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ABSTRACTS

Theis, Laurent; Morin, Marie-Pier; Tambone, Jeanette; Assude, Térésa; Koudogbo, Jeanne; Millon-Faure, Karine. *Functions of two auxiliary educational systems aiming to support students with difficulties during mathematical problem solving.*

Abstract. Solving mathematical problems is a major challenge for students with difficulties. In this article, we examine an assistance system tested by an elementary school teacher during a two-year collaborative research. This system consists of setting up two auxiliary educational systems (AES), in the form of a work session with the students presumed by the teacher to be having trouble, that is held prior to the solving of the problem with the whole class and another work session held after the solving of the problem. Within the AES, the teacher explains the problem to the students, and discusses concepts with the student regarded as prerequisites by the teacher. In the AES held after the solving of the problem, the teacher revisits the institutionalisation made with the whole class. In this article, we analyze the potential functions of our assistance system through the triple dimensions identified by Sensevy et al. (2000): Chronogenesis, mesogenesis and topogenesis.

Barrera-Curin, Raquel; Bulf, Caroline; Venant, Fabienne. *Didactic, Semantic and Metaphors: Analysis of Languages in Class of Geometry.*

Abstract. This work focuses on the role taken by different forms of language during the first academic experience of symmetry by young children, in the context of primary school in France. We pay special attention to. A situation of introduction of symmetry in a class of CE1 (grade 7 or 8 years) was observed to this purpose. This paper aims to provide our analysis of this situation, which are grounded into a didactical theoretical framework enriched with semantic, discursive and metaphoric-conceptual analysis tools. This original approach allows us to understand the symmetry in all its complexity and to analyze finely the inter-influence of three dimensions (acting-talking-thinking) that characterize both the mathematical activity of the students and of the teacher.

Martin, Vincent; Thibault, Mathieu. *Quebec perspectives on Seven Decades of Research on Teaching and Learning Probability.*

Abstract. In this literature review, we present research from around the world as well as from Quebec that focused on the development of probabilistic reasoning, and on learning, and teaching of probability. We organize this review into three chronological periods: piagetian, post-piagetian, and contemporary. Through this historical overview, we can see an evolution in research moving from a majority of works issued from psychology field, primarily aimed to describe and understand the probabilistic reasoning and conceptions of individuals to research that are now mostly developed in the field of education which are related to learning, and teaching of probability in the school context. We are concluding by outlining gray areas related to teaching and learning probabilities which deserve to be enlighten in future research.

Duval, Raymond; Pluvinage, François. *Standpoints on elementary algebra and its teaching.*

Abstract. This first article of a series of two presents on teaching elementary algebra different standpoints, not always easy to reconcile with each other; a second article will cover activities to promote the learning of algebra. The expectations expressed by the institution on this learning are determined by the common uses of algebra in everyday or professional life, such as the introduction and use of formulas in a spreadsheet. But the results observed at the end of compulsory schooling are clearly insufficient. From a cognitive standpoint, the phased curriculum of algebra does not appear satisfactory, especially not taking into account the difference between symbolic writing and the natural language. The historical view shows, before the use of algebraic notation, the use of algorithmic processes significantly more advanced than the beginnings of algebra, so difficult to transpose in education; but it also points out that following the invention of printing, writing algebraic and relative numbers have arisen simultaneously, which deserves consideration for teaching algebra. Our analysis of the treatment required by algebraic problem solving first highlights the role of the functional

designation, next to the direct designation, and the crucial importance of a commonly misunderstood operation, namely that of renaming considered objects. Then arose the fundamental semiotic distinction for analyzing the specific cognitive functioning for processing complete expressions in algebra, namely between a sign and its occurrences.

