



Didactic Sequences in Science and Mathematics Teaching in Brazil

Secuencias Docentes en Ciencias y Matemáticas en Brasil

As Sequências Didáticas no Ensino de Ciências e Matemática no Brasil

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ABSTRACT: *The objective is to analyze the academic works defended in Brazil between the years 2015 to 2019 in the area of concentration of Science and Mathematics that present as a subject of study a Didactic Sequence (SD) proposal. The present research is of a qualitative nature and is classified, from the point of view of its objectives, as descriptive-exploratory. To search for academic works on the Capes platform, the studies of Sampaio and Mancini (2007) were used as a methodological reference. Among the theoretical contributions referenced in the analyzed studies are: Zabala, Ausubel, Delizoicov, Pais and Carvalho. Of the SD structures apprehended, the ones developed based on the 3 pedagogical moments coined by Delizoicov from Freire stand out: problematization, organization of knowledge and application of knowledge. It is observed that problematization is a common item in SD structures. Those that are distinguished due to their particularities, and have as main objective to promote meaningful learning.*

LEARNING. SCIENCES. TEACHING. MATHEMATICS. DIDACTIC SEQUENCE.

RESUMO: *Tem-se como objetivo analisar os trabalhos acadêmicos defendidos no Brasil entre os anos de 2015 a 2019 na área de concentração de Ciência e Matemática que apresentam como objeto de estudo uma proposta de Sequência Didática (SD). A presente pesquisa é de natureza qualitativa e se classifica, do ponto de vista de seus objetivos, como descritiva-exploratória. Para a busca dos trabalhos acadêmicos da plataforma da Capes, usou-se como referencial metodológico os estudos de Sampaio e Mancini (2007). Entre os aportes teóricos referenciados nos trabalhos analisados constam: Zabala, Ausubel, Delizoicov, Pais e Carvalho. Das estruturas de SDs apreendidas destacam-se as desenvolvidas com base nos 3 momentos pedagógicos cunhados por Delizoicov a partir de Freire: problematização, organização do conhecimento e aplicação do conhecimento. Observa-se que a problematização é um item comum nas estruturas das SDs. Essas que se distinguem devido às suas particularidades, e possuem como principal objetivo promover a aprendizagem significativa.*

APRENDIZAGEM. CIÊNCIAS. ENSINO. MATEMÁTICA. SEQUÊNCIA DIDÁTICA.

RESUMEN: El objetivo es analizar los trabajos académicos defendidos en Brasil entre los años 2015 a 2019 en el área de concentración de Ciencias y Matemáticas que presentan como tema de estudio una propuesta de Secuencia Didáctica (SD). Esta investigación es de naturaleza cualitativa y se clasifica, desde el punto de vista de sus objetivos, como descriptiva-exploratoria. Para buscar trabajos académicos en la plataforma Capes, se utilizaron los estudios de Sampaio y Mancini (2007) como referencia metodológica. Entre las contribuciones teóricas a las que se hace referencia en los estudios analizados se encuentran: Zabala, Ausubel, Delizoicov, Pais y Carvalho. De las estructuras SD apreñendidas, se destacan las desarrolladas en base a los 3 momentos pedagógicos acuñados por Delizoicov de Freire: problematización, organización del conocimiento y aplicación del conocimiento. Se observa que la problematización es un elemento común en las estructuras SD. Los que se distinguen por sus particularidades y tienen como objetivo principal promover un aprendizaje significativo.

APRENDIZAJE. CIENCIAS. ENSEÑANDO. MATEMÁTICAS. SIGUIENDO LA ENSEÑANZA.

Introduction

In the learning and teaching process, many methodological approaches can be taken to ensure that the act of teaching reaches the goal to learn by who teaches and learns at the same time and, most of all, to those who learn even without teaching. The Didactic Sequence (DS) choice for this paper's making can be due to the perception that some educators, in studies about methodological approaches for teaching, use the DS term erratically, because they are actually studying lesson plans. However, it is understood that a lesson plan can contain features of a DS as far as the teacher/student/content/time/space relationship goes on the teaching practice.

