ARTICLE

Mathematical modeling, mediator-guiding teacher, and constructivism:
discursive interlacements in the constitution of the teaching figure

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ABSTRACT

The purpose of this article is to discuss the few conditions that made it possible for the emergence of the statement "*the teacher, while developing Modeling activities, is no longer the transmitter but a mediator-mentor in the process of teaching*" in the field of Mathematical Modeling from the perspective of Mathematical Education. We make use of the concepts, discourse, enunciate and statement from Michel Foucault's line of thought. The analytical material from which the aforementioned enunciate emerged encompasses theses and dissertations defended in the period between 1987 and 2016, which report, describe, or discuss the development of Modeling activities in the classroom of basic education. The analysis made it evident that the constructivist discourse did not consist only of a possibility for the emergence of the statement mediator-teacher, but also of the crystallization of this teaching representation as a pedagogic truth in the field of Mathematical Modeling.

KEYWORDS

mathematical modeling; teaching of mathematics; mediator-mentor teacher; constructivism; discourse; statement.

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MODELAGEM MATEMÁTICA, PROFESSOR MEDIADOR-ORIENTADOR E CONSTRUTIVISMO: ENTRELAÇAMENTOS DISCURSIVOS NA CONSTITUIÇÃO DA FIGURA DOCENTE

RESUMO

O objetivo deste artigo é discutir sobre algumas condições que possibilitaram a emergência do enunciado "*o professor, ao desenvolver atividades de Modelagem, deixa de ser transmissor e passa a ser um mediador–orientador no processo de ensino*" no campo da Modelagem Matemática na perspectiva da Educação Matemática. Utilizamos, como base teórico-metodológica, os conceitos de discurso, de enunciação e de enunciado advindos do pensamento de Michel Foucault. O material analítico do qual emergiu o enunciado citado abrange teses e dissertações defendidas no período de 1987 a 2016, as quais relatam, descrevem ou problematizam o desenvolvimento de atividades de Modelagem em sala de aula na educação básica. As análises evidenciaram que o discurso construtivista se consistiu não apenas em campo de possibilidade para a emergência do enunciado professor-mediador, mas também na cristalização dessa representação docente como uma verdade pedagógica no campo da Modelagem Matemática.

PALAVRAS-CHAVE

modelagem matemática; ensino de matemática; professor mediador-orientador; construtivismo; discurso; enunciado.

MODELADO MATEMÁTICO, PROFESOR MEDIADOR-TUTOR Y CONSTRUCTIVISMO: ENTRELAZAMIENTOS DISCURSIVOS EN LA CONSTITUCIÓN DE LA FIGURA DOCENTE

RESUMEN

El propósito de este artículo es discutir algunas condiciones que hicieron posible el surgimiento del enunciado "*el docente, al desarrollar actividades de Modelado, deja de ser transmisor y se convierte en mediador–tutor en el proceso de enseñanza*" en el campo del Modelado Matemático desde la perspectiva de la Educación Matemática. Utilizamos, como base teórico-metodológica, los conceptos de discurso, enunciación y enunciado que surgen del pensamiento de Michel Foucault. El material analítico del que surgió el referido enunciado abarca las tesis y disertaciones defendidas en el período de 1987 a 2016, que informan, describen o problematizan el desarrollo de las actividades de Modelización en el aula de educación básica. Los análisis mostraron que el discurso constructivista fue no solo un campo de posibilidad para el surgimiento del enunciado profesor mediador-tutor, sino también la cristalización de esta representación docente como una verdad pedagógica en el campo del Modelado Matemático.

PALABRAS CLAVE

modelo matemático; enseñanza de las matemáticas; profesor mediador-tutor; constructivismo; discurso; enunciado.

INTRODUCTION

Modeling[1] has gained its space in Mathematical Education, becoming not only a teaching tool in the teaching-learning process of Mathematics, but also as a research field. In this process of "appearance" and consolidation, the figure of the teacher and the aspects and specificities of the students' world have become essential elements both for the development and application of the classroom activities and for the research field. This means that these elements play a relevant role as objects of study in academic literature, which organizes and characterizes, discursively, the roles of the teacher, the students, and even the importance and need to include elements that are beyond the walls of the school in the teaching-learning process, integrating them to the community and the realities experienced by the teacher and the student.

Then, Modeling became structured by putting in practice a discourse that encourages discussions about the critical construction of the student, closer to their reality and experiences; discussions, therefore, that "make sense", aiming at a reflection towards action, in which mathematics, through Modeling, becomes a tool to understand the world. Also, it encourages possibilities of rupture with the hierarchization of the teacher-student relationship, with the establishment of a dialogic and equitable environment, in which the teacher plays a very specific role so that this rupture is possible: the one of mediator-advisor.

When considering that, we put ourselves in motion to discuss the processes of organization and constitution of the objects that compose Modeling, be it the teacher, the student, the reality, or the mediation, thus questioning how and why these objects have become essential to the formation, consolidation, and circulation of a pedagogical truth. Also, to think about up to which point, as researchers and educators immersed *in* and *for* the Modeling discourse, we produce and contribute with processes of objectivation, both teacher or student-related, because: perhaps by validating that discourse, which aims at interrupting a traditional pedagogical discourse[2] on behalf of a more contextualized mathematical teaching, aren't we also authenticating and selecting a hegemonic discourse?

