Mathematical Function and Social Representations

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***Abstract*- This paper presented a learning sequence design to an alternative representation construction that allowed students to acquire the function concept through associate meanings such as variable, variation and variability. The study was carried out under the social representation theory.**

Keywords- Function; Central Node; Social Representations; Peripheral System; Variability

I. INTRODUCTION

The design of the learning sequence is built upon notion of variability which arises from a social practice exercised in engineering practices that occurred throughout the eighteenth and nineteenth centuries, and that allowed us to characterize the concept function in a better way [9]. With this meaning related to this concept, we will try to influence the peripheral elements of the student's cognition by placing them in a process of deconstruction and re-contextualization of the concept by self, as shown below. The variable, variation and variability concepts are related to the function, but currently students set aside those two first concepts to learn the third concept, getting a "hole" in their understanding [3].

II. DESIGN

For our research, establishing the theoretical concept of "representation" is important because of its different meanings. We will focus on the social psychology definition of this concept. According to Jodelet [8] a (SR) is: "(...) a form of socially constructed knowledge (...)". The concept appears as a construction and interpretation of the reality. At a scholar environment, the representation is not a behavior of the scholar reality or of their effective social functions, but an original construction. This means a construction process of knowledge-based on social experiences. Supporting this point of view, we have used the "representation" term like "understanding" from some comparative studies that have been carried out [4].

A. Social Representations

The Social Representations Theory (SRT) argues that every representation is organized around a "central node" consisting of one or more elements that give the representation its own meaning, the scientific character of the (SRT). The "peripheral elements" are around the central core performing an essential role in the representation as hierarchical elements, due to they are in interface between the central core and the object itself [2]. They are sensitive to immediate context and allow the integrating of individual experiences, which supports the heterogeneity of the group.

In the construction of knowledge it should be noted that students have prior representations and progressive development of them, leading to an operational level closer to reality providing tools in solving problems. The conceptions in cognitive structuring process evolve and support the knowledge that is being built [10]. It is the teacher, who through speeches and praxis supports the creation of a new concept. Hence the importance of practices carried out in the classroom and beyond.

As predicted by the SRT, the peripheral elements have an advocacy role, however they can be changed (removed, modified, and increased) under the effect of a change in social practices, which, results in a gradual change of the representation, its disintegration or total transformation [9]. In our case, the intention was to include the elements of a variational character in the notion of a function, meaning we contemplate the conditions for a transformation of (SR) proposed by [7], namely:

- It has to be a characteristic event with a high degree of involvement of the group.
- It has to take into account the external circumstances of representation, understood as the physical, economic or social environment in relation to the object of representation, as a result of the previous event changing traditional practices and their relevance.
- That the change in practices by the group be perceived as irreversible, this leads them to reorganize the field of representation.

Changing a (SR) is necessary to break the previous representation, which is sometimes difficult because of the coexistence between the old and new design. In teaching mathematics, this last one will be possible to the extent that the learning sequences are designed to involve students in processes of change:

"(...) mathematical knowledge appears as a social construction, by the fact that the basis of mathematical knowledge (linguistic knowledge with its conventions and rules) is social construction and the fact that interpersonal social processes dialog and criticism are necessary to make subjective mathematical knowledge of an individual in a socially acceptable objective knowledge (...)" [6].

B. Sequence

In the design of the sequence proposed by Beitone (Figure 1) quoted in [5] whose base is the initial social representation that the student has about a particular object, and through a process that includes five stages taken from the (SRT), we were able to add items to the peripheral system,

since we do not want to break the representations that have the subject under study, but increase the elements with variational characteristics to give the subjects a better understanding and application of the concept of function. The design of the situation must be such that allows students to formulate explicative hypotheses (even such that are contradictory), under a process of conjecture-refutation, which emerge in the sensitization phase and rely on their own conceptions. Some of these verbalized hypotheses can be eliminated by the students in their discussion, guided by the by the teacher; this will allow them to get the reconstruction phase.