The researches about teaching turned to Science and Math are increasing at the last two decades due to the creation of area 46, at the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes in Portuguese). As the implementation of programs at this area has been progressive, it is estimated that academic productions that are a result of graduate or post-graduate courses throughout the country focused many problems found at the school day to day, including the approach of a DS as a product and teaching methodology.

By this perspective, some questions were established: which are the definitions of DS presented by education researchers? The academic concept of DS is based on which Science and Math teaching authors? Which structures of DS can be found in academic studies developed in Brazil at the Science and Math teaching fields? The main objective is to analyze the studies focused on the Science and Math fields presented in Brazil between 2015 and 2019 which are about DS proposals. The specific objectives are: present some definitions about DS based on Science and Math researchers; to verify the theoretical bases about DS that are used on studies found at the Capes site; and learn the DS structures of some of them.

This research has a qualitative approach and is classified, by its objectives' point of view, as descriptive and exploratory. In order to search for academic studies at Capes (2020) platform, we used Sampaio and Mancini (2007) studies as methodological reference.

We present, in this paper, the methodological routes adopted at the research; some definitions given to the term DS, followed by the analysis of academic studies that have, as their focus, a proposal for didactic sequence, its theoretical approaches and the DS structures.

1 Methodological routes

By its nature and classification, this research aims to describe features of a certain population, with purpose to identify possible relations between the variables, thus getting close to the explanatory research (Gil, 2010). The paper was developed in two different phases. The first one consisted at the literature review about definitions attributed to the DS term by authors of the educational field which, in that sense, fulfilled the objective of: presenting some definitions of DS from the perspective of authors from Science and Math fields. The second phase consisted of consulting academic studies at Capes. At this phase, we sought to fulfill the other objectives that were proposed on the paper, as we explain below.

Following some of the methodological reviewing instructions suggested by Samapaio and Marconi (2007), we pursued, at Capes platform, a search for dissertations and thesis that presented a DS proposal as an object of study. The authors alert that before initiating a literature review, it is important to define objectives, to identify the literature and to select studies that can be included on it. To summarize, the literature reviewing process suggested by the authors follows the flow to set out the scientific question: to define the databases to be consulted along with the keywords e search strategies; to establish selection criteria for the consulted papers; to conduct the searches at databases; to apply the selection criteria and justify possible exclusions; to analyze the studies included on the review; to prepare an abstract synthesizing information and, as last, to present a conclusion.

In order to attend to the research objectives, the expression “sequência didática” (didactic sequence) in quotation marks was included on the database. Then, we downloaded the studies that were presented between 2015 and 2019, found after filtering the following features: year (2015, 2016, 2017, 2018, 2019); scientific field and concentration field (Science teaching and Math). To analyze the studies, we chose some that could represent both the Science and Math fields.

2 Some definitions attributed to Didactic Sequences

The didactic sequence appeared in France at the 1980s, starting to be approached in Brazil at the 1990s through implementation of the National Curricular Parameters (Parâmetros Curriculares Nacionais – PCN). Both in France and Brazil, DS was initiated in a teaching mother language context and only after this it was also used on other knowledge fields (Oliveira, 2013).

It is a consensus at the academy that the definition on DS, in Brazil, starts with the author Zabala (1998). Given that prerogative, other definitions about DS will be presented, even if they aren't approached with this name, defended by authors on Science and Math fields, such as: Delizoicov (2008), Carvalho *et al* (1995), Guimarães and Giordan (2011) and Pais (2015).