The need to understand this process is based on the fact that the role of mediation-advisement is, discursively, specific and well-established by Modeling, and we do not question about why there is a need, an emergency and a consolidation of this representation, and not the other. Thinking about the processes of the constitution of the teacher is important, since it is by understanding such processes, we can reflect about how the teacher is crossed by the discourses, about how much the speech subjectifies us and about Modeling itself.

Therefore, we work with the problematics: how did the need for the practice of mediation-advisement start? How did this representation become so essential

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1   Throughout the paper, we chose to use the word Modeling to refer to Mathematical Modeling from the perspective of Mathematical Education.
2   We consider a traditional pedagogical discourse the one in which the knowledge is prioritized to the detriment of the student's reality.

for Modeling itself? We understand that, to think about the teacher in the context of Modeling, it would be important to understand the process of constitution of the mediation-advisement practice in the scope of Modeling, which operated to constitute a teacher representation: the mediator-advisor teacher.

Thinking about this problematic can also help us in other areas that comprehend the specificities of the teaching profession; or even think about the processes of implementation and development of Modeling, extending to processes of teacher formation.

Therefore, our objective[3] is to investigate which processes enabled the constitution and the consolidation of the teacher representation as mediator-advisor in the scope of Modeling. In other words, our goal is to investigate discursive and epistemological facts that facilitated the possibility for the emergence of the statement "*the teacher, when developing Modeling activities, is no longer a transmitter, but instead a mediator-advisor in the teaching process*" in Modeling. Based on this statement, we will investigate the discursive relations between Modeling, constructivism, and the teacher representation.

In this sense, by analyzing the speech, more precisely through the theorizations of Michel Foucault, we aimed at proving, based on the previously mentioned statement, how the constructivist discourse operated in the process of constitution of the mediation-advisement practice in the field of Modeling. That is, we tried to show how the constructivist discourse operated for the constitution of a teacher representation in the field of Modeling, which incorporated, throughout its own process of constitution, constructivist discursive elements.

We emphasize that the aim is not to discuss the development of Modeling activities in the classroom in elementary school according to the assumptions of constructivism; we go in the opposite direction: to discuss how, discursively, the assumptions of constructivism influenced the emergence not only of Modeling, but mainly of the mediation practice.

THE CORPUS, THE ENUNCIATIONS AND THE STATEMENT: THE THEORETICAL-METHODOLOGICAL BASIS

THE CORPUS

Brazilian theses and dissertations elaborated from 1976 to 2016 compose the corpus of this study. Such productions are focused on research that describes or discusses the development and application of Modeling activities in the elementary school classroom. The initial approach was stipulated based on Silveira (2007), who states that the year of 1976 presents the first record of the pioneer academic production about Modeling from the perspective of Mathematical Education; 2016

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3 This study is structured based on a piece of the doctoral thesis of the first author, performed under the orientation of the second, in the Postgraduate Program in Education at Universidade Federal de São Carlos (UFSCar).

is the year when we started our research. The composition of the corpus included 6 theses, 37 academic masters dissertations, and 62 professional masters dissertations.

MAPPING THE TITLE

The investigation of this study is based on the statement "*the teacher, when developing Modeling activities, is no longer a transmitter, but instead a mediator–advisor in the teaching process*", since this is the statement that provides visibility and encourages, in the scope of Modeling and Education, the idea of the teacher representation as a mediator-advisor. Thus, we describe the processes that led us to mapping this statement so that we can further analyze it, articulating it to the constructivist discourse.

Therefore, to compose our theoretical-methodological bases, we established strategies and specific procedures capable of providing a planned and organized path, based on the theorization by Michel Foucault, as well as on the analysis of the discourse.

So, we begin the methodological process by exploring the material starting with the *statement analysis*, more specifically, based on the concept of monumental reading (Veiga-Neto, 2014), in which the corpus of analysis is taken as a monument, and not as a document. From this perspective, history plays a methodological role, which means working the document-monument "[…] in its interior and to elaborate it." (Foucault, 2008, p. 7, our translation), establishing, through the set of documents themselves, their own units of relations, and not "[…] to interpret it, not to determine whether or not it tells the truth nor its expressive value." (Foucault, 2008, p. 7, our translation). Therefore, the undertaken analysis, through monumental reading, was carried out based on what was manifested and visualized in the documents-monuments — the theses and the dissertations —, making room for the idea that the discourse — regarding the teacher in Modeling — is discontinuous: from the time of its emergence, it is susceptible to being interrupted, changed and reorganized.

From the monumental reading of the corpus, we begin to *examine the statements*, which refer to the voices of the authors who produced the academic papers and who will tell, in a particular and individual manner, *who* the teacher in Modeling is. In order to be understood, these voices need to be inserted in a specific historical and social time; still, the way in which each text builds its speech is unique, and not reproduceable (Foucault, 2008). That is, each scientific record has its individuality by saying *who* the teacher is and *how he should be* when doing Modeling, so that the way each text builds its speech is unique, and not reproduceable. Therefore, the goal of the examination of statements is to understand everything that is *said* about the teacher who does Modeling: how he or she is perceived, seen, characterized, delimited, wanted, that is, to understand and perceive elements that represent the figure of the teacher.

After the examination, we begin the process of *structuring the statements*, which showed discursive recurrences about the role of the teacher, that is, "lines" that were recurrent and provided visibility to a change of posture of the teachers who develop Modeling.