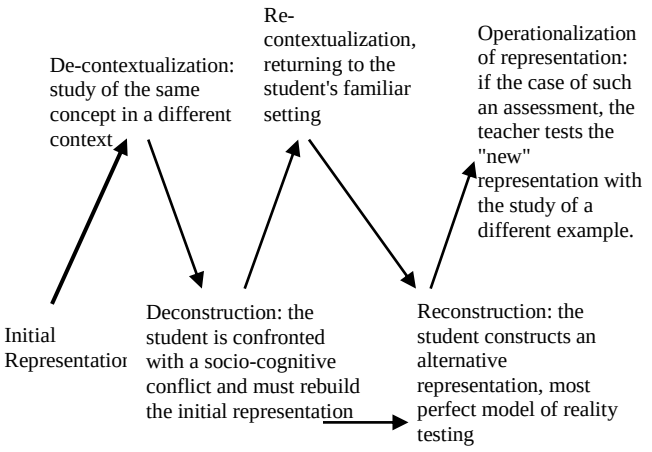

Fig. 1 Sequence proposed by Beitone to change a social representation

The objective of the first Phase of Sensitization is bringing out the conceptions of students and putting them in discussion to formulate a number of assumptions regarding to the necessary criteria for the definition of variable and variation; includes Activity 1 where the teacher describes magnitude, and then gives a definition of variable, and Action 2 where the professor shows how variables change when you move one side of a triangle.

In the De-contextualization Phase (the concept is studied or applied in another situation different from above), the teacher asks the students to brainstorm by discussing the relationship between the variables via increasing or reducing the height of a trapeze.

In the Phase 3: Deconstruction (the student confronted with a socio-cognitive conflict and must rebuild the initial representation), an analytical expression is asked for that showing the phenomenon, further more it includes a second activity for teams of 3 to 4 people to coordinate some ways of representation.

In the fourth phase of Reconstruction (student builds an alternative representation, a more perfect model to analyze the reality), presenting two linking activities among the various ways of representing a function.

Finally, the fifth phase Operationalization (the teacher tests the "new" representation) consists of two activities: exploration and verification in which students must apply the topics viewed and answering questions designed to achieve a connection between the ways of representation of the cases presented, and finally to provide a definition of the function concept involving the associated meanings embedded in the situation.

III. RESULTS

We believe that in (SR), about the concept of function, students integrated the idea of variability in their peripheral system because, in practice, when they were asked to solve a problem, we find procedures that show it applying the "new" contents of these representations. By comparing the student responses about the function concept between a preliminary analysis [11], and the expressions of those to whom the sequence was taught, we note serious differences: the first shows in a sense of dependence of variables, influenced by teachers, textbooks and current personal ideology, however, the responses of the last item are listed as "something that shows all the changes", "what it varies", and the "different instances" where teacher speech talks about the idea of variation.

These results demonstrate and confirm the impact that social practices have on conceptions that are held by a particular object.

IV. CONCLUSIONS

Applying the (SRT) represented a major challenge to our proposal, since the studies made so far do not include handling mathematical object itself, but ideologies about them, or even the application of any methodology in math class [6], or the impact that a (SR) on a mathematical process has in a mathematics classroom with students of different nationalities [1]; or as (SR) that a teacher possesses in a multicultural mathematics classroom including individual environment such as needs, motivation, interests, place of learning and skills, and influences the way of teaching [11]. We show that it is possible to apply the model that itself (SRT) provides for the transformation of a representation, adapting the design of a learning situation which takes into account both (SR), the results of the preliminary analysis by rescuing a concept that has been lost in the evolution of the teaching process or not taken as the key to the construction of the notion of a concept.

The application of the sequence of work, was a phenomenon of progressive evolution of the peripheral elements by integrating new elements from the above (the notions of variable, variation and variability), particularly under the influence of changing classroom practices. About the central core, it is kept, which is not surprising given its stability and resistance to change.

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