For Zabala (1998), the Didactic Sequence (DS) is “a set of ordained activities, structured and articulated to achieving certain educational objectives, which have principles and objectives known both by teachers and students” (Zabala, 1998, p. 18, our translation). It is understood by the author that didactic sequences must be considered as a way to situate activities, allowing identifications e preliminary characterizations in the way of teaching, fending the conceptions of DS just as some kind of task. The author reminds that arguing about educational practices is a way of:

[...] emphasize the instruments that allow us to introduce, at the different intervention ways, those activities that enables an improvement of our practicing in classes, as a result of a deep knowledge of the intervenient variables and the functions that each one of them has on the learning process of boys and girls [...] (Zabala, 1998, p.54, our translation).

Zabala (1998) mentions that the contents to be worked on at the teaching/learning process must involve, aside from the happenings (facts, events, situations, phenomena, to synthesize, conceptual contents), the procedural and attitudinal features. They can be directly related to the educational objectives proposed by Delors (2003), such as: learn to know, learn to do/to learn and learn to be/to coexist. For Zabala (1998), a Didactic Sequence may involve themes as: presentation of a problematic situations; intuitive answers or assumptions; sources and search for knowledge/solutions; preparations of conclusions/exposure of solutions; generalization, applications, exercising; test or exam, and evaluation.

In order to defend a constructivist conception of education, Zabala (1998) lists, as a job for the teacher at the teaching/learning process (no Processo de Ensino/Aprendizagem – PEA): to plan the DS in a flexible way, in order for it to be possible to suffer adaptations, according to the students' needs; to count on students' contributions and knowledges during the whole educational process; to help students find meaning on what they are doing; to establish goals within the students' reach; to offer adequate help; to promote a self-structuring way of thinking, in a way that the student can establish as many relationships to the content as he/she can; to establish an healthy environment and mutual respect relationships, based on trust, promoting self-esteem and self-evaluation; to promote channels of communication; to progressively potentialize the students' autonomy; and to evaluate in a fair way. The author also mentions that it is a job for the students to: make sense, with help from the teacher, for the taught content; follow the teaching/learning process, using it as a base for the teachers' contribution; evaluate his/hers own competence, with help from the teacher, if necessary; assume an active role, being a much of a protagonist at the teaching/learning process as the teacher.

It is observed that the proposition of a problematic situation and the search for its resolution is the starting point of the DS structures defended by Zabala. Besides, regarding the PEA, the author clears his comprehension about the relevance of students, teachers, management and school environment at the development of educational activities.

Delizoicov (2008, p. 58) uses the expression didactic-pedagogic dynamic to refer to a didactic proposal developed by him based on Freire's work. Believing that the students must know scientific knowledge in order to reinterpret situations, Delizoicov suggests a didactic-pedagogic dynamic for teachers in the field of Science based on three pedagogic moments (3MP): initial problematization, knowledge organization and knowledge application.

Regarding the moment of initial problematization, Delizoicov (2008, p. 55, our translation) states the following: "the starting point of this problematization is making the student feel the need to gain other knowledges that he/she still doesn't have, meaning that the goal is to make a discussion about the situation in order to create new knowledge". At this moment, a previously selected situation related to the theme must be presented in a way that, from it, the specific knowledge to be interpreted must be introduced. The teacher's job is to question, confront the student's interpretation.

Thus, at the knowledge organization, "[...] the selected knowledge in the process of thematic reduction, articulated with the initial problematization, are systematically studied in this moment about the teacher's orientation" (Delizoicov, 2008, p. 56, our translation). In this moment, there is the systematic study of the knowledge involved in the theme and the initial problematization. Many activities must be approached, in a way that the teacher can develop the concepts that consider essential for the student to comprehend the problematic situations listed at the didactic sequence. It is up to the teacher to mediate the relationship between the students and the scientific knowledge, in order to make them understand the problem and apprehend the knowledge.

In the moment of knowledge application, it is sought to "[...] enable the students so that they can use the knowledge, with perspective to educate them in order to articulate, constantly and routinely, the scientific concepts with real situations [...]". (Ibidem, our translation). Thus, the teacher's job consists in enable the students to apply the acquired knowledge at the classroom in real situations, be it linked to the

starting theme or not. The students must use the scientific knowledge explored in the knowledge organization, articulating them with situations that are part of their lives.