Therefore, through these discursive regularities, it was possible to give visibility to the statement: "*the teacher, when developing Modeling activities, is no longer a transmitter, but instead a mediator-advisor in the teaching process*". The discursive regularities are in the dimension of what is said, and it is through the understanding of the rules that conduct the formation of Modeling itself as a discourse that we seek, amid the dispersion of this speech, to give visibility to the statement.

The statement then characterizes itself as a methodological tool, which is presented as an elementary unit of the discourse and is constituted by a set of statements that are immerse in a network of relations with other elements that are like it.

So, to examine the constructivist educational discourse to understand the emergence of the statement of the mediator-advisor teacher is to treat it "[…] as a practice that determines the historicity of the statements; so, writing it as a unit of this discourse." (Silva, 2004, p. 162, our translation) becomes so significant to think about the constituted knowledges in a specific period of time — such knowledges that will constitute the teacher representation in Modeling.

Besides, what characterizes a statement is its enunciative function, which gives it elements that will provide the possibility of visibility and circulation, once it enables the statement to be "[…] produced by a subject, in an institutional place determined by social and historical rules that define and enable it to be enunciated." (Gregolin, 2004, p. 26, our translation). This enunciative function, therefore, acts as the gear that regulates the relationship of dependence between practice and discourse, since the statement is the concreteness of the discourse.

Foucault (2008) shows us that analyzing statements does not mean submitting them to a founding instance, nor thinking about them as an organic, autonomous totality, closed in itself and susceptible to — alone — constituting a sense, but instead analyzing them as elements in a field of coexistence and correlations, exclusions.

Based on this conceptual tool, we examine the educational constructivist discourse in order to "[…] diagnose techniques, processes, strengths that move history, build discourses and constitute subjects." (Sargentini, 2004, p. 94, our translation) and that operated for the emergence of the statement about the mediator-advisor teacher, leading him to a position that is only his in the discourse of Modeling, exposing a discussion about the conditions of possibilities of the appearance of what was said, written, manifested and re-updated.

THE NEW SCHOOL AND CONSTRUCTIVISM: DISCURSIVE INTERLACING FOR THE CONSTITUTION OF A NEW PEDAGOGY

The pedagogical discourse, especially that of John Dewey, in the 20th century, marked a movement of questionings about the pedagogical practices that, up until then, structured the educational system; it brought up another way to understand and make education, materializing pedagogical practices that reconfigured old pedagogical habits, enabling the onset of an experimental pedagogy.

The pedagogical discourse of the philosopher-educator has shown us that the school reached the position of a central institution in society, opening up to

the world and considering the child as an essential part of educational practices, beginning to recognize and consider the children's needs and capacities, as well as the processes that involve experimentation. This discourse meets a *desire* for improvements and efficiency in the school dynamics, that is, a *need for renovation*, announcing the news. However, we understand, based on Santos (2006, p. 136, our translation), that:

> [...] it is not about [...] questioning whether or not there was an old school and a new school, but instead of declaring that both mostly appeared thanks to a series of statements that express the characteristics of archaic, traditional, inadequate […] that apply a disqualification to the School and, on the other hand, express the need or the will to operate transformations in the School and in school practices. With this discourse *for* a new school, I refer to a varied range of statements that form themselves from the early 20th century, starting with the problematization of school educational practices. […] these statements are not unison nor organic […], but, instead, active voices of different tones, spread through the most diverse fields of knowledge and active varied practices and educational practices.

In this sense, the discourse for a new school states, among other ideals, the concern with childhood, thus giving visibility to the active role of the child in educational processes, as well as the valorization of the practice in the teaching process.

Foucault (2008) showed us that, in history, the facts are not given, ready or concluded; they are not real in themselves; on the contrary, they are produced based on a strength dispute of interests that fight to impose themselves as legitimate and real in a specific discourse. Based on that, we understand that both the Deweyan pedagogical discourse and the discourse for a new school are products of a dispute for the hegemony of an educational discourse: that wishes to impose itself as real, legitimate and that emerges based on a discursive plot that involves the economic, political, cultural, and social fields, which characterize the end of the 19th century and the beginning of the 20th century.

This means that, when we go through the historical narrative of Brazilian education in the early 20th century, it is possible to find discursive diversity, with different and diffuse statements that constitute the Brazilian educational field and that were organized with different political and cultural, and especially pedagogical opinions, influenced by different theoretical bases. So, "[…] the hegemonical discourse of educational historiography […] did not recognize important projects that were developed in the beginning of the century, making them invisible to history." (César, 2004, p. 68, our translation). In this strength dispute for a new school, the Deweyan pedagogical discourse and the defense of a new school gain visibility, which are embraced and recognized by Brazilian educators, who despite accepting some divergent characteristics, converged to a will of reforming educational practices.

Therefore, facing the new social and economic organization that was presented in the early 20th century, in the 1920s and 1930s a pedagogical project was

organized and wished to impose a model of unified educational practices, that is, "[…] a single pedagogical project for the entire national State, the New School pedagogy." (César, 2004, p. 63, our translation).

Therefore, a discourse is installed that brings about a feeling of *need for change*: the modernization and democratization of society and an education aligned with the social development of the 20th century. This then means not only revising the role of the school, but mainly the ways through which the school institution worked.

