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The development of the mathematics curriculum in basic education with technology

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This poster refers to a project concerning an educational teaching experiment that focuses on the development of the curriculum on the 7th grade of basic education, by integrating technology. Using a learning environment with an exploratory nature, based on diversified tasks involving the use of graphing calculator, we aim to create an innovative curriculum in this level of education.

The teacher is the mediator of all the curricular decisions, having the responsibility to reorganize the main curriculum proposal, adapting, transforming, innovating and setting methodological teaching strategies that foster motivation and improve student outcomes (Pacheco, 2001).

According to several authors, the implementation of technology in the teaching of mathematics, namely computers and calculators (Domingos, 1994; Lee & McDougall, 2010; Tan & Tan, 2015) influences the way in which it is taught and enhances students' learning, for they build themselves their knowledge by premise creation. There are several benefits that emphasize the incorporation of technology in learning environments, namely, the increase of motivation, involvement, cooperation, hands-on learning opportunities, confidence and technological skills of students (Costley, 2014). In addition, those tasks are tools that generate activity in an interactive form, supporting the mathematical knowledge (Ainley et al., 2013).

This study is supported by the Activity Theory and seeks to understand how students, in solving specific tasks with the aid of the graphing calculator, builds their mathematical knowledge embedded in a learning community. Being the activity system within the classroom the unit of analysis, the third generation of the Activity Theory (Engeström, 2001) allows us to understand what happens when different activity systems interact. More specifically we seek to understand the instrumental genesis (Rabardel, 1995) and the semiotic potential played by technology in a student's activity system, developing the process of semiotic mediation (Bussi & Mariotti, 2008). In this sense, we intend to investigate how the graphing calculator influences, reinforces and facilitates the quality of teaching and learning and promotes the processes of instrumental genesis and semiotic mediation in the performance of tasks in curriculum development. We seek to get answers to the following research questions: Which are the instrumental action schemes created by students when they use a graphing calculator? How does the teacher promote the process of semiotic mediation? How does the graphing calculator act as semiotic mediation tool? How does the integration of technology in the curriculum influence the process of teaching and learning? What is the quality of the achieved learning?

Based on research of an interventionist nature, using innovative practices that aim to promote new ways of learning, enabling improvements on an educational level, a qualitative paradigm based on a Design Research process will be adopted. The techniques used to collect the data shall be based on the planning of the study units, the elaboration of reports by the students as a result of completing the tasks and reports resulting from the participant observation of the teacher as a mediator. We will

also consolidate the structured observation of lessons, using a logbook, photographs of the graphic representations in the calculator, videos and audio recordings, during the performance of the tasks (Cobb, Confrey, diSessa, Lehrer, & Schaube, 2003). Empirical data will be collected in the school year of 2016/17 in a public school in the district of Setúbal, in Portugal.

We therefore intend to present an innovative curriculum development project, that integrates a strong technological component in an educational level where traditionally this kind of approach is not commonly used. The use of tasks permeated by graphic technology seek to highlight the semiotic dimensions present in the instrumental genesis that are activated in different activity systems.

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