Although Delizoicov does not use the term DS, it is understood that the 3MP is a didactic proposition by which he suggests the organization of activities at the dynamic of the teaching/learning process.

Carvalho *et al.* (1995) use the term *elaborated-activities* to refer to activities that aim to provide conditions for reaching knowledge to the students. They defend that, in the Science and math teaching, the making of different activities must be accompanied by problems, problematic and questioning situations. They alert that the problem must be planned, to wake the students' interest to seek solutions, and that search must make the students use their acquired knowledge. They also understand that mistakes must be used by the teacher, in a way that the student absorb the knowledge. Because they publish many researches in the field, these authors are referenced in several studies that mention DS.

It is understood that the DS definition by Carvalho is based on the idea of several problem-based activities to be proposed to the students, as Delizoicov and Zabala postulate.

Guimarães and Giordan (2011, p.3, our translation) define the didactic sequence as an instrument that can “become an important mechanism in socializing knowledge in school, the school community and the community around the school”. Besides, an elaborate DS based on a social cultural perspective can be an option to minimize tensions between a decontextualized teaching. As the authors present a DS structure in Science teaching, they indicate topics to each one of them: title, audience, problematization, general and specific objectives, contents, dynamics, assessment, references and used literature.

The authors define the proposed topics for a DS as the following: the title cannot be underestimated, it has to be attractive; the audience specification is a factor that demonstrates that a DS cannot be universal; the general objectives must be reachable; the specific objectives are detailed organizers of the teaching intention; the contents must promote the continuity of several didactic unities; the dynamics are crucial to develop learning situations; the assessment must attend the DS' objectives and contests; the references are used during the classes; and the literature is the one that contributes to the DS' making (Guimaraães and Giordan, 2011, our translation).

When approaching teaching in the Math field, Pais (2015, our translation), indicates that:

A didactic situation is made by multiple pedagogic relationships, established between teacher, student and knowledge, with purpose to develop activities towards teaching and learning a specific content. These three elements of a didactic situation (teacher, student, knowledge) indicates the necessary step to see the classroom as a living room (ps¹. 969-970)

To him, a didactic sequence is “made by a certain number of planned classes, previously analyzed with purpose to observe learning situations, involving concepts that are predicted in the didactic research” (ps. 1529, our translation). The author understands that DS lessons are sessions, so they cannot be compared to regular classes. In this sense, the application of didactic sequences is presented by him as one of the phases of a didactic engineering², which he understands as research methodological orientation.

There are other authors in the Science and Math teaching field that present propositions of DS' based on the learning/teaching conceptions of Ausubel, as well as Freie, justifying, thus, their DS based on the theory elaborated by them.

¹ This terminology is used due to it being the way of locating the mentioned text in certain eBooks.

² These are the four fases of didactic engineering: “preliminar analysis, conception and *a priori* analysis, application of a didactic sequence and *a posteriori* analysis and assessment.

Ausubel is the author of the meaningful learning theory, which is based on the idea that, in the process of teaching, the teacher must be based on the knowledge previously acquired by the student (subsumption) to gain new knowledge. Therefore, to Ausubel, new information is based on sub-sumptions of the learner's cognitive structure. For the assimilation to happen, the acquisition process and the learning organization by the student, there must be a content that is potentially meaningful, making them express liveliness to relate to the material in a substantial, non-arbitrary way to his/hers cognitive structure. Based on conceptual knowledge, this approach depends more on the relations between the concepts than the number of concepts itself. Ausubel express the importance of planning what will be taught aiming to follow four main principles: progressive differentiation; integrative reconciliation; sequential organizations; and consolidation (Moreira, 2007).