So, the emergence of the debate about Brazilian education is generated and materialized in the New School movement, which suspends the "old" current pedagogical practices. Even though the school remains with the ideal of being the main alternative to solve the problems of society, it will now work with different dynamics.

The changes in school will be based on Biology and Psychology; the new pedagogical practices will address childhood, which will be seen as a "[…] pre-intellectual age, in which the cognitive processes are closely interlaced with action and dynamism, not only motor, but also psychic, of the child, […] which never tends to separate knowledge from action." (Cambi, 1999, p. 514-515, our translation). The discourse of the valuation of childhood and the child finds, in the 19th century, "[…] both by philosophical-social inspiration and due to advances in Psychophysics and Psychobiology." (Silva, 1989, p. 7, our translation), a possibility to circulate, once it allows the production of new processes of childhood representation.

There is a discursive production of the valuation of theories that address children, specifically: there is a production movement of a scientific discourse that handles the processes of growth and maturity of the child; that discusses the systems through which the children develop, learn, organize themselves and acquire knowledge.

A discourse is created and moves towards a speech in which pedagogical practices are aligned with the scientific discourse of psychology, that is, pedagogy must be a result of an alignment between the field of education and the field of psychology.

In this sense, Cunha (1996) argues that Dewey, when proposing a way of education based on experimental pedagogy, points to a "solution" for the problems found in the practice of traditional pedagogy. But, on the other hand, the author (*idem*, p. 8, our translation) emphasizes that Dewey also leaves a problem for Psychology, considering that

> [...] the teaching process should be able to take the elaborated contents to a logical level, which characterizes the thought of the adult, and adjust them to the cognitive capacity of the children at different ages. This task requires a theory capable of explaining how the thinking process develops itself.

This gap left by Dewey, interlaced with the ideals produced by the New School movement, is constituted by a field of possibility for a movement that shifts the methodological practices to the psychology field, configuring a discursive interlacement between Pedagogy and Psychology. The New School movement, therefore,

enables Psychology to scientifically organize the pedagogical knowledges, making it an essential knowledge for the student. According to Vasconcelos (1996, p. 16, our translation) and Carneiro (2009, p. 7, our translation), respectively:

> Even though traditional methods have not fully neglected the children's development, with the new methodology childhood psychology became used in a large scale as a subsidy for pedagogical practices. The idea was to build a pedagogy that used the new scientific knowledge acquired by an experimental-based psychology. The great advance of psychology in the 20th century was, undoubtedly, a basic condition for the development of new methods.

> With the New School movement in Brazil, coming from European and North American centers, Psychology became a crucial science to subsidize the school transformations and the new conception of current Education in the country, providing its theoretical and technical devices […]. Besides, Psychology would also work to instrumentalize Pedagogy, so that it could also become a scientific Pedagogy.

The previous excerpts show us that psychology earned a "place" in terms of educational discourse, and, besides, constituted itself in such conditions that the so wanted — and needed — changes could be reached by the New School movement. The educational discourse is configured to give the scientific-psychological discourse a status of credibility, which authorizes, organizes, and institutes the new pedagogical practices. Therefore, the new conception of childhood is imposed as a fundamental knowledge through which the psychological and pedagogical discourses are interconnected.

With that in mind, the members of the movement for the introduction of the New School in the Brazilian scenario not only used the psychological discourse, but also that of the "[…] Deweyan pragmatism to configure […] a concept of democracy and education that could work as a base for their political and pedagogical projects, giving them some legitimacy inside the political and educational debate at the time." (Ribeiro, 2004, p. 171, our translation).

The ideals of the New School movement were, little by little, being incorporated to the discourse of Brazilian educators, who understand that a renewal in the educational processes was necessary, thus allowing a "[…] proper social orientation to the modern demands of the 20th century […], taking on the psychopedagogical aspect resulting from a new conception of childhood: […] an active child, allied to a pedagogical conception of an active school." (Vasconcelos, 1996, p. 27, our translation).

So, the wish for changes was materialized in education reforms: these occurred throughout the country; and even taking on different characteristics, they represented the strong embracement of the discourse for a new school. Therefore, the ideals of the New School activated practices that reconfigured the education scenario, requiring new educational principles, as well as new concepts about teaching, thus repositioning the student and the teacher in this process.

The New School principles are mainly based on the development of the students, on whom the planning of the education process is focused, so the educators play a secondary role. The processes of research are valued through problem-solving activities, in which the students are encouraged to be active, learning how to learn. In this process, the teacher plays a much more "liberal" role, making room for the students, giving them the freedom so that they can, for themselves, actively and independently, go through the teaching and learning process. Much is said about pedagogical practices and methods no longer addressed to the teacher, but instead to the student, and about the respect to the development stages.

This new scientific organization of pedagogical knowledges is based on the theories formulated by Jean Piaget, in the scope of Psychology. Based on that, the new methodological routes that guide the education practices will put down roots in Brazil, operating towards the production of a new pedagogical discourse: constructivism. According to Rossler (2005, p. 7, our translation) and Duarte (2010, p. 39, our translation), there are, respectively:

> In a first approach, and also temporarily, we could define constructivism as a set of different theoretical aspects that, despite an apparent heterogeneity or diversity of focuses inside its line of thought, have as their basic reference core the genetic epistemology of Jean Piaget, around which some characteristics that define the identity of the constructivist ideology as a philosophical, psychological and education ideology are aggregated, thus sharing the same set of assumptions, concepts and theoretical principles.