Coulange, Lalina; Verdugo, Paula. *A Comparative Study of the Teaching of Algebra in France and in Chile.*

Abstract. In this paper, we present the results of a comparative study on the teaching of algebra in France and in Chile. Within the Anthropological Theory of the Didactic, we studied and compared the mathematical knowledge related to the distributive property, taught within each school system. The analysis of programs and textbooks reveals significant differences in the knowledge to be taught or taught. We also analyzed the knowledge of students, through a questionnaire given to French and Chilean students (aged 14-15). The analysis of the answers allows us to establish differences between the *mathematical praxeologies* students have learnt. It also reveals similarities that reveal the difficulties of (Chilean or French) students in learning algebra. Finally, we conducted a brief experimentation in a French class that introduced a type of tasks present in the Chilean textbook. This experimentation allows us to examine the role of geometric framework in the study of the distributive property, more represented in the knowledge to be taught and taught in Chile than in France

Bridoux, Stephanie; Grenier-Boley, Nicolas; Hache, Christophe; Robert, Aline. *Teaching Knowledge during Lectures in Mathematics. Analyses and Examples.*

Abstract. We investigate several issues tied to the moments when the teacher introduces in his classroom the general, formal mathematical knowledge (the “course”). These issues are especially explained with reference to a theoretical hypothesis stated in terms of “pseudo-concepts”. Our didactical analyses take into account the contents of the course and its sequence of events. In particular we clarify several discursive “proximities” that may or may not appear during the sequence of events. Such proximities are particularly associated to explicit “closenesses” between students’ work over contextualized activities and the underlying general non-contextualized statement. These analyses are first illustrated on examples extracted from a course about graphical representation of functions (14-16 years old students). Secondly, we compare three types of courses on sequences and functions’ limits given to first-year university students: a textbook, a video and a lecture. The study reveals differences between diverse courses. It leads to clarify the issue about the specificity of the courses’ input in the students’ learning.

Mesnil, Zoé. *Logic in high school syllabuses, a knowledge to be taught.*

Abstract. With the resurgence of logical concepts in new syllabuses, a *knowledge to be taught* appears more explicitly than it did in previous years. This led me to study the teaching of logical concepts in high school as the study of a didactical transposition process. But because the goal is not to teach mathematical logic, but to teach logical tools for mathematical activity, I propose to introduce into the didactical transposition’s scheme a *reference knowledge* between the *mathematical knowledge* (mathematical logic) and the *knowledge to be taught*. In this article, I am showing through the example of the implication, which aspects of logical concepts it would be relevant to take into account in such a knowledge, and I rely on the criteria established to construct a framework for analyzing syllabuses and textbooks.

Couderette, Michèle. *Teaching Algorithmic: A Problematic Introduction in the High School Curriculum.*

Abstract. In 2009, the high school curricular reform introduced algorithms in mathematics teaching. This is a new hybrid object, at the crossroads of mathematics and computer science, for which most teachers are not trained. Therefore, how do teachers approach this part of the program? To answer this question, we observed a mathematics teacher in a second grade in high school, for one year school. In order to conduct an analysis, we articulate two theoretical frameworks: the anthropological theory of didactics (ATD) and the joint action theory in didactics (JATD). The ATD provides tools for analyzing the tasks proposed by the math teacher to the students against the background of the concept of mathematical praxeologies. The JATD allows to put in view the expectations of the institution with what is actually taught in the classroom over several sessions of algorithm teaching. The results show the difficulties of teaching a knowledge that has its references in two disciplines. The co-constructed

knowledge developed in the class is referred either under their mathematical specificity or their computer specificity. As a result of that, students do not really learn algorithmic knowledge.

Oktaç, Asuman. *Abstract Algebra Learning: Mental Structures, Definitions, Examples, Proofs and Structure Sense.*

Abstract. A reflection is made about Abstract Algebra Learning, motivated by the reading of an article published previously in this journal. The reflection involves elements of APOS (Action – Process – Object – Schema) Theory and related published works as well as results from other studies involving definitions, examples, proofs and structure sense.

Barrier, Thomas ; Mathé, Anne-Cécile ; Mithalal, Joris. *Initial teacher education in geometry at primary school.*

Abstract. The context of the research is initial primary school teacher education in geometry. We study and compare three implementations of a collectively designed training sequence by three trainers with distinct status and/or research interest. We highlight some variations in the knowledge that the trainers institutionalize, with a specific focus on figure visualization. The research background concerns the potential effects of those variations on teacher training.