

THE GRAPHING CALCULATOR IN THE DEVELOPMENT OF THE MATHEMATICS CURRICULUM IN THE 7TH GRADE OF BASIC EDUCATION

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This poster refers to the first data of a project that involves an educational teaching experiment that seeks to integrate technology in the curriculum of the 7th grade of basic education. This study is supported by the Activity Theory and seeks understand the instrumental genesis and semiotic potential played by technology in student's activity system, developing the process of semiotic mediation.

Keywords: Graphing calculator, curriculum development, Activity Theory, Semiotic Mediation, Instrumental Approach.

INTRODUCTION

Adopting several teaching strategies, in an essentially exploratory learning environment, based on several tasks that involve the use of the graphing calculator, it is intended to create an unusual curricular dynamics at this level of education. Some of the tasks are specific to the different topics of the curriculum (eg Algebra, Statistics or Geometry) and others are intended to relate various domains of mathematics, using mathematical modeling.

It seeks to understand how the student builds mathematical knowledge in solving specific tasks with the support of the graphing calculator as a member of a learning community. The Activity Theory (Engeström, 2001) is used to understand how the teacher, faced as a representative of a cultural community of reference, taking into account the semiotic potential of the graphing calculator, orchestrated didactic interventions with this mediating artifact, developing the process of semiotic mediation which is increased through the instrumented activity of the student.

The purpose of this study is to investigate, in the development of the curriculum, how the use of technology, namely the graphing calculator, promotes the processes of instrumental genesis and semiotic mediation, in the student's system of activity in interaction with other systems of activity, through the orchestration of the teacher. In this sense, the central questions inherent to the study are presented: *What are the schemes of instrumented action created by students when they use a graphing calculator? How does the graphing calculator act as semiotic mediation tool?*

THEORETICAL FRAMEWORK

Benefits of the implementation of technology in the teaching of mathematics

There are several benefits that emphasize the incorporation of technology into didactic environments, namely increased motivation, involvement, cooperation, hands-on learning opportunities, confidence, and students' technological skills (Costley, 2014). For Schwartz (1999)

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there are five aspects of mathematical activity: (a) conjectures and exploration; (b) acquisition, evaluation and analysis of data; (c) modeling; (d) conceptual foundation of manipulative skills; (e) deepening and broadening understanding; that if they are explored through a weighted software, it will contribute to the development of abilities in the students and teachers, as well as influence the achievement of the educational objectives of the society, present in the mathematics curriculum.

The inclusion of the graphing calculator by students at different levels of school performance, shows that all have positive benefits, when a teaching approach is done with this artifact and with more significant emphasis in students with special educational needs (Li, 2010).

Activity Theory

Being the unit of analysis, the activity system within the classroom, the third generation of Activity Theory (Engeström, 2001) allows us to understand what happens when different systems of activity interact.

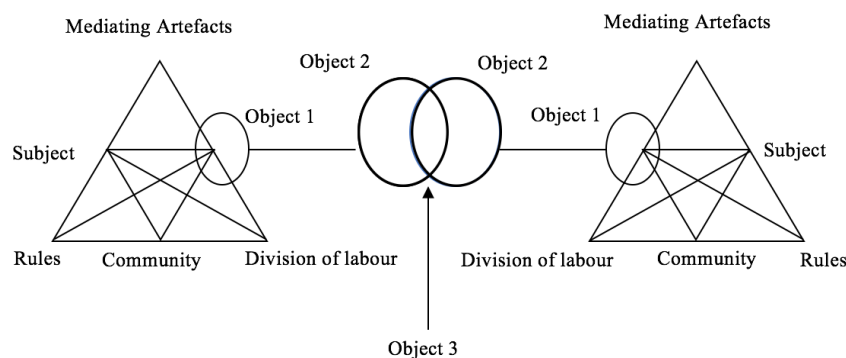


Figure1 - Two activity systems in interaction (Adapted from Engeström, 2001, p. 136)

Instrumental Genesis

The construction of an instrument is not spontaneous and occurs according to a process called instrumental genesis. An instrument is seen as a mixed entity, as it results from the appropriation of an artifact, material or symbolic, by the subject, through associated schemes (Rabardel, 1995). The schemes of use are directed to the management of the artifact and the schemes of instrumented action are entities directed to the accomplishment of the task (Drijvers & Trouche, 2008).

