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**Reflections on school mathematics experiences:  
Mathematics teaching as a practice of excluding  
students from mathematical culture**

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**Abstract**

This presentation outlines the conceptual framework and reports selected preliminary findings of an ongoing research aimed at tracing main aspects of mathematics teaching practice that is prevailing in Greek secondary schools and spotting characteristics of this practice directly promoting or indirectly reinforcing the exclusion of students from mathematical culture.

Memories of experiences from secondary school mathematics content and the teaching behaviors and pedagogies of their mathematics teachers were collected from 288 prospective kindergarten teachers using a questionnaire.

The conceptual framework for the interpretation of data adopts the Bourdieu's analytic tools of habitus, field and habitant. As a main conclusion, it may be claimed that the habitus of mathematics teaching is a strong contributing factor to the construction of cultural divisions among students so as some students to be included in, and others to be excluded from mathematics culture.

### **1. Background of the study**

This presentation reports the conceptual framework and selected preliminary findings of an ongoing research aimed at, firstly, tracing main aspects of the mathematics teaching practice that is widespread in Greek secondary schools and, secondly, spotting characteristics of this practice which directly promote or indirectly reinforce the inclusion or the exclusion of students from mathematical culture.

Mathematics teaching is understood as a practice that intentionally attends to students' learning of mathematics by attending to the representations of mathematical knowledge, the students' mental processes of knowing, and the instructional media in which teacher and student interact (Cohen, 2011). As exemplified by Herbst et. al. (2010), attending to the representations of mathematical knowledge includes teaching tasks such as selecting embodiments of mathematical ideas, formulating mathematical statements, providing mathematically persuasive explanations, choosing problems for students that promote understanding of target mathematical concepts and more. Attending to the students' mental processes of knowing includes tasks of teaching such as eliciting students' thinking, interpreting students' conceptions and identifying errors, e.t.c., while attending to the instructional media includes a number of diverse tasks of teaching associated with interpersonal dynamics, communication, and the affordances and constraints of the institution where the teaching and learning activities are taking place.

Mathematics teaching practice is widely explored and many research methods have been applied to its investigation. Most of them collect data employing many instruments and techniques, from action research and observation in present time to interviews and questionnaires addressed to teachers or/and students immediately after a sequence of mathematics lessons. Let aside any other validity problems, the data concerning teaching practices which are collected by asking students in current or in the immediate past time may be considered as charged by their momentary and occasional reactions and assessments and thus in some way biased. On the contrary, data collected by students when a long time has been passed which are referring to their memories of mathematics teaching may be considered as more valid being processed and stabilized by personal reflective re-assessment. On this ground, the research reported in this presentation has collect and analyses memories of experiences and reflective assessments of school mathematics teaching as offered by students after two or three years of their graduation from secondary schools and currently being prospective

kindergarten and primary school teachers. Such an approach allows, in my view, not only the tracing of main aspects of the prevailing mathematics teaching practice but also the uncovering of its contribution to the construction of cultural divisions among students so as some of them are included in, and others are excluded from mathematics culture.

In this line of thought, the conceptual framework for the interpretation of our data adopts the Bourdieu's analytic tools of habitus, field and habitant, which offer a theoretical viewpoint to understanding mathematics teaching practices contextualised in educational fields. As described by

Bourdieu, habitus is "*an acquired system of generative schemes objectively adjusted to the particular conditions in which it is constituted*" (1977, p. 95), which, however, it is not only a structuring structure, which organizes practices and the perceptions of practices, but also a structured structure: the principle of division into logical classes which organizes the perception of the social world. (Bourdieu, 1984, p.170). Habitus is "*...necessity internalised and converted into a disposition that generates meaningful practices and meaning-giving perceptions; it is a general, transposable disposition which carries out a systematic, universal application - beyond the limits of what it has actually learnt.*" (Bourdieu, 1984, p. 170). Noyes (2004) argues that "*Bourdieu's central concept of habitus illuminates the mathematics teacher socialisation context because it explains how embodied life history structures classroom practices*". The concept of habitus is dialectically related to the concept of field, which is the social medium whereby habitus comes about and become reconstituted through experiences. In our case the field is school mathematics teaching. Both these concepts, which can only exist in relation to each other, are closely associated to the concept of habitant. Habitant refers to physical and social space wherein the agents, in our case mathematics teachers, are physically sited. The mathematics teachers being physically located in the habitant of school mathematics practice are leaded either to a process of harmonization of their dispositions to those of the generalized other prevalent in that habitat or in dissonance, depending upon the relative social positions of the various agents involved.

