

ABSTRACTS

**Levain, Jean-Pierre; Le Borgne, Philippe; Simard, Arnaud; Didierjean, André.** *The impact of the evolution into master courses on the expertise in proportionality problem solving among students and primary school trainee teachers.*

**Abstract.** The aim of the research is to assess, in the French context, the impact of the evolution of the teachers' trainings into master courses on the development of the expertise in proportionality problem solving. For this purpose, we will describe three successive periods from 2008 to 2015, each representing a teaching model. We will consider, for each of these models, the added value of every education year, the influence of the competitive exam, the specifics of the obtained degree. The exploitation of a questionnaire, constituted by 19 scaling and enlargement problems, proposed to 1138 students, allows to check if the studied education model has effect on the success and failures patterns, as well as the levels of expertise that ensue.

**Proulx, Jérôme; Lamarche, Marie-Line L.; Tremblay, Karl-Philippe.** *Algebraic equations and mathematical activity in mental mathematics: on teaching challenges*

**Abstract.** This article explores students' and teachers' strategies when solving algebraic equations without paper and pencil or any other material aid. The enactivist notions of problem-posing offer conceptual grounds to engage in analysis of students' and teachers' strategies, and in their comparisons. This leads to the exploration of differences in the nature and origin between the solving processes of students and those of teachers, as well as challenges in relation to teaching and learning of algebra equation solving. Final remarks reflect on the potential of being sensitized to the nature of these differences in solving processes.

**Nechache, Assia.** *The categorization of tasks and the worker-subject: a methodological tool for the study of mathematical work in the probability field*

**Abstract.** This article focuses on the study of the mathematical work produced after the resolution of probabilistic tasks as well as the students' role in the elaboration of this mathematical work. This led us to categorize mathematical tasks (simple, standard, rich) according to their level of epistemological and cognitive demand. This categorization is associated with students' learning in the form of a worker-subject (jobber, technician, engineer). Using this categorization and the Mathematical Working Space (MWS) model, we analyzed the implementation of a probabilistic task in two tenth grade classes. This analysis of the two class sessions allowed us to characterize the transformations of the nature of the tasks by the teachers during its implementation. These transformations generate a decrease in the level of cognitive demand of the task and also in the students' role in solving the task.

**Tessier-Baillargeon, Michèle; Leduc, Nicolas; Richard, Philippe R.; Gagnon, Michel.** *Comparative study of tutorial systems for geometry proof learning*

**Abstract.** This article proposes a state of the art of tutorial systems for high school planar geometry proof learning. The chosen approach is part of exploring the research problem that motivates the development, by our research team, of a tutorial system named QED-Tutrix, that we will present in another paper. In the following article, a synthesis and a comparison of existing tutorial systems is carried out on the basis of a set of original indicators highlighting the differences between the systems covered by our analysis. Each indicator aims to describe the functioning of the studied software according to the geometric work made possible at their interface. Eleven tutorial systems are compared according to their integration of a geometric figure, the structure they impose on the student's reasoning and the tutorial intervention they offer.

**Lagrange, Jean-Baptiste ; Rogalski, Janine.** *Knowledge, concepts, and situations in first learning of programming and algorithmics*

**Abstract.** In several countries including France, there is a growing interest for the teaching and learning of algorithmics and programming at school and college level. It is then necessary to question the objectives of this teaching and learning, and to propose controlled implementations. This article, written

by a researcher in cognitive ergonomics and a researcher in didactics, aims at assessing some research results in this field, on the basis of research work conducted sporadically for thirty years. It first attempts to show the permanence of questions related to beginners' conceptual difficulties, and then tackles the issue of learning situations. Then it takes stock of results obtained in psychology of programming, focusing on a conceptual field precisely identified around the concept of computer variable. The conclusion gives evidence of a broad field of research now open.

**Guirette, Rebeca; Gómez-Blancarte, Ana; Valero-Pérez, Ricardo. *Recognition of visual variables and significant symbolic units of quadratic functions***

**Abstract.** In this paper, we explore the qualitative recognition by 144 high school students of the visual variables of the graphical representation of a quadratic function and the significant symbolic units of its algebraic writing. This recognition emerges when students are asked to move from the graphical register to the algebraic register, and conversely. The results show that the association between the visual variables of the graphic register and the symbolic units of algebraic writing has not been fully recognized. It is considered that, although the students study the effects of the coefficients of a quadratic function, they tend to only associate them with translations through the axes, instead of with pertinent visual changes. This is not sufficient for a qualitative global apprehension that allows the coordination between the visual variables of the graphical representation of a quadratic function and the significant symbolic units of its algebraic representation.

**Carrillo, José; Montes, Miguel; Contreras, Luis C.; Climent, Nuria. *The teacher's knowledge from a perspective based on its specialization: MTSK***

**Abstract.** This paper shows the conceptualization of an analytical model of mathematics teacher's specialized knowledge, which is based on the seminal work of Lee Shulman. In order to show the potential of the model, it is used here to analyze a particular case of a teacher of Spanish Secondary Education. The analysis shows the intertwining between different features of the knowledge of the teacher, reflecting the integrated nature of that knowledge, allowing, at the same time, a work of decomposition and synthesis of it. That will allow us to manage the design of teachers' education, conducting also to a better understanding of mathematics teaching.