

Mathematical modeling activity in pre-service teacher Education: A case of Mathematical Activity to discovery

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1. Introduction

In Colombia, the mathematical training of students in primary and secondary school has, among other purposes, to recognize the cultural diversity, the need for greater equity levels and individuals able to be have a critic position facing the different social and democratic requirements; hence the mathematical modeling has gained ground as a way to meet these education purposes and, therefore, it is suggested as one of the processes the mathematics curriculum must articulate.

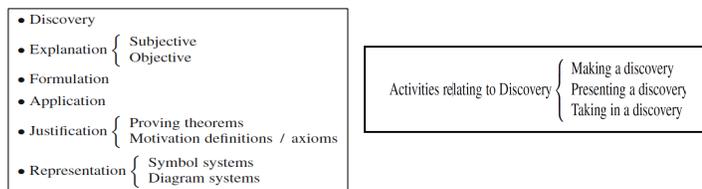
Such realities require the school mathematics to be developed in places consistent with the environment needs; in turn, this situation imposes the teachers and researchers challenges to reveal the nuances and characteristics the mathematical knowledge has in such environments. As a result of this situation, the view on school mathematics should not be focused only on knowledge as a result that must be acquired, but on the ways in which this knowledge can emerge. In that sense, we focused on the *mathematical activity* and we put our minds to develop a study that would allow us to understand some aspects of this activity when it is developed in mathematical modeling environments focused on the interests of modelers.

2. Mathematical Activity. A brief view of literature

In this presentation our intention is not to be exhaustive in characterizing the current international literature on *Mathematical Activity*; therefore, we will only deal with two of the views or contexts to which some researchers refer when they use the term *mathematical activity*:

- Within the *professional mathematicians*, the mathematical activity is addressed to the construction of new knowledge (mathematics), to the creation of new theorems, the construction of ways to prove theorems already proven, the discovery of new relations between mathematical objects, etc. In this sense, the mathematical activity can be referred to the work done by mathematicians and allows "expanding" the existing knowledge.
- Within the *mathematics education context*, where different characters are involved (teachers, students, researchers, etc), the mathematical activity recognizes the ways of using the mathematics at school, and it is related to a more dynamic view of mathematical knowledge in which also takes into account the involvement ways of such characters.

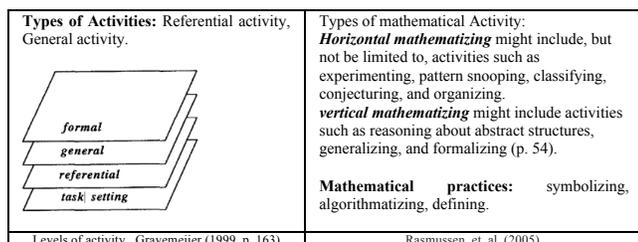
In the first situation, *the advanced mathematics*, some mathematics philosophers such as Giaquinto (2005) have revealed some of the (sub) activities that are implicit in the mathematical activity, namely:



(Giaquinto, 2005, p. 85)

In particular, regarding the *Discovery* activity, the author states there are other three activities related to it; and, in such activities, he assigns roles to mathematicians, teachers, and students.

In the case of Mathematical Education, the term mathematical activity is frequently used, for referring to mathematics as a human and social activity. The term has a meaning that refers to mathematics under construction and not established mathematics, i.e. mathematics where the students are included in its construction.



3. Research Setting

The study included a group of 13 students from a program of mathematics teachers' initial training who were enrolled in their penultimate semester. The students are from a subregion where the economy is based on agricultural production. The students took part in eight working sessions (one per week), the sessions lasted six hours each. Along the first three sessions were discussed some of the difficulties the students had concerning some mathematics topics, and it was observed how the mathematical modeling could be or not a prospect for meeting those challenges through the production of mathematical meanings based on the students' context. Prospective teachers worked together with the teacher-researcher in the mathematical models production that could emerge, e.g. the utility bill. In a (re)view of the activity carried out during this models production, some thoughts emerged about the mathematical modeling possibilities offered both for the mathematical knowledge production and the understanding of the phenomenon itself. In the last part, the students were committed to the development of mathematical modeling processes according to their main interests. Each of the sessions was recorded in audio; field notes about the work sessions were taken and were analyzed the written reports made by the students about their investigation process.