Freire is frequently remembered by educators and researchers for being the idealist of a teaching proposal based on a problematizing conception of education, in which is possible to establish a dialogic relationship between teacher and student. Therefore, for him, dialogism is the essence of education (Freire, 1987).

This paper does not intend to issue any value about the correct definition of a DS. We intend to show different kinds of DS in a way that contributes to the comprehension of what we are studying. Thus, each concept has its perspective and theoretical/epistemological basis, which must be assessed when analyzing a DS.

3 Analysis of academic studies that present a DS proposal

In September 2000, in Capes, area 46 was created, containing Science and Math teaching fields. Although that creation was an incentive to researches in those fields, we understand that, before that time, researches from several fields of knowledge started to systematically study teaching at Science and Math. This action was reinforced in the 80s and 90s when teaching organizations like SBEM (Sociedade Brasileira de Educação Matemática), SBenBio (Sociedade Brasileira de Ensino de Biologia) and Abrapec (Associação Brasileira de Pesquisa em Educação em Ciências) were born (Nardi, 2015).

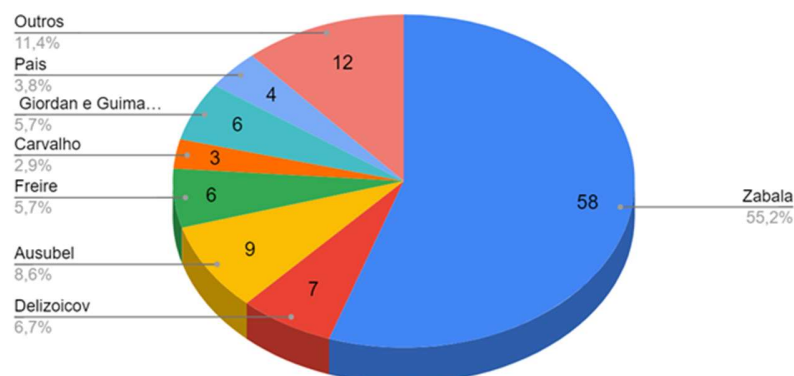
Aiming to analyze studies developed at Science and Math fields, a search for dissertations and thesis that involved developing a DS at Capes database was conducted. 3236 texts that referenced "sequência didática" (with quotations marks) were shown. When we applied the filters: year (2015, 2016, 2017, 2018, 2019); knowledge field and concentration field (fields of Science and Math teaching), the amount of studies went to 220, being that 149 of these had the study in archives and only 105 actually presented a Didactic Structure.

It is observed that, of the 105 analyzed studies, 75 are from the Science field, while 30 are from Math field. It is also noticeable that the majority (101) is a product of activities developed in professional master's degree programs, while four are activities developed in PhD programs.

We chose to present de DS structure of 10 studies, because we understood that they represent the basis of the other's DS.

3.1 Theoretical approaches used by authors in academic studies which aim to analyze Didactic Sequences

Based on data shown on the following graphic, it is noticeable that the Didactic Sequences present on academic studies were based on theoretical approaches of authors such as: Freire, Delizoicov, Zabala, Guimarães e Giordan, Carvalho, Pais and Ausubel, among others.



Graphic 1: Theoretical basis on DS used in academic studies at the fields of Science and Math teaching in Brazil, 2015-2020.
 SOUCE: made by the authors, 2020.

In the studies that use Zabala as theoretical basis, the definition of didactic sequence emphasizes the author’s proposition, that thinks DS as a “set of ordered activities, structured and articulated to accomplish certain educational goals, which have beginnings and endings known to both teacher and student” (Zabala, 1998, p. 18, our translation). According to the author, the Didactic Sequence must be understood as a criterion that allows identifications and preliminary characterization for the way of teaching, not being just some kind of task.

