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Editorial - Thematic Number 2021 - Documentational Approach to Didactics

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The Documentational Approach to Didactics is a theory developed within the scope of the didactics of French mathematics, which has been established nationally as an important theory for the analysis of the teacher's professional development. We say nationally, because internationally it has already reached all continents, with contributions from renowned researchers of international mathematics education.

The intention of this thematic issue was to bring Brazilian research supported by this theoretical contribution, with a view to disseminating them and expanding the use of DAD in our country, whose rich and diverse cultural characteristics can add new elements to the study of the teacher's resources and documents. This theory has two main authors, Luc Trouche and Ghislane Geuduet, French researchers of the didactics of mathematics, well known among us. Birgit Pepin, a German researcher who has brought valuable contributions, joined them. Other theories are a consequence of DAD, such as the theory of Instrumental Orchestration.

The articles in this issue are the result of group and individual research approaches and come from different Brazilian states, with foreign contributions by Trouche and Trgalová. We highlight a material available on the DAD, including the website of the Re(s)sources Conference (2018, Lyon), the book *The Resource Approach to Mathematics Education*, edited by Springer in 2019, the digital book organized by Igliori, *Compreender o trabalho dos professores do ensino básico: uma abordagem pelos recursos* [Understanding the work of

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basic education teachers: an approach through resources], published in 2021 by Editora Blücher, in addition to the several articles already published by international and Brazilian authors.

Researchers of the Graduate Studies Program of Mathematics Education of PUC-SP have used the theoretical framework of the DAD in their research. And through institutional support, they have been able to count on Trouche's partnership and supervision. From this perspective, in 2021, it was possible to hold ten seminars, one per month, guided by Trouche, aimed at reflections on the DAD. The Documentational Approach to Didactics complements a specific methodological approach, called reflective methodology on the documentational work of teachers. This theoretical approach dialogues with other theories and other methodological approaches.

This thematic issue of the journal EMP is an immersion in the DAD, treated in different contexts. Some users of this theory were unable to finalize their articles. The Covid-19 pandemic has bogged us down; yet, we have reached 17 articles, a significant production. This Editorial summarizes the different research themes and perspectives of national authors who work with DAD, with foreign collaborations. Let us go to the articles.

The first, authored by Pessoa da Silva *et al*., entitled: "Documentational Approach to Didactics in the Planning and Implementation of a Mathematical Modeling Activity", presents an activity planned and analyzed by teachers in continuing education, within the scope of a discipline of Mathematical Modeling of the master's degree in Mathematics Teaching. Data comes from audio and video recordings of the planning and implementation of the activity, the record of the lesson plan, and the students' reports. Through qualitative analysis subsidized in the Documentational Approach to Didactics and Trees of Association of Ideas, the research showed that the plan initially structured by a pair of teachers was reworked considering suggestions from other teachers in training, and underwent changes during classes and by suggestions received, counting on the reports of the pair in the discipline conversation circle.

The second article is entitled "Probity and Teacher Engineering in Mathematics: A Reflection in the Light of the Articulation between the Documentational Approach, ATD and Didactic Engineering". Its author is Pantoja da Silva. The author brings an essay resulting from

a theoretical discussion to reflect on the notion of Probity and the relationships underlying the development of teaching work conceived in a similar way to engineering, identifying possible links with mathematics teaching. Through an exploratory methodology that relies on the articulations established between the notions provided by the Documentational Approach to Didactics, the Anthropological Theory of the Didactic and Didactic Engineering, it obtains results that point out that this notion of expanded probity in the didactic sense constitutes the epistemological foundation of an institutional Documentational Genesis.

"Instrumental Orchestration of a Mathematical Situation of Applications of Double Integrals" is the title of the third article, by Francisco Eteval da Silva Feitosa and Roberta dos Santos Rodrigues, which aims to describe and analyze an Instrumental Orchestration that aimed to apply the double integral in determining the center of mass of a variable density blade and the electrical load in a given region. The qualitative study involved undergraduate students in mathematics and engineering from a public university in Amazonas, Brazil. The theoretical framework is composed of Trouche's theory of Instrumental Orchestration and Brousseau's theory of Didactical Situations. The results show, among other things, that the action, formulation, validation, and institutionalization stages, when used in the Instrumental Orchestration execution mode, are important elements of Didactic Situations and that, through them, the teaching and learning processes contribute to the construction of knowledge.