> The core reference of constructivism is the genetic epistemology of Jean Piaget […]. From the pedagogical point of view, this means that the activities with higher educational value are those that promote this spontaneous process of thought development.

Foucault (2008) showed us that searching the origins, the essence of the facts narrated by history is somehow the same as "fantasizing" about those facts, as if the origin of things were an untouchable place; the place of a pure and absolute truth, which represents the beginning of it all, the identity of things, their value. What we can see from the statements is exactly the search for the place of origin of constructivism, for its identity. In reality, the statements represent the space of production of the constructive discourse, which is associated and refers to Piagetian theories of thinking. Jean Piaget is certainly the discursive space towards which most educators and researchers usually "[…] refers everything or almost everything that tends to stay under the aegis of this term." (Revah, 2004, p. 26, our translation).

However, from a Foucauldian perspective, the relevant fact in this process is the onset of the constructivist ideal as a pedagogical practice, since the important thing is having the clarity that the object — constructivism — could "[…] appear anywhere […], because the conditions of possibility for that were already in place." (César, 2004, p. 47, our translation), that is, the possibility that the pedagogical

practices could be scientifically organized by the knowledges of psychology and biology was already in place.

Then, in this sense, Piaget was one of the names that left a significant mark in the history of Brazilian education, especially regarding constructivism, while developing a theoretical work about the processes of childhood development, which entered the pedagogical discourse in Brazil through the doors of the New School.

In his work, *Genetic Epistemology*, Piaget (2002, p. 4, our translation) investigates the bases of knowledge aiming at showing that "[…] the specific problem of genetic epistemology is […] the development of knowledges, that is, the passage from a not so good knowledge, or more or less poor, to a richer one.". The concern is exactly in knowing how and which are the processes that allow the *passage* from one state to another that is more complex, reflecting on the ways used by individuals to *build* the knowledge.

For Piaget (2002, p. 8, our translation), knowledge is a continuous process that results from "[…] interactions that produce themselves amid subject and object, and that depend on both at the same time.", that is, it is a consequence of established interactions between the subject and the object, mediated by the action of the subject himself. In this sense, the Swiss warns us:

> Interest is nothing, in effect, if not the dynamic aspect of assimilation. As deeply shown by Dewey, the true interest appears when the "I" identifies with an idea or an object, when it finds in them a mean of expression and they become a necessary fuel to its activity. When the active school requires that the students' effort should come from them, without being imposed, and that their intelligence, without receiving the already prepared knowledge from outside, simply requires that the laws of all intelligence be respected. (Piaget, 1970, p. 162, our translation)

> […] it is clear that the educator continues to be indispensable, as an encourager, to create the situations and prepare the initial devices that are able to generate problems that are useful for the children, and then organize against examples that lead to reflection and require the control of situations that are too hasty: the desire is that the teacher is no longer a lecturer, but someone who stimulates research and effort, instead of being satisfied with the transmission of solutions that are ready. (Piaget, 1978, p. 15, our translation)

The aforementioned excerpts show us that the nature of the knowledge is active. The knowledge is not ready, just waiting to be transmitted, acquired, or accepted by the individual; instead, the individual goes through a *process of development*, through *stages of development*, in which one changes and produces knowledge. *Actively*, the individual builds knowledge, once knowledges derive from action. This demonstrates a process of interaction between *subject and object*; between *subject and mean*, so that "[…] talking about construction of knowledge means talking, at the same time, about construction of the subject who knows and the object to be known, and both appear as a result of a permanent building process." (Sanchis and Mahfoud, 2007, p. 166).

In this sense, Piaget (1978, p. 10-11) refers to an epistemological direction of constructivist nature that, from the pedagogical point of view, enables "[…] to emphasize the activities that favor the spontaneity of the child, showing the importance of the active character in the process of search for knowledge.".

Therefore, based on these ideas, Piaget develops the bases of the constructivist theory, which dislocate to the educational field. This way of perceiving the subject-object-knowledge relationship has established an alignment between the Piagetian and New School theories of thinking in relation to the importance of changes in education and its principles.

MATHEMATICAL MODELING AND CONSTRUCTIVISM: DISCURSIVE RESONANCES IN THE CONSTITUTION OF THE MEDIATOR-ADVISOR TEACHER

The circulation of the Piagetian constructivist discourse, according to Vasconcelos (1996), could be felt in the 1960s and 1970s in Brazil, but still in a non-hegemonic and consolidated manner. After the 1980s, the constructivist discourse gained strength and visibility in the country, showing an "explosion" marked, according to Revah (2004, p. 24, our translation), not only by an extension of Piaget's ideas, but also "[…] by the studies and reflections developed by Emília Ferreiro […], which place constructivism in the present […], delimiting a type of natural place for constructivism.".

The theories and research by Emília Ferreiro place the constructivist discourse in the present, marking its hegemony in relation to the pedagogical discourse that circulates in the Brazilian scenario. In this process of consolidation, the discourse is re-updated, configuring a new space of production of the constructivist discourse, now named and organized as post-Piagetian.

