



**HAL**  
open science

# Physical and virtual classroom in the learning of mathematics: analysis of two episodes

Agnese Del Zozzo, George Santi

## ► To cite this version:

Agnese Del Zozzo, George Santi. Physical and virtual classroom in the learning of mathematics: analysis of two episodes. Eleventh Congress of the European Society for Research in Mathematics Education, Utrecht University, Feb 2019, Utrecht, Netherlands. hal-02422202

**HAL Id: hal-02422202**

**<https://hal.science/hal-02422202>**

Submitted on 20 Dec 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Physical and virtual classroom in the learning of mathematics: analysis of two episodes

Agnese Del Zozzo<sup>1,2</sup> and George Santi<sup>1,2</sup>

<sup>1</sup> Free University of Bolzano, Italy; [adelzozzo@unibz.it](mailto:adelzozzo@unibz.it), [gesanti@unibz.it](mailto:gesanti@unibz.it)

<sup>2</sup> NRD, Department of Mathematics, University of Bologna, Italy;

*Keywords: Virtual classrooms, didactical contract, Chevallard's triangle.*

## **Purpose of the study.**

The aim of this study is to investigate how a virtual classroom can foster the physical classroom activities in order to create a new learning environment that enhances peer education. The introduction of a virtual space, in addition to the physical one, offers new forms of social interaction that could allow students to overcome their difficulties. This space is available beyond the school time shared in the physical classroom and gives students the opportunity to design it according to their needs, cognitive styles and social practices. Analyzing two episodes, we propose a tentative framework to design an effective implementation of a virtual classroom in the physical classroom.

## **Introduction.**

In a secondary school of Bologna (Italy) where several teachers of different subjects used the G Suite for Education, some mathematics teachers started using [Google Classroom](#) (GC). The following two episodes involved two classes with different mathematics teachers. All the students were acquainted with the basic functions of GC. The first episode happened in a 10th grade class where the teacher proposed GC as a daily tool used by the students to share their questions and doubts with the teacher and the rest of the class. This episode regards the spontaneous behavior of a student who supports her classmates in the solution of an exercise. She shared on the [GC Stream](#) a photo of her notebook (with the solution in pen and some additional comments in pencil) supported by the comment “*I was able to get the right answer. If you want, you can have a look. I added in pencil the passages that I skipped so that you can better understand them*”. This spontaneous behavior of the student inspired a further study for a deeper analysis of the potentiality of virtual classrooms in addition to the physical one.

The second episode regards an experiment carried out with a mathematics teacher available to introduce, for our research, GC in a 12th grade class for a limited period. The teacher proposed GC as a social environment where the students could share their ideas and support each other to overcome their difficulties. An item of a multiple-choice test carried out in the physical classroom highlighted students' difficulties in dealing with the domain of logarithmic functions. The teacher decided to trigger the students' social interaction in the GC to find the correct answer. Therefore, the teacher assigned the same multiple-choice exercise asking the students to answer and compare the results on the Stream. Students posted in the GC Stream only the letter (A, B, C or D) of their answer without discussing the inconsistencies of their results. The students, in the next lesson, admitted that they actually had a debate but on their WhatsApp group avoiding the use of the GC.

After this episode, the teacher decided to use GC only to assign homework and to communicate with the students.

### **Theoretical framework, research questions and methodology.**

This study suggests that the introduction of a virtual classroom requires a didactical design that takes into account the relation between the vertices of Chevallard's Triangle (Chevallard & Joshua, 1982): teacher, pupil, and knowledge. From the two episodes, it emerges that the characteristics of the side pupil-teacher determines the students' interaction with the virtual classroom. In the first episode, the students did not perceive any imposition on the part of the teacher. They felt free to use the virtual space spontaneously. Instead, in the second episode the teacher explicitly invited the students to work on a specific task. We believe that an appropriate theoretical framework for an effective introduction of a virtual classroom is Brousseau's (1997) Theory of Didactical Situations. In fact, the first episode can be interpreted as a non-didactical situation where there is not a specific teaching design. Although the students used the GC as a peer education environment, there was no evolution after the episode we described. The second episode can be interpreted as a didactical situation that constrained the students in the clauses and effects of the didactical contract (D'Amore, Fandiño Pinilla, Marazzani, & Sarrazy, 2018). The teacher had an explicit objective that she declared to her students and the potential of the virtual classroom seemed to be absorbed by the dynamics of Brousseau's Didactical Contract. The students, in the GC Stream, strictly attended the teacher's requests. The inconsistencies of the students' answers emerged on the GC Stream and triggered the expected social interaction but the discussion among students took place on the WhatsApp students' group. This kind of virtual group cannot be considered a true virtual classroom because it discards the teacher from Chevallard's triangle. The introduction of a virtual environment requires the presence of all the actors of Chevallard's triangle. The teaching design should realize an a-didactical situation that fosters personal implication on the part of the students and the breach of the didactical contract. Within this framework, the research questions that inform further studies are: how can we design an a-didactical situation in an enlarged learning environment that includes a virtual classroom entangled with the physical one? How do we manage this new variable, the virtual classroom, when designing an a-didactical situation? Within an effective interaction between the physical classroom and the virtual classroom, what artifacts and Semiotic Means of Objectification could emerge (Radford, 2008)?

### **References**

- Brousseau, G. (1997). *The theory of didactical situations in mathematics*. Dordrecht: Kluwer Academic Publisher.
- Chevallard, Y. & Joshua, M.A. (1982). Un exemple d'analyse de la transposition didactique: la notion de distance. *Recherches en didactique des mathématiques*, 3(1), 159-239.
- D'Amore, B., Fandiño Pinilla, M. I., Marazzani, I., & Sarrazy, B. (2018). *El contracto didáctico en educación matemática*. Bogotá: Editorial Magisterio.

Radford, L. (2008). The ethics of being and knowing: Towards a cultural theory of learning. In L. Radford, G. Schubring & F. Seeger (Eds.), *Semiotics in mathematics education: epistemology, history, classroom, and culture* (pp. 215–234). Rotterdam: Sense Publishers.