So, the habitat shapes the habitus which in its turn shapes the habitat through the social usages that it makes of it. According to Bourdieu (1974, 1989), habitus, field and habitant are the constitutive elements of a complex process through which schooling system regulates the intergenerational transmission of cultural capital, in a way that reinforces the existing social difference and maintains the established unequal social hierarchies.

## **2. Research methodology**

In the research reported in this presentation they have participated 288 prospective kindergarten teachers. A questionnaire constructed containing 30 items which register their memories of experiences concerning secondary school mathematics content and the teaching behaviors and pedagogies of their mathematics teachers. The items of the questionnaire emanate from a content analysis of 80 answers to the following prompt provided by the researcher during one of his lectures to his students being newly graduated from the secondary school: *“please write in a few words the most pleasant and the most unpleasant experience from your secondary school mathematics that they have been impressed in your memory.”* Initial coding of the reported experiences generated a number of positive and negative experiences which were classified in three categories using as a criterion their direct relation to the mathematics classroom. These categories are: pedagogy experiences associated with instructivist or constructivist features of teaching and learning practices, teacher experiences referring to interactions with teachers during mathematics classes and mathematics content experiences. Experiences related to testing and examinations have been included in one of these three categories, according to the related case. Finally, five positive and five negative statements were selected for each category that represented the most frequently occurring experiences and they properly worded as items of the questionnaire. All items were answered on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

## **3. Preliminary findings**

Preliminary findings of this ongoing research are briefly presented in the following with no further comments due to the space limitations in this conference paper. The participants of this research report that new math content has usually not been easy to understand and they had usually difficulties in comprehending math content. Frequently during mathematics classes they got lost and had trouble keeping up in their lessons. They generally have had difficulties relating new mathematical concepts to those they had previously learned and this is remembered as a frustration producing situation, as they consider mathematics a sequentially organized progression of concepts, an idea also emphasized by their teachers.

The content experiences from school mathematics are found to be closely related to their memories of teachers' teaching behavior as well as to

their experiences from their teachers' pedagogies. Most of the participants in this research they report that their math teachers were not, in most cases, patient and supportive in their efforts to learn mathematics and many times they remember them to become frustrated or even derogatory with their students. Many of them they are convinced that their teachers did not spend the necessary amount of time helping them to understand concepts and techniques of mathematics. Furthermore, a significant percentage of the respondents acknowledge that many times their mathematics teachers made them feel dumb in class and most of the students remember that they did not feel comfortable seeking help from their mathematics teachers outside class. At the same time, a significant percentage of the respondents acknowledge they believe that many of their mathematics teachers were competent as mathematicians.

Concerning pedagogies of school mathematics most of the participants report experiences of an instructive model employed by their teachers. Their mathematics teachers used, as a rule, a lecture format in their lessons relied on the chalkboard to present concepts and techniques of mathematics taught, demanded from their students to sit quietly and listen while they were assigned several homework problems in each lesson. Most of the teachers are remembered to focus mainly on memorization of facts, formulas and procedures. Very few of the respondents report that they remember mathematics concepts taught to be connected to real world situations and also very few remember their teachers to use mathematics games to reinforce their understanding of mathematics concepts and procedures.

Finally, not significant differences found in school mathematics memories according to the age of the participants. That is, teaching behaviors and pedagogies of Greek secondary school mathematics teachers are well established and time-independent. It seems that the structuring power of dominant school mathematics teaching practice reproduces the predominant models of mathematics teaching philosophy and pedagogy through the reproduction of teachers' dispositions by processes of their harmonization illuminated by Bourdieu (1984).

#### **4. A final comment**

Bishop (1988) has argued that the learning of school mathematics may be seen as a process of "mathematical enculturation" which aims at the initiation of students into the conceptualization, symbolization and values of mathematics culture. Lerman (2006) associates mathematics enculturation to a process of becoming mathematical, and comments that according to re-

search evidence becoming mathematical can mean different things in different modes of teaching.

From the viewpoint of mathematical enculturation, it may be claimed that the habitus of mathematics teaching is a strong contributing factor to the construction of cultural divisions among students so as some students to be included in, and others to be excluded from mathematics culture.

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