This reconfiguration of the Piagetian discourse is characterized by a process of reorganization of a set of practices that articulate themselves, enabling and establishing the changes that marked and caused transformations in the Piagetian constructivist discourse. This means that is it not only about a continuity of ideas, of thoughts that, naturally, *evolve* and *discover* new things that aggregate and give a new face to the constructivist discourse; instead, it is about the installation of new rules of formation on which the post-Piagetian constructivist discourse is constituted.

The process of consolidation and expansion of constructivism is also characterized in a diffuse manner, once in the discourse there are "[…] several lines within constructivism itself, which mark "[…] existing differences and divergence between the constructivism authors themselves." (Duarte, 2010, p. 39, our translation). However, even with such a dispersion, the constructivist discourse has rules in its formation, which includes regularities that are inherent to and specific of the discourse itself, allowing us to find enunciative recurrences that constitute it. In these regularities, we can find statements such as the centrality of the student in the teaching process, the importance of the active-passive opposition in relation to the student, and the construction of knowledge by the subject, for example.

So, the constructivist discourse, from the moment of its emergence, is likely to be changed, and this discontinuity is what brings the excerpts and new orders, distinguishing what is still valid or not; and, again, it is now renamed as post-Piagetian, thus defining what learning and *its* mechanisms *are*, *its* methods, as well as the role of the student, the school, the administration, that is, defining other pedagogical truths.

With that in mind, the ideas of Emília Ferreiro will become a space of "consolidation" of the post-Piagetian constructivist discourse; and this will be strongly embraced in the 1980s in Brazil. In this process of establishing new educational practices through the post-Piagetian constructivist discourse, we can observe an important moment of rupture operated by Ferreiro's discourse: the authority of the method, which has always been a concern in the pedagogical discourse.[4] Then, the *how to teach* dislocates to the *how to learn* (Ferreiro and Teberosky, 1999): there is a rupture, because the method cannot create knowledge.

In the *Written Language Psychogenesis*, Ferreiro and Teberosky (1999) discuss about the psychogenetic levels through which students become readers and writers, emphasizing the importance of *understanding the ways through which children apprehends* — how to learn — the process of reading and writing through an interactionist and constructivist theoretical model. Starting with this constructivist model, Ferreiro and Teberosky (1999) argue about the need to develop another conception regarding what the writing is, being based on an epistemological reflection. This means understanding writing as a "[...] historical process of construction of a representation system, not a coding system." (Ferreiro, 2001, p. 12, our translation), in a sort of correspondence.

In this sense, the writing and reading learning processes, for Ferreiro and Teberosky (1999, p. 29, our translation), involve considering the children as subjects who already have knowledge about language, a subject that thinks. The authors state that "[…] the subject we know through Piaget's theory is the one who actively seeks to understand the world surrounding him and tries to solve the questions brought about by this world.".

Therefore, we observe Piagetian discursive resonances in the constructivist discourse about the literacy process, since "[…] obtaining knowledge is a result of the subject's activity itself; this means that the starting point of all learning is the subject himself." (Ferreiro and Teberosky, 1999, p. 32, our translation). Thus, the constructivist discourse makes room for a student who, instead of receiving knowledge produced by others, in that case, the teacher, configures oneself as a student who: basically, learns through their own actions

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4   The pedagogical discourse from the XVII, XVIII and XIX centuries, especially in the voices of Companhia de Jesus, Jan Amos Comênio, Wolfgang Ratke, and Juan Bautidta de La Salle, gave the method maximum authority in the teaching process, being the teacher a replicator of this method. With the thoughts of Jean Jacques Rousseau, there was room for the pedagogical discourse, announcing the importance of changing the positions of teacher and student in the teaching process, as well as the unquestionable authority of the method (Cambi, 2020).

about the objects of the world and builds their own categories of thinking, while organizing their world.

In this sense, it is important that children, during the literacy process, are in touch with elements from their reality, their routines; elements that bring about desires and curiosity, so that they can develop spontaneous actions regarding writing and reading. Let's see some excerpts referring the post-Piagetian discourse:

> Generally, in psychological pedagogy [constructivism] there are two basic premises: 1. About the student: learning happens through the action of the student about the objects; 2: About the teacher: has a mediating role, facilitating the learning process of the student: this person should be able to trigger problematic situations. (Miranda, 2005, p. 34, our translation)

> For constructivism, the learning process would be an individual construction of the subject [...]. Learning is located and should take place in realistic scenarios; the routine of the subject and the subject himself bring the necessary content so that the learning can occur. (Arce, 2005, p. 50, our translation)

> Constructivism was certainly the prevalent movement in education in general in the past decades. The idea is that knowledge is actively built by the student, and not only transmitted by the teacher, being passively apprehended. (Santos, Oliveira and Junqueira, 2014, p. 7, our translation)

Through the statements, we realize that the practices developed in the classroom are not in the center of the learning process, but instead involve the psychological and cognitive development of the child. Such learning is now understood based on a conceptual dimension, that is, to learn the representation system is to apprehend a new object of knowledge. Thus, the apprehension of this new object of knowledge will take place in the activity of the subject while interacting with the object of knowledge. Therefore, the post-Piagetian constructivist discourse reorganizes the teaching practices and imposes itself in a dominant manner in the educational field, being embraced, recognized and widely diffused in the pedagogical discourse.