Semiotic Mediation

The Semiotic Mediation is a theoretical approach that at a didactic level approaches the teaching and learning of mathematics through the integration of technology, with the objective to analyze the different types of signs included in activities oriented by artifacts. In a classroom environment, in activities performed with artifacts, several signs emerge that can be used intentionally by the teacher to explore semiotic processes, aiming to guide the evolution of meanings within the class community. From the individual point of view, there are personal meanings that are related to the use of the artifact arise, namely as regards to the objective of accomplishing the task, on the other hand, from the social point of view, the mathematical meanings that may be related to the artefact and its use. In this sense, there is a double semiotic relationship articulated by the artifact, called by the semiotic potential of the artefact that is characterized by the easiness it has in associating culturally determined mathematical meanings, with individual meanings that each subject develops in the use of the same or in the accomplishment of tasks with their support. The artifact plays a dual

role, both as a means of performing a task, and as a semiotic mediation tool to fulfill a didactic goal (Bussi & Mariotti, 2008).

METHODOLOGY

The techniques used to collect data for the research problem were based on the planning of the study units, writing of reports by pupils resulting from the completion of the tasks and reports from the participant observation of the teacher, insofar as investigator and mediator. It also consolidated rigorous, attentive and structured observation of classes, using the logbook and photographs of graphic representations of the graphing calculator (Creswell, 2012).

DATA ANALYSIS

Taking into account task 1 and task 2, the first one was given at the beginning of the experiment and the second given one month later:

Task 1 - Use the graphing calculator to represent the following functions: $y = 2x$; $y = 3x$; $y = 5x$; $y = -2x$; $y = -3x$; $y = -5x$. What do you conclude?

Task 2 - What is the relationship between the amplitude of inscribed angle and the amplitude of angle to the center of a circle? What is the mathematical model that fits the situation?

In task 1 it was noticed that the students were still appropriating the graphing calculator artifact, using schemes of use, in situations such as:

Student1: How do I enter another function?

Student2: Press control **tab**!

As time went by the students were more comfortable in manipulating the graphing calculator and developed instrumented schemes of action, solving the tasks. On the other hand, the students, in task 1 when analyzing the graphs of the functions, taking into account their personal meanings, arrived at the properties of the linear function.

In task 2 the students have easily understood that the amplitude of an angle to the center is double the amplitude of an inscribed angle and they also have easily transited among various representations (geometric, tabular, graphical, algebraic). The worst performing student was able to first arrive at the modeling function of the relationship.

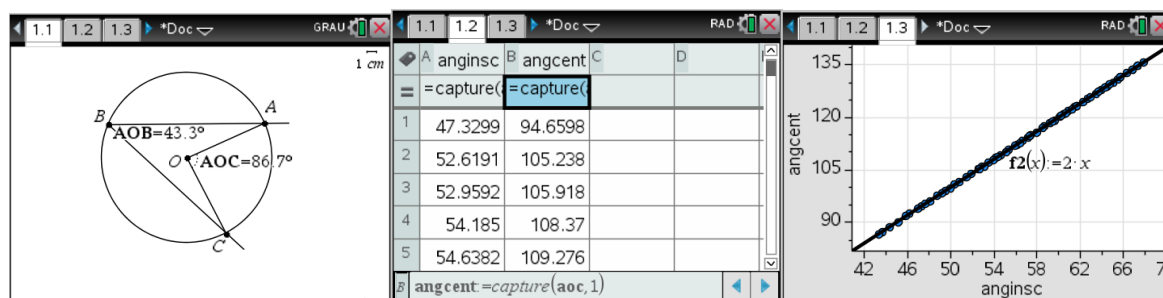


Figure2 - Records of the various representations of the graphing calculator in the resolution of the task2

CONCLUSIONS

The students developed schemes of instrumented action (mental schemes) through schemes of use. Being difficult to directly observe the mental schemes, the observations was limited to the

techniques that the students accomplished with the artifact and also as they said in their oral reports. The transformation of the artifact (graphing calculator) into an instrument is still being done.

Given the semiotic potential of the artifact the teacher acted as a mediator and used the artifact as a semiotic mediation tool in solving the tasks in social environment where several activity systems interact. The students produced personal signs, related to the meanings that emerge from the accomplishment of the task and the use of the artifact, developing the collective production of common signs related to the use of the artifact and the mathematical contents to be learned. In this sense, in both tasks the students managed to articulate the personal meanings with the mathematical meanings, operating a process of semiotic mediation.

This project will continue in the school year 2017/2018.

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