Now, the fourth article. Title: "Trajectories of Research with Basic Schoolteachers Analyzed from the Documentational Genesis Perspective", authored by Celina Aparecida Pereira Almeida Abar, Chrystian Bastos de Almeida and Adriana Oliveira Dias. Those authors propose to use Documentational Genesis (DG) as a support to understand the teachers' professional development through the study of their interactions with resources, a variety of artifacts, and their uses for the development of their practice. Due to the Covid-19 pandemic, both studies, starting in 2020, were developed remotely through the Teams and Google Meet platforms, in addition to WhatsApp. The first research presents the analysis of an activity in a context of remote and collaborative work of two teachers on Compound Interest. In the second, the analysis is of the documentational trajectory of a chemistry teacher and his performance online. In those studies, the teacher's documentational trajectory is marked by adaptations to

follow technological advances and the use of the internet combined with the teaching and learning process. Regarding the results, we highlight the influence of mathematical knowledge for teaching in the process of instrumentalization of this game and the different types of instrumental orchestrations planned and effectively implemented for its use in the classroom.

Lima Lira, Melo Espíndola, and Trgalová present in the fifth article, entitled "Teachers' Appropriation of First-Degree Equation Games Proposed in Textbooks", the clipping of an ongoing study in the Programa de Pós-Graduação em Ensino das Ciências (PPGEC), about mathematics teachers' appropriation of games to teach first-degree equations. This study was developed with a mathematics teacher of the final years of elementary school from the perspective of the reflective methodology, woven in the Documentational Approach to Didactics. Regarding the results, we highlight the influence of mathematical knowledge for teaching in the process of instrumentalization of this game and the different types of Instrumental Orchestrations planned and effectively implemented for its use in the classroom.

Article number six brought the "Analysis of the Resource System of a Mathematics Teacher in Remote Education", an article written by Rosana Maria da Silva, Rafael Marinho de Albuquerque and Rogério da Silva Ignacio. This analysis considers that the crisis resulting from Covid-19 brought challenges to the school as an institution, when social distancing caused the prohibition of access to much of the resources that teachers had. Given this scenario, the authors were interested in studying how the teachers' document system, especially of mathematics teachers, were affected in this environment of change, temporarily deprived of a significant part of their respective resource systems. Two experienced mathematics teachers were monitored in their Documentational Genesis processes to adhere to remote teaching. They employed the principles of the Reflective Research Methodology, undertaking a follow-up of 13 months of teaching activities. Readers can find the partial conclusions of the study that are still in progress outlined in the text.

In the seventh article, Diego Jonata de Medeiros and Iranete Maria da Silva Lima dedicated themselves to investigating "A Teacher's Resources to Teach Statistical Content in the Final Years of Elementary Field Schools." The research was developed within the framework of a master's degree and was based on the Documentational Approach to Didactics,

Field Education, and Statistical Education. This article focuses on the resources of one Documentational Approach to Didactics of the three teachers who participated in the research, to characterise them in materials and non-materials, and in mother resources and child resources. It can be inferred that this teacher presented resources that can contribute to the field school students' statistical literacy if used for that purpose.

"Instrumental Approach and Applications" is the title of article number eight, by Henriques, aiming to contribute to the use of Pierre Rabardel's Instrumental Approach as an effective theoretical framework in the development of works by researchers who are interested in the analysis of technological tools. The author pays special attention to digital technological tools, choosing GeoGebra software as a computational learning environment. The article intends to extend the Instrument-Based Activity Situations (IAS) model in three dimensions, provoking a reflection on the role of the Teacher or the researcher in the primitive relations of this model in external research during the application in the classroom.

Article number nine is authored by Miriam do Rocio Guadagnini, Valdir Bezerra dos Santos Junior, Renato da Silva Ignácio and Marlene Alves Dias presents a study on "Number and Algebraic Factorization: The Ecology of a Protomathematical Object due to the Introduction of New Praxeologies from 1960 to 2021 in Elementary School". It is an analysis of a collection for each decade and two current collections that follow the BNCC guidelines. The methodology is defined by Lüdke and André as documentational, with the theoretical framework centered on the Anthropological Theory of the Didactic (ATD). The results show a very stable ecology if we disregard the 1960s, which represents modern mathematics. The article is a reflection about the loss of space of the study of algebraic fractions as of 1998, indicating that teachers must pay greater attention, especially when studying Differential and Integral Calculus.