With that in mind, let's observe some statements regarding the discursive field of Modeling:

> [...] Mathematical Modeling is learned through action, that is, by building mathematical models and dedicating efforts to improve these models. Acquiring confidence only by making their own models, as rough as they can be. (Burak, 1992, p. 61)

> Beforehand, we think the result of our (joint) experience was gratifying, because instead of providing the student with expression in its final form, we ended up crossing — together — the paths that led to it. (Spina, 2002, p. 24)

> The process of Mathematical Modeling favors the interaction of the individual with the environment in which he or she lives, since it is the project that allows

to explain, build, make decisions, understand, conjecture, represent, analyze the essence of reality, through the mathematical world. (Camilo, 2002, p. 53)

The activity contextualizes the content of proportionality as a linear function, with good examples, but we observe that the student does not participate in the construction of the concept; it is offered ready and concluded. In our proposal of didactic activity, the student plays an essential role, since he is the one who collects data to represent in the table, right after he builds the chart, and then he is encouraged to find the algebraic expression that models the problem. (Abegg, 2014, p. 24)

Statements give visibility to the resonance of the constructivist discourse in Modeling by showing the essence of the teacher giving opportunity for the student to understand how and why mathematics is processed, once this understanding allows the student to be alphabetized mathematically, that is, to build his mathematical knowledge.

Magnus (2018, p. 157, our translation) shows us, when writing the monument-history of Modeling, that, after the 1980s, there is a displacement, a transition of the expression *Models* to *Modeling*, which designates "[…] the process of obtaining a Modeling model. That is, to obtain a mathematical model, a process of construction called Modeling is used.". For the author, this displacement represents the discursive interlacement between Modeling and constructivism, so that learning is no longer understood as "[…] the copy of models, but as a *process of construction* that can lead to the model, displacing the sense of teaching based on models towards the process of building models." (Magnus, 2018, p. 159, our emphasis, our translation).

To our understanding, this interlacement pointed out by Magnus (2018) shows that the matter of the model building process, of building mathematical knowledge, leads to an epistemological question: what knowledge is and how we can reach it. We observe *strong discursive resonance of constructivism in the field of Modeling* when we look at the *importance of building mathematical knowledge* by the student in the teaching process, creating a discourse in which the knowledge is reached through action, practice, activity, construction, as a process. Now, knowledge is no longer contemplative, transcendental, but practical; it is the interaction with the mean, the action to reconstruct meanings, and no longer the reproduction of techniques and meaningless rules for the student.

For that, it is necessary to allow the student to recognize mathematics as his object of knowledge — investigation and reconstruction —; and the starting point for that is to consider the knowledges already possessed by the student in relation to mathematics based on his experiences, reality, routine, wishes, that is, on references that are part of the student's practical life, even in more basic situations. From this perspective, discursive resonances are also shown in the statements when the Modeling discourse refers *to the student and the teacher*.

The wish is for an active, spontaneous student, responsible for his teaching process: the student himself should manage his own learning process, which will

be stimulated by his own effort; such an effort is triggered by his interest. When managing his learning process, the student is put in control of the teaching process, stimulated by activities whose base is his interaction with the mean, with the teacher and with the other students. Therefore, the active character is materialized, for instance, by actions such as: participation in the classroom; research; questionings; skills of reflection, comparison, positioning oneself, debating, searching for solutions, so that what is considered as a need inside a classroom is also repositioned. Now, it is inevitable that the school environment be established based on practices that stimulate the spirit of freedom, autonomy, cooperation, partnership between student and teacher, so that the former be "[…] entirely active in the sense of a personal rediscovery of the truths to be achieved." (Piaget, 1970, p. 78, our translation), with room to guide oneself spontaneously and independently in the education process.

Considering that, characteristics such as collaboration, mediation and orientation become visible in the Modeling discourse in relation to the role of the teacher, producing a representation of the teacher as *cheering*, *encouraging*, *facilitating*, and *guiding*. In this discursive organization, the teacher takes on the position of mediating and articulating situations and moments that enable the students to develop all of their capacities and potentialities, always backed up by the singularities of the stages of psychological development of the student.

In reality, the psychopedagogical bases try to "[…] instrumentalize the teacher to fundament his practice and understand its importance in the classroom routine." (Macedo, 1988, p. 50, our translation). This instrumentalization matters, once the students are different individuals, with different cognitive structures, who recognize and structure the information in different ways, so that each one will have their own process of building the knowledge; and will conduct *his or her* interpretations and resignifications. Thus, the teacher can organize and plan, in a more precise manner, the learning environment, in which mathematics works as a support and a tool for reflection to build models, encouraging the development of a constructive, active, and spontaneous participating student for his own knowledge.

The classroom organizes itself based on a specific teaching practice — mediation —, which gives visibility to the role of the teacher as a "[…] *set of activities* that promote cognitive development […], *the teacher is responsible for presenting challenging situation*s that allow the student to perceive the imbalance there is between him and the content of the school classes." (Cunha, [2008], p. 7, our emphasis, our translation).

Therefore, the teacher, together with the child, becomes central in the teaching process in the sense of being as active, interested and motivated as the student, to "[…] create educational strategies in which the student can be placed in the center of the process together with the teacher." (Silva, 2017, p. 27, our translation) in an interactive and collaborative manner.

From this perspective, the learning of mathematics through Modeling is understood from a dimension of construction of knowledge, because we consider "[…] both its dimension as a product and its dimension as a process, that is, the path through which the students personally elaborate the knowledge." (Mauri, 2004, p. 88, our translation).

