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GEOMETRICAL TEACHERS LITERACY: AN EQUITY INTERNATIONAL FRAMEWORK IMPROVED BY NETWORK DISTANCE COURSES

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Introduction

In order that mathematics educators can help to transform our society, we must guarantee that teachers have access to information and some literacy trends in a way that they can be subjects for changes independently of sociocultural differences. Freudenthal's work (1997) showed that the role of contextualisation is strongly related to the reflective thinking. In our work, we assert that this role should be related to the reflective geometrical thinking. But, how can we help teachers to evolve on geometrical aspects in order to help students to be prepared as citizens who are geometrically literate? What is the role of professional development to foster the necessary evolution on teachers' geometrically based knowledge? Can we prove that realistic geometrical approach are just western "first world" teaching practice? And, if so, why does it happen?

Analyzing literacy literature one can observe that people give a main influence to arithmetics in everyday life and let the geometrical perspective underestimated in this context. In fact, when comparing Spanish and Brazilian school traditions, we can see that there is only a few research studies in Brazil exploring geometry from an everyday life perspective. And, what about the contradiction of having an approach similar to the Spanish one proposed in the new Brazilian National Curricular Parameters (PCN)? Could we argue that sociocultural difference in both countries are so big that we can observe different needs for training teachers, even though curricular issues are so similar?

Many Brazilian teachers who live far from the big centers of teacher training have less opportunities for acquiring and improving their geometrical knowledge than the Spanish ones for many reasons. We assume that the ability of teachers and future teachers to develop better geometrical understanding is an evolving process that present multiple faces. It also implies that we should understand and observe in what stages teachers are and what experiences they have in both countries. Therefore, can technological tools help to promote equity for teacher practice and development in such a way that also improves their students' geometrical citizenship? (Giménez,1997). For that reason, our work has two interrelated main goals. First, to identify and observe teachers beliefs, concepts and practices with respect to geometry. Secondly, to implement teachers geometrical training through the use of internet. Our work analyzes the role of critical aspects of the situated professional knowledge acquired by teachers in different experiences. It answers and also stimulates new questions within the debate proposed by sub-theme 4.

Investigative experiences

Four different cooperative investigative experiences will be discussed in order to confront teachers' geometrical understanding when using technological tools and without them: (a) presential regular course for future primary school teachers at Barcelona University; (b) presential regular course for future secondary mathematics school teachers in Goiânia, Jataí and Seropédica (Brazil); (c) online course for inservice teacher training for junior secondary school mathematics teachers prepared in Brazil and Spain (Bairral, Giménez , Togashi, 2000); and (d) online course for primary school teachers of Bradesco Foundation (Brazil) based on the study of angles. A new course experience that is now in the preparation stage will be specially devoted to the analysis of everyday geometrical literacy.

Geometrical literacy and professional identity

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Through a first curricular comparison between Brazil and Spain we could recognize the needs for observing background differences in mathematical teaching practices in both countries. As an example, we noticed in Spanish schools influences and uses of more popular tesselation ideas and pictures in the study of symmetry. Could this explain the difference observed in Brazilian schools that use ethnomathematical approach to consider only trees, patterns and movements when exploring symmetry? Nevertheless, many teachers can be considered geometrically iliterate in both countries because of the process of constructing similar professional geometrical identities (Dubar, 1997). One characteristic issue is the difficulty that teachers have to become aware of and to notice certain relations between geometry and citizenship. Another one is the limited common cognitive and metacognitive geometrical background of teachers. Let's look at similar answers of Brazilian (BG1-BG3) and Spanish groups of teachers (SG1-SG3) working together to the same task.

Trainer- How to represent the length of our classroom in the piece of paper?
BG1- *We will reduce. Because the scale is 1:100. Then a meter becomes centimeter.*
BG2- *Yes, because if we do not reduce, the paper is not enough. Then, tell me such a reduction. Because we need to reduce the size to represent it in the sheet of paper. Remember for instance yesterday we used 1:100.*
BG3- *Because in this way we can know how it fits the house before it was built.*
SG1- *Reduction. Because we use a scale to represent measurements of the room in the paper. Example: 1:100 → 5 meters into 5 centimeters.*
SG2- *Through a reduction. Because it's difficult to arrange a sheet of paper of about 5 meters, then we did a scale 1:100.*
SG3- *Reduction, because we transform 1 meter into 1 centimeter.*

In another situation, two days later, three groups of teachers said that "*1:200 is two times in 1:100*", making confusion between scale and measurement. Following our data analysis we have observed teachers' reluctance in contrast to students' openness of mind. While students accept creativity situations more freely, teachers do not accept so easily some of them. For example, when exploring geometrical concepts teachers felt surprised with new ideas such as the use of: (a) maps of exit hotel for fire situations; (b) subway networks; and (c) the business chair drawing to explore angle activities. The situation is similar with future teachers who always felt surprised when the instructor asked them to find the angle of a street, and to describe how to calculate it.

Conclusions

The studies revealed the importance of developing meta-strategic and metacognitive components of teachers' knowledge at the online environment (Giménez & Bairral, 2001). In all the investigative experiences, we observed that both cognitive and emotional desequilibrium furnished the main opportunities for promoting professional geometrical development. In general, contextualisation was difficult, and just at the end of the online courses that some short comments and classroom situations were identified by the researchers as displaying evidence of small changes on teachers' beliefs. Furthermore, technological tools provided more equity for changes to happen. Teachers in the online courses are viewed as essential protagonists in the formation of their own professional identity (Dubar,1997) using the specific professional resources (Putman & Borko, 2000) which are appropriate to explore geometrical issues. Nevertheless, online course gave the opportunity for specific geometrical reflections about technological facilities (as CABRI), leading teachers to become researchers of their practices when involved with dilemmas strictly related to teaching practicing.

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