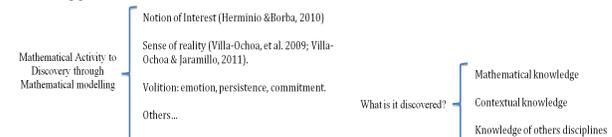
4. Some results

Along the different sessions, the prospective teachers worked on mathematical activities: *the discovery, the representation (realization of the model), communication, justification-validation, among others*. This presentation is based on a description of the discovery activity as the starting point of the mathematical modeling.

Identify the *Mathematical Activity to Discovery* through mathematical modeling, involves being aware of evidence that give clues to the following questions:

- What is it discovered?
- How is it discovered?
- What aspects are involved in this activity?
- What kind of mathematics are involved in this activity?

Some approaches:



5. Final considerations

The term "mathematical activity" is generally focused on the actions carried out by a mathematician for creating mathematics, in turn, these are mainly grounded on the demonstration activity of a mathematical statement. However, a look at the mathematical activity from the mathematical modeling at school requires to focus on the practices and actions (verbs) rather than on the results themselves (nouns). This look at the mathematical activity, imposes a dynamism which is consistent with those visions where the mathematical modeling can be used to promote a process in which formal mathematics is reinvented by the students themselves (Gravemeijer, 1999).

Mathematical Activity to discovery through mathematical modeling is a starting point for understanding the ways in which the modeling processes have their genesis in the students' interests. In that sense, it becomes an input for the development of researches in mathematical modeling; researches that are focused on the mathematical modeling in situations in which the students are invited to participate in the modeling processes (Borba and Villarreál, 2005).

The notion of *Mathematical Activity to discovery* is linked with other ideas such as *Sense of reality* and *notion of interest* that have been concerned for investigating how the men are likely prone to reinvent mathematics through modeling.

References

Borba, M., & Villarreál, M. (2005). *Humans-with-Media and the Reorganization of Mathematical Thinking: Information and Communication Technologies, Modeling, Visualization and Experimentation* (Vol. 39). New York: Springer

Giaquinto, M. (2005). *Mathematical Activity*. In P. Mancosu, K. Jørgensen & S. Pedersen (Eds.), *Visualization, Explanation and Reasoning Styles in Mathematics* (Vol. 327, pp. 75-87). Netherlands: Springer.

Gravemeijer, K. (1999). How emergent models May foster the Constitution of formal Mathematics *Mathematical Thinking and Learning* 1(2), 155-177.

Hermínio, M. H. G. B., & Borba, M. C. (2010). A noção de interesse em projetos de modelagem matemática. *Educação Matemática Pesquisa* ISSN 1983-3156, 12(1), 111-127.

Hermínio, M. H. G. B. (2009). O processo de escolha dos temas dos Projetos de Modelagem Matemática. *Bolema: Matemática Education Bulletin= Bolema: Boletim de Educação Matemática*, 22(33).

Rasmussen, C., Zandieh, M., King, K., & Teppo, A. (2005). Advancing Mathematical Activity: A Practice-Oriented View of Advanced Mathematical Thinking *Mathematical Thinking and Learning*, 7(1), 51-73.

Villa-Ochoa, J. A., Bustamante, C., Berrío, M., Osorio, A., & Ocampo, D. (2009). Sentido de Realidad y Modelación Matemática: el caso de Alberto. *ALEXANDRIA Revista de Educación em Ciência e Tecnologia*, 2(2), 159-180.

Villa-Ochoa, J. A., & López, C. M. J. (2011). Sense of Reality Through Mathematical Modelling. In G. Kaiser, W. Blum, R. Borromeo Ferri & G. Stillman (Eds.), *Trends in Teaching and Learning of Mathematical Modelling* (pp. 701-