We understand that the *discursive resonances of constructivism in Modeling operate for the idea that a change in posture is necessary* for the teacher who develops Modeling, creating possibilities for the emergence of the statement "*the teacher, when developing Modeling activities, is no longer a transmitter, but instead a mediator-advisor in the teaching process*".

Magnus (2018) showed us that Modeling emerges from an explosion of forces created by the existence of a crisis in Mathematical teaching in the period from the 1970s to the 1990s. For the author, this crisis is constituted from the statements "*the students have difficulty to learn Mathematics*" and "*Mathematics is distant from reality*", which worked as a justification for the Modeling activities, which appear as a possibility to attenuate the crisis, that is, "[…] to soften the difficulty in learning Mathematics, and also to show its use from its connection with reality." (*ibidem*, p. 113, our translation).

Therefore, we understand that it is the constructivist discourse that operates the transmitter-mediator displacement, and whereas Modeling, as a pedagogical solution for a system in crisis, is interlaced with constructivist ideals, it incorporates them, re-signifies them and reorganizes them during its own constitution, then operating towards the consolidation of this teacher representation: it contributes with a process of "erasing" the representation of transmission and conserving that of mediation-orientation.

So, the statement "*the teacher, when developing Modeling activities, is no longer a transmitter, but instead a mediator-advisor in the teaching process*", which composes the Modeling discourse, marks the passage from a discursive practice of transmitting the knowledge to a discursive practice that questions, problematizes and breaks this view, marking a space of dispersion and discontinuity.

The statements effectively written in theses and dissertations name, select and describe a new object — the mediator-advisor teacher —, operating towards a new discursive construction. There is, therefore, a re-signification of the teacher through new discursive practices, which emerge from the new requirement of mediating-advising.

It is possible, since the mediator-advisor teacher statement works as a way of reorganizing past statements that are present in consolidated discourses, in a sort of set of things that have been said. The teacher representation is "[…] built based on a memory that emerges in specific moments, always remembering that in each emergence there is the production of a new meaning." (Navarro-Barbosa, 2004, p. 97, our translation) for that representation, which is built in the bases of dispersion and discontinuity, as well as the discourse itself.

Therefore, any discursive sequence we consider can contain already stated information. There would be "[...] a process of re-updating the past in the discursive actions of the present." (Fischer, 2001, p. 220, our translation).

In this sense, we can infer that the statement "*the teacher, when developing Modeling activities, is no longer a transmitter, but instead a mediator-advisor in the teaching process*" lies on a set of things that have been said of a pedagogical discourse that has been claiming for its hegemony and consolidation — since

the principles and ideals of Dewey until constructivism — and that preceded the Modeling discourse.

This process is configured according to the functioning mechanisms of the discourses since there are "[…] statements and relations that the discourse itself puts in motion." (Fischer, 2001, p. 198, our translation). It is a process of relation of strengths and interests that operate for the permanence, erasing or the re-signification of a discourse.

With that in mind, we understand that the mediation-advisement element, which characterizes and defines the teacher who does Modeling, is backed up by the idea of building knowledge, the process of interaction and the action between the subject and the object of knowledge, so that mediating-advising is to create possibilities that stimulate the construction of knowledge. So, *mediating-advising is to construct interventions*, which can be of different natures. In the case of the teacher who develops Modeling, intervention can be understood as Modeling itself, since it is the process through which the teacher organizes its action; plans; establishes the goals and steps of learning; and organizes the "context" to enable the student to see mathematics as a knowledge to be built, rebuilt and re-signified.

FINAL CONSIDERATIONS

From a discourse that inspired the desire for a new school, for a new conception of childhood and for a new perspective of the teaching process, came the image of the mediator-advisor teacher in the learning process for the construction of knowledge.

This emergence was based on the interlacement and the articulation of knowledges coming from Psychology, Biology, and Pedagogy, which are implied in the conditions that enabled the emergence of mediation-advisement associated to the figure of the teacher. These knowledges sustained and provided, as scientific knowledges, truths that fueled the constructivist discourse, leaving discursive resonances in the field of Mathematical Modeling.

This enabled the constructivist discourse to operate towards a conception of *production and construction of knowledge*, disseminating an idea not only about what knowledge is and how its production takes place, but disseminating and determining different aspects that include the whole teaching system, such as the curriculum and the formation of teachers, for example.

However, even though each one of these areas — Psychology, Biology, Pedagogy — has "[…] its way, its importance and its own discourse […], they can all be connected [by] the will of producing truths." (Santos, 2006, p. 28, our translation). Therefore, it is exactly in the space that opens, with the desire to produce truths, that comes the figure of the mediator-advisor teacher in Modeling, which is organized and defined as a pedagogical truth through *the desire and the need* for a teacher who is placed as a mediator-advisor of the teaching process, giving opportunities for the student to build his own knowledge.

We now ask: if mediation-advisement is perceived as the construction of interventions, how to be a teacher that builds interventions through Modeling?

Which are the expected knowledges for the teacher to become a builder of interventions? What are the mechanisms that trigger the practice of mediation-advisement in the scope of Modeling? Which strategies will be installed and will be serving the practice of mediation-advisement? With these questions, we continue in the exercise of thinking about Modeling.

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