The 58 studies that present Zabala as theoretical basis are distributed as the following: 29,3% (17) studies in 2015, 13,8% (8) in 2016, 12,1% (7) in 2017, 13,8% (8) in 2018 and 31% (18) in 2019. Two of these (FAGUNDES, 2015; LIMA 2019) use Zabala in his theoretical reasoning, but the DS are bases on other authors. Lima (2019) uses the three Pedagogical Moments (3MP) developed by Delizoicov based on Freire. The author mentions that, along with students from the Young and Adult Education (EJA in Brazilian Portuguese) modality from the city of Jataí-GO, a DS, which aims to teach physics at EJA, was created, starting from a poll with the previous knowledge that the students had. The educational product of this study was a DS titled “Horário de Verão em Debate” (Lima, 2019, p.7)

Fagundes (2015) uses the pedagogical and methodological assumptions (dialog and problematization) approached mostly by Zabala, Berbel and Paulo Freire. In order to make this DS, the problematization methodology depicted by Berbel was adopted, and followed the phases of the “Arco de Magueréz³” (Magueréz’s arc, in a free translation): problem definition/reality observation, key topics, theorization, solution hypotheses and reality application (Fagundes, 2015).

The authors Castro (2019) and Carvalho (2016) combined Zabala’s theory (1998) with SEIs (Sequências de Ensino Investigativo, or Investigative Teaching Sequences, in a free translation) teaching methodology. SEIs have a teaching proposal based on investigation and are composed by the following phases: problematization, coming up with tests and hypothesis, group experimentation, written or drawn records of the main ideas, research and data socialization⁴.

³ The method proposed by Charlez Magueréz in 1966, known as the “Arc of Magueréz”, “proposes the observation of a reality/situation from different perspectives, which enable the student or teacher to student to verify the existing problems” (Fagundes, 2015, our translation).

⁴ This methodology is discussed at Science teaching field by Anna de Carvalho, who is also referenced at the study.

The other 54 studies followed Zabala's (1998) theoretical individualities regarding didactic sequence structure.

At the 6 studies that used Freire as theoretical basis, the author's inclusion to substantiate a didactic sequence as a pedagogic problematizing strategy is noticeable. Two of these studies – Moreira (2015) and Saugo (2016) – used or mixed theories from other authors when elaborating their DS. Moreira presented a DS based on Freire's (1996), Ausubel's (1996) and Zabala's (1980) theories and methods, with the theme "Sun, Earth and its living beings" (p. 15). The DS activities were planned to integrate students; to that end, the author used different strategies, culminating in the structure of the following activities: assessment of students' previous knowledge, introduction to the theme, exploration, learning assessment and learning reviewing (Moreira, 2015).

Saugo (2016) uses an investigative sequence based on Ponte, Brocado and Oliveira (2009). To them, to investigate is to seek to understand what isn't already known. By the mathematicians' point of view, to investigate is to discover relationships between known and unknown mathematical objects, seeking to identify their respective priorities. The mathematical investigation was elaborated from four different moments: "[...] situations acknowledgement, preliminary exploration and questions formulation; [...] formulation of conjectures (hypothesis); [...] execution of tests and conjecture refinement; [...] demonstration and discussion of the work that was done" (Saugo, 2016, p. 21, our translation).

At the seven studies that were based on Delizoicov, they mention the author as a follower of Freire's didactic strategy, emphasizing the relevance of effective theme problematizing that can be developed at the classroom, in a way that the theme involves and instigate the student, for him/her to make an effort on solving the problem, boosting the learning/teaching process. The didactic structure followed by Delizoicov is the methodological structure of three pedagogic moments: initial problematizing, knowledge organization and knowledge application.

Araujo (2018), based on Paulo Freire's pedagogy, elaborated, applied and analyzed a didactic sequence structured in Delizoicov's 3MP methodology. The DS was planned and developed aiming to discuss sexuality at a capixaba state school High School classroom, based on the students' previous knowledge, resulting in an educational product that conducted systematized activities to reach the planned objectives.

