Methodology for analysis didactic teaching epistemic path through the Theory of Semiotics Functions

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Introduction

This paper is part of the theoretical framework of the research project entitled Teaching Path Analysis to Epistemic Teaching the method of integration by parts, work done as a requirement for the degree of Doctor of Education in Mathematics Education online. The text focuses on two parts: the first relates results of investigations conducted by the educational math that show first, that the curriculum is focused on teaching the formal aspects of the concepts of calculus rather than on the epistemological dimensions and cognitive. On the other hand show that the professional thinking of teachers, implies a view of learning as a process of retaining information that is transmitted by the teacher and the student reception.

The second part of the paper is focused on the Theory of Semiotics functions, also known as the "Focus ontosemiotic of Mathematical Cognition (EOS), taken as a theoretical and methodological framework for this PhD research. A detailed description of the set of theoretical notions that currently comprise the EOS and are classified into five groups, each of which allows a level of analysis of the teaching and learning of specific topics in mathematics is done. As an appendix to this part aspects of competition in training analysis within the EOS are discussed. Elements to be considered in the fourth phase of this research nominalized as "phase results, conclusions, limitations of the study, perspectives and recommendations for the future."

Keywords: Instructional Analysis, epistemic trajectory epistemic configuration semiotic function, systems of mathematical practices, suitability criteria

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theoretical Framework

Traditionally teaching Calculus starts in high school, regular is conceived as knowledge that closes the cycle of secondary education and begins to higher education where, among others, the formal definition of limit are present, derivative and integral . In the case of the boundary, is performed by one or two examples of numerical approximations and in some cases for the derivative and integral with the analytical calculation of the variation of a function. This approach is intended to motivate the student's own formal representations of the process of abstraction as Dreyfus (1989) cites do for Azcarate (1996) argues that in the Advanced Mathematical Thought (PMA), it is understood that the process of abstraction is given by "replacing confined concrete phenomena by concepts in the human mind, where it becomes clear that define, analyze and formalize become more important in the higher grades." Thus the "understanding" of the concepts discussed in the exercise of proper algorithms for each item and its properties is intended. However, research findings (Cornu, Sierpinska, Orton, ...) on the understanding of these concepts to the conclusion that it is determined by complex notions that were developed over a long time (19th century) by the community mathematics and they created new styles of mathematical thinking and new ways of thinking.

Although there are research results in mathematics education, as Cooney (1994); Turégano (1998); Artigue (1998, 2002); Llinares (1998); D'Amore (1999.2003); Radford (1997, 2003, 2006); Godino & Fuller (1998); Sfard (2000); Muñoz (2000); Tall (2002); Kleiner (2002); Depool (2004); Li (2004); Contreras, Font, Luque & Ordoñez (2005) in press; Font & Ramos (2005); Godino, Contreras & Font (2006) in press; Ramos & Font (2006); D'Amore, Godino & Font (2007); Thompson and Silverman (2007); Gordon and Gordon (2007); Moreno-Eyebolt, Hegedus and Kaput (2008); Hill, Blunk, Charambus, Lewis, Phelps, Sleep & Ball (2008); Planas and Iranzo (2009); Charalambus (2010); Contreras, Ordonez & Wilhelmi (2010); Font, Planas, & Godino, (2010); Font (2011); Giménez, Font & Vanegas (2013); Font & Adam (2013), in the teaching process is still a significant emphasis on the formal aspects of the concepts of calculus that goes from the curriculum, rather than on the epistemological and cognitive dimensions; focused only on the procedural, in algorithms iteratively applying the Student descontextualizados environment. We see concepts as derivative and integral are explained via the concepts of limit and function, sometimes accompanied by their geometric representations: the line tangent to a curve at a point considered as the area under the curve of a function positive in the range considered. Such status has been generating a "culture" in the teacher and the student, where "learning to say" what the derivad and comprehensive and represent geometrically, without an understanding that allows them to study phenomena of continuous variation. Usually it is not perceived that the calculus conceived as a "tool" that provides them with efficient algorithms, which in future can come to some sort of application.

Professional Knowledge of Teachers

Among the studies that have been devoted to describe the evolution and development that has taken the line of research on teacher work are the Llinares (1998), postulating the need for an evolution from more cognitive perspective (study of teacher thinking) whose foundations are grounded in cognitive psychology to more sociocultural perspectives (study of knowledge and practice of the teacher), whose foundations are grounded in anthropological and epistemological principles of knowledge. He proposes that the skills of teachers in the subject they teach are a criterion for teacher quality. Furthermore, regarding the content of this knowledge, he noted several subcategories, including those that could be considered knowledge of specific subject matter, knowledge of specific teaching contents thereof and curricular knowledge encompasses not only specific to the matter, but also of other materials (Shulman, 1989). The description of the various categories of professional knowledge of mathematics teacher provides relevant for the design of training programs (Llinares, 1998) data. As Llinares (1998) offers a professional perspective, based on theoretical frameworks in cognitive psychology and sociocultural perspectives, from which it is proposed to analyze the processes of formation of mathematics teachers.

Instead Bromme (1994) argues that the way in which practical knowledge is generated due to heuristic transformations of theoretical knowledge and integrating them by teachers. The generation of practical knowledge is seen as a personal construction of the teacher who becomes the use of their professional knowledge in specific situations when managing teaching and subsequent reflection of them. Therefore, the characterization of professional knowledge is not only what the teacher knows (components of professional knowledge) but what it does (use of knowledge, professional activity).

Cooney (1994) notes that most studies have a common feature, and that is to give an account of local knowledge of teachers, rather than on the transition from local to general. That is why Cooney (1994) states that this research developed on the professional thinking of teachers carry implicit understandings of learning and retention process information, whereas a transmission scheme by the teacher and the student reception rearranged contents thanks to pedagogical content knowledge that teachers possess (Gómez, 2000).

On the other hand, the work of Piaget and Garcia (1982) noted that the construction of knowledge may depend on the questions asked, the epistemology of the concepts and how the study of cognitive rules can reach the subject's own processes construction of knowledge, it is clear that there will have to resort to verbal statements, or even an analysis of awareness, but essentially an analysis of what the subject (as opposed to what you think it does) to acquire and use knowledge or expertise, or to consider it as well founded. In his three levels of development a scheme detailing for different fields, whose general features are:

i. Intra: characterized because the student does not recognize all elements of the scheme highlighting actions by its operational. The student uses the elements in isolation and find it difficult to relate different elements.

ii. Inter: It is characterized by the recognition of relationships between elements of the scheme and therefore there is greater potential for leverage of deductive ability. The transition from one stage to another often occurs as a result of reflection on the relationships between schema elements

iii. Trans: no manifestations characterized -during solving problems-that the student has constructed an underlying structure completely. The structures achieved at this level give rise to new intra analysis leading to new inter- and trans new structures.

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