

# The graphing calculator as an instrument of semiotic mediation in the construction of the function concept

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## Introduction

According to some authors, the graphing calculator facilitates the students' ability to reflect and generalize, when involved in performing exploratory tasks, leading them to the construction of mathematical knowledge (Doorman, Drijvers, Dekker, Heuvel-Panhuizen, Lange e Wijers, 2007). We present the resolution of the task: "My hand", with the graphing calculator, whose purpose was to consolidate the concept of function and to understand when a cartesian graph corresponds to the representation of a function. On the other hand, looking at the artifact, the graphing calculator, as a instrument of semiotic mediation, we intend to analyze how the transition from personal meanings to mathematical meanings (Mariotti, 2018) was developed, in the resolution of the task.

## Theoretical Framework

The use of an artifact in solving a mathematical task can provide the emergence of pre-existing student knowledge, which relates to the mathematical knowledge essential to the teaching-learning activity. The teacher can intentionally exploit the semiotic potential of an artifact that translates into the facility that the artifact possesses in associating mathematical meanings evoked by its use, culturally determined, with personal meanings that each subject develops in its use (instrumented activity) in the completion of specific tasks. In this way, the process of semiotic mediation is developed around the notion of the semiotic potential of an artifact and a didactic cycle (Mariotti, 2012, 2018).

## Methodology

This study is framed in a broader qualitative research, following an interpretative approach. The experiment was conducted in the school year of 2016/17, in a class of the 7th grade, with 29 students. In this poster we present the performance of two students, Berta and Maria. The techniques used to collect the data were based on students' written reports, direct observation of the researcher, images of the graphic representations of the graphing calculator screens and logbook (Creswell, 2012).

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## **The task presented to the students: "My hand"**

The task consisted in drawing the outline of a hand using paper and pencil, in a cartesian referential and placing points at choice. The first point had to be equal to the last point, for the line to be closed. Subsequently, each student represented in the graphing calculator, the polygonal line that had as vertices the coordinates of the chosen points. The students had to justify whether the visualized representation was a function and to conclude under what conditions a cartesian graph represents a function. Previously, the students had learned the concept of function and the representation of a function through diagram of arrows and tables. The students individually performed the task with the artifact, the graphing calculator. Afterwards, the individual productions were analyzed, and the collective discussion, managed by the teacher, was developed, promoting the evolution of students' personal meanings towards mathematical meanings (Mariotti, 2018).

## **Analysis of Results**

The graphing calculator, allowed them to visualize another form of representing a function, its graphical representation. The semiotic potential of the graphing calculator, inherent in the visualization capacity and dragging technique (Mariotti, 2012), as well as the collective discussion, fostered the emergence of personal meanings related to mathematical meanings. The student Maria showed evidence that she had mobilized mathematical knowledge learned previously. The personal meanings that arose were related to mathematical meanings learned earlier.

The student Berta showed a certain difficulty in distinguishing the difference between object and image, as well as formally constructing the concept of function. However, these aspects "seem to us" to have been filled with the collective discussion and the insistent orchestration of the teacher. In the poster, the results will be presented in detail.

## **Conclusion**

When learning takes place in the social environment of the classroom, in which individual productions are promoted, resulting from the accomplishment of tasks, using the graphic calculator and later collective discussion, orchestrated by the teacher, it can generate a greater ease in the transition from personal meanings to mathematical meanings.

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