Ausubel's theory was used on 9 academic studies as theoretical support to defend an elaboration of didactic sequences, as happened in Maciel (2015). The authors present Ausubel in his theoretical pillars to remember his theory regarding to didactic actions under the influence of teaching/learning strategy factor. These studies are divided in fields of chemistry and physics, approaching themes such as: quantum physics, Planck's constant determination, chemical solutions, thermodynamics, energy conservation, electromagnetism, rotation, polymer contents and hydrodynamics.

Three studies that uses Carvalho's (1995 and others) theory to substantiate the proposed activity were found. There were several kinds of problematizing and argumentative situations, involving strategies that seek to make the students acquire knowledge in an autonomous way.

It was observed that Cruz (2016), even having Carvalho's theory as theoretical basis, presents his DS about anxiolytic medicine aiming to investigate problem-based teaching potential (EABRP). The approach used for teaching organic chemistry in high school was assessed based on Leontiev's theory of activity, which uses the following categories: "objective, actions, subjects, operations and results system" (Cruz, 2016, p. 19, our translation).

Guimarães and Giordan (2001 and others) were referenced in 6 of the analyzed studies. In them, the following structure for didactic sequences was presented: "title, audience, problematizing, general objectives, specific objectives, contents, dynamics, assessment, references and used literature" (Guimarães and Giordan *apud* Souza and Sondermann, 2018, p. 137, our translation). The teaching of physics with support from technological gadgets was predominant on these studies.

One of the presented studies had a DS proposed by Santos (2017), intitled “Gincana da Física Térmica” (Thermal physics contest, in a free translation), supported by on-line games, by using the HP software, and using game as JQuiz (Q&A game). This whole DS elaboration, validations and applications process was based on Guimarães and Girodan (2011 and others).

Pais (2015) was referenced at 4 studies, all of them approaching math content learning, as was Germano’s (2016). However, Germano (2011) proposed a didactic sequence based on Guy Brousseau’s (2008) Theory of Didactic Situations (TDS or TSD in Portuguese), which affirms that didactic situations must be presented as a scientific resource, integrating the contributions of many disciplines in math teaching. Germano’s (2016) educational product was a activities notebook, based on a DS, about the teaching of complex numbers supported by the use of GeoGebra to collaborate with math teachers. The presented DS had 9 situations, them being: A, B, C, D, E, F, G, H and I, all of them divided by: theme, mathematical content, objective, structure, material resources, previous knowledges, situations of: proposal, formulation and validation.

We conclude that, from the analysis of theoretical approaches in 93 studies, 93.5 % (87) used the same basis for both theoretical foundations and DS structuration moments, and only 6.5% (6) used ou mixed the DS’ structures with approaches from authors other than the ones mentioned at the references.

The twelve theoretical approaches mentioned at graphic 1 as “others” are Machado (2002), Villani and Nascimento (2003), Pietrocola (2006), Ferreira (2008), Santos (2009), Pinheiro, Abar and Sá (2012), Monteiro (2013), Vale and Barbosa (2015), Fazenda (1998), Vygotsky (1999), Burke (1969) and Binet (1786-1856).

3.2 Didactic sequence’s structure expressed in academic studies on the Science and Math fields presented in Brazil.

Since we verified studies from the years 2015 to 2019, and 105 among them presented Didactic Sequences, we categorized the DSs found in two different structures, because it was observed that they represent most of the DS analyzed in this research. As it is noticeable in the table below, the first structure is highlighted. To exemplify it, we sought to present one author/structure in each year.

