the objective of everyday situations, they got into activity to seek a solution to this problem. This SDA "[...] awakened in students the need to appropriate the *concept of measuring length*, yet primarily in an elementary way, by measuring their own height" (COSTA, 2016, p. 122, our translation). With the emergence of the first doubts and solutions, and the operationalization of this and the next actions, the author states that the approximation of the appropriation of the concept was occurring gradually.

The second situation that emerged from everyday life illustrated in this text is in Silva's dissertation (2014). The theme for the situation arose from a proposal for an annual trip with students from the fifth grade of elementary school. Mata is a city, close to Santa Maria, in Rio Grande do Sul, considered a tourist spot in the region. The starting point for triggering the teaching actions was to investigate how many of the children at the school already knew the city of Mata. Then, studies were carried out about the region and they sought to provide answers to the following triggering problem: "How can we organize the data we collect so that we can understand and disseminate the information contained in our research more quickly?" (SILVA, 2014, p. 65, our translation).

Facing the triggering problem, statistical knowledge was mobilized as they needed to select the best strategies to organize and present the data, arising from the reality of the emerging theme.

## Conclusion

Considering the intention initially presented to contribute to the appropriation of the concept of Teaching Guiding Activity in research and to overcome possible weaknesses in the elaboration of teaching situations based on this concept, we took as reference the research involving

teaching and the training of teachers who teach mathematics in the light of the AOE principles.

From this perspective, we sought to highlight the general way in which these SDA are presented both in teaching processes in Basic Education and in teacher education processes, highlighting the movement of historical synthesis of the concept and collective synthesis.

Understanding the triggering problem in the development of learning triggering situations for the learning of a concept and the form of action in the teaching situation involving the community figure as central aspects in the movement of SDA involving games, virtual stories, and situations emerging from everyday life, present in the papers.

In the analyzed papers, it was noticed that the experience with situations that trigger learning in the formative processes contributed to the process of meaning of the learning actions for the subjects' mathematics teaching activity. The collective actions developed during the process, as well as the role of mediation, the study of the essence of mathematical concepts, and how these concepts relate to teaching create conditions for the appropriation of these subjects' theoretical thinking through the articulation between the AOE and the mathematical concepts, causing this form of organization of the mathematics teaching activity to be triggered.

The illustrations of SDA in some papers sought to show the general way of formation and organization of teaching in line with the AOE presuppositions. They intend to explain a movement that seeks to overcome the simple proposition of games or the mere telling of excerpts from the history of mathematics as a path to teaching and that often do not trigger learning, that is, they do not allow for the dialectical unity between teaching and learning.

In this sense, they do not exhaust the possibilities of teaching organization, but rather, they seek to highlight some aspects highlighted here in a movement of provisional synthesis of the present study: the need

to recognize the triggering problem in the SDA; the characteristics of the triggering problem that make it possible to bring the subjects closer to the historical movement of the mathematical concept; the SDA dynamic that favors the sharing and collective synthesis of the movement of conceptual appropriation by the subjects.

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