"The Teacher, Digital Resources, and the Documentational Approach to Didactics: A Triad to be Considered in the Engineering of Educational Software" is the theme of the tenth article, by Ricardo Tiburcio dos Santos and Marilena Bittar. They discuss the possibility of a theoretical articulation between the Documentational Approach to Didactics and Didactic-Computational Engineering in the context of the creation and use of digital technological

resources to assist teaching activities. The hypothesis launched is that the teacher carries out evaluations, adaptations, and combinations to insert a new resource in their classes: software engineering is interested in those tasks and this data collected by this professional since, at this moment, the teacher assumes the role of a resource designer. The authors consider that the study should contribute to the development of educational software, from the perspectives considered.

Xavier Neto, Ferreira da Silva, and Trouche are the authors of article number eleven, "An Analysis of the Academic Production on Documentational Genesis between 2012 and 2020". What they bring is an excerpt from the bibliographic review of the first author's thesis to offer a contribution to researchers interested in the subject. Investigations published in electronic portals of journals, theses, and dissertations with databases from Brazil and abroad were selected and organized by the categories of analysis 'curricular reforms', 'teacher training' and 'pedagogical practices', highlighting the contours of the Documentational Genesis process. Concluding, the authors highlight the need for a long period of observation to understand the Documentational Genesis and identify the use schemes, as well as inferences about the teachers' professional development.

Gitirana and Lucena wrote "Online Instrumental Orchestration: A Model Thought from Remote Teaching". In this twelfth article, the authors introduce the notion of Online Instrumental Orchestration as an adaptation of the Instrumental Orchestration model in times of remote-emergency teaching, and for the future of online teaching. As an analysis, they bring the evolution of aspects of adaptation of the Online IO in the workshops, explaining the flexibility, the change in the classroom geography, the need to understand the articulation between the Instrumental Orchestrations and the protocols of students, monitors, and educators.

Thirteenth article is authored by Assis and Trouche. It is entitled "Uniting the Pieces of a Puzzle: Dialectical Perspectives and Documentational Genesis in the Mathematics Teachers' Initial Education", and aims to illustrate the Documentational Genesis considering a real situation of planning and implementation of a class experienced by a mathematics degree student from the perspective of the three dialectics: instrumentation/instrumentalization, "mother" resource /"child" resource, and productive activity/constructive activity. For the data

re-reading, we list three guiding questions: what does the student rely on in terms of resources? What are the reasons for her choices? What are the learnings in the training process? The research was based on the Documentational Approach to Didactics. The study of the task versions was essential to identify knowledge, beliefs, and learning of Documentational Approach to Didactics of the prospective teacher.

The fourteenth article, “The integration of the Documentational Approach to Didactics and a Design Process for the Development of a Platform to Support Distance Learning" is by Rodrigues Silva, Bellemain, and Laurentino. The authors deal with the integration of the theory of the Documentational Approach to Didactics (DAD) with a design process, as a methodology for the construction of a platform to support the teaching work in the teaching of online geometry. The methodological structure was composed of the application of field research, problem mapping, question method, reflective investigation, brainstorming, and prototyping. The methods were chosen according to the objectives of each of the seven stages of the design process. In a first analysis, it is possible to identify the potential of the integration of the DAD with the design processes to produce an artifact that helps the teaching activities.

The fifteenth article and second to last article, authored by Rocha, is entitled “The Use of the Documentational Trajectory Concept to analyze the Relationships between Resources and the Mathematics Teacher’s Professional Development”. In the article, Rocha mobilizes the notion of Documentational Trajectory, proposed in the framework of the Documentational Approach to Didactics, to analyze the mathematics teachers’ professional development. Therefore, the text is based on the methodological principles proposed in the Reflective Research. The analysis showed that throughout her career, the teacher changed the way she relates to textbooks, digital resources, and co-workers.

The thematic number ends with the sixteenth article, entitled “From Lyon’s “Re(s)source Conference” to the Covid-19 Pandemic: Impacts and Contributions to the Theory of the Documentational Approach to Didactics”, written by Igliori, organizer of this issue and the Editorial. The researcher brings an essay on the evolution of the DAD in the times of the Re(s)source Conference and the Covid-19 Pandemic. It is time to rethink our social relations, including educational ones. In this perspective, UNESCO's call to make mathematics

“humanized” is interesting. As a result, the different conceptions about resources, documents, instruments, among others, and what was inferred from the teacher/resources dialogue about the impacts of the pandemic on education are evidenced.

The special issue on the Documentational Approach to Didactics brings a consistent and representative material of Brazilian research supported by this approach. This production confirms the diversity of situations in which the DAD can give support.

Have a nice reading!