Structure 1 of Didactic Sequences in:				
Luz (2015)	Oliveira (2016)	Gehrke (2017)	Ribeiro (2018)	Castro (2019)
Initial questionnaire;	Presentation of research project and initial questionnaire	Diagnostic test;	Presentation;	Initial questionnaire;
Introductions;	Problematizing;	Initial questionnaire for previous knowledge analysis;	Initial questionnaire;	First moment: presentation of problem and hypothesis formulation;
Problem;	Discussion;	Record of students’ response to activities;	Game application;	

				Second moment: Guidance to research and hypothesis test;
Activity solving;	Experimental activities;	Activities;	Experimentation;	Third moment: knowledge systematization;
Final questionnaire.	Final questionnaire.	Final questionnaire.	Exercise list;	Fourth moment: Final questionnaire and assesmente activity (knowledge application)
			Game application;	
			Final questionnaire.	

Table 1: Presented DSs in academic studies between 2015 and 2019: structure 1

SOURCE: Made by the authors based on the consulted references, 2020.

Based on the sequences presented by authors such as Luz (2015), Oliveira (2016), Gehrke (2017), Ribeiro (2018) and Castro (2019), which were selected based on similarities and key topics, we can observe that the structure is divided in five moments: presentation and initial questionnaire, introduction, problematizing, discussion and activity resolution, and final questionnaire.

Below, we have the 5 DS that present the same structure. They are preceded by its authors, being one of each year. We also observed that authors mix theoretical basis to substantiate both their references and the DS structure presented in their studies.

Structure 2 of Didactic Sequences in:				
Abreu (2015)	Celante (2016)	Santos (2017)	Arcias (2018)	Cora (2019)
Theme;	Title;	Audience;	Audience;	Title;
Audience;	Audience;	Problematizing;	General objective;	Audience;
Problematizing;	Problematizing;	General objective;	Problematizing;	Problematizing;
General objectives;	General objective;	Contents and methods;	Knowledge organization;	General objective;
Specific objectives;	Contents and methods;	Learning assessment.	Knowledge application;	Contents and methods: - Class - Specific objectives - Contents

Content;	Specific objectives;		Assessment.	Assessment.
Assessment.	Assessment.			Consulted references.

Table 2: Presented DSs in academic studies between 2015 and 2019: structure 2
 SOURCE: Made by the authors based on the consulted references, 2020.

The selected authors on the aforementioned table - Abreu (2015), Celante (2016), Santos (2017), Areias (2018) and Cora (2019) – presented a structure of Didactic Sequence proposed by Giordan and Guimarães (2011) and Zabala (1998), which was made of: title, audience, problematizing, general objectives, specific objectives, contents, dynamics, assessment, references and used literature. This also contains the three pedagogic moments named by Delizoicov: initial problematization, knowledge organization and knowledge application.

In analyzing both DS structures presented on tables 1 and 2 of this paper, we can notice that problematizing is a key topic and the difference between them lies in the proposition (or not) of problems as a DS’ first phase.

Conclusions

The referential basis of Didactic Sequences presented on the analyzed studies mostly uses Zabala’s (1998) theory, even if we only observe the emergence of new DS proposals in Science and Math teaching at Brazil. It was also observed that authors mix theoretical basis to substantiate both the references and the DS’s structure presented in their studies.

We highlight that the DS structure, inspired by the proposition of the 3 pedagogical moments (3MP in Portuguese), developed by Delizoicov based on Freire, has been progressively utilized by researchers in Brazil, as they also use problematizing and situational problems, respectively, for basis to the teaching process and as absorbed knowledge assessment to the students.

The propositions of different problematizing activities, questioners and dialogical are the common topics in the different DSs analyzed at this paper. The DSs distinguish themselves due to its individualities, but their goal is only one: to improve learning.

The attempt to learn the DS structures in studies will only make sense as long as they are developed. One DS structure can assume several features depending on the teacher, the student, time and space that it is being used. Even if there are educational products available to educators about determined contents, the methodological strategies can and will vary according to the interests and realities of students and teachers, in a way that there is, according to Ausubel, a meaningful learning of the taught contents.

To see a DS as an activity requires the active participation both of student and teacher. Through it, the teacher can improve his/hers work at the classroom and the students can learn in a meaningful way, thus reaching the educational objectives.

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