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Procedia - Social and Behavioral Sciences 197 (2015) 398 – 403

Procedia
Social and Behavioral Sciences

7th World Conference on Educational Sciences, (WCES-2015), 05-07 February 2015, Novotel Athens Convention Center, Athens, Greece

# A Real Context Problem for Consolidating the Similarity

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**Abstract**

Constructing a new mathematical structure depends on conceptual understanding and connection with previous constructs. For the purpose of obtaining a new mathematical structure, the process of constructing a concept is defined as abstraction. The weaknesses of new structures that are generated create need their consolidation and so consolidation has been added as a step of the abstraction process. The purpose of this case study is to examine the solving process of a real context problem for consolidating similarity of triangles. The participants are two mathematics education master students. Consequently, it has been determined that participants have similarity knowledge theoretical but in order to consolidate it, they have to encounter more real context problems.


Peer-review under responsibility of Academic World Education and Research Center.

*Keywords:*RBC+C, abstraction, consolidation, real context problem, similarity

## 1. Introduction

It is frequently stressed on the importance of real context problems in mathematics teaching and learning. The National Council of Teachers of Mathematics [NCTM] in its Standards (NCTM, 2000) articulated and promoted a view of mathematics teaching and learning where students solve real-world problems set in meaningful contexts, communicate their ideas in appropriate mathematical language and symbolism, make conjectures and justify their solutions. Additionally, students should have opportunities to make connections between what they do in the classroom and their daily life, and connect different representations of mathematical concepts so that they view

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Peer-review under responsibility of Academic World Education and Research Center.
doi:10.1016/j.sbspro.2015.07.155

mathematics as an integrated whole rather than a series of seemingly unrelated ideas.

In association with real-world math problems in mathematics education increases the importance of mathematics for students. Secondary School Mathematics Curriculum suggests using real context problems and carrying out modeling activities during education process (MEB, 2013). Mathematics program in our country has been made in reconstruction by adopting constructive approach in recent years. In this context, the importance of research on the transition among the world of mathematics to the real world is increasing.

Mathematizing is a bridge between the real world of the situation and the mathematical world of the model. An example of mathematizing is a student creating a variable expression (a property or part of the mathematical entity) to represent the time required to complete a real-world action (a condition or key piece of the real-world situation) (Zbiek & Conner, 2006). Abstractions can articulate what different situations have in common, they can mediate between the problem solver and new situations to which the abstractions appear to be applicable. Abstraction can be said to enhance the transfer of previously learned knowledge or abilities, on the basis of the perceived analogy among situations (Reeves & Weisberg, 1994).

Hershkowitz, Schwarz, & Dreyfus (2001) characterized abstraction as a process that takes place in a complex context that incorporates tasks, tools, other artifacts, personal histories of the participants and also in social and physical settings. Abstraction in Context is a theoretical model with three observable epistemic actions: Recognizing, Building-with and Constructing–the RBC-model. According to the model constructing incorporates the other two epistemic actions in such a way that building-with actions are nested in constructing actions and recognizing actions are nested in building-with actions and in constructing actions. The authors mention the importance of consolidation of the newly emerged structures and by adding the consolidation process the model called RBC+C model. Consolidation of a construct is likely to occur whenever a construct that emerged in one activity is built-with in further activities. These further activities may lead to new constructs. Hence consolidation connects successive constructing processes and is closely related to the design of sequences of activities (Dreyfus & Kidron, 2014).

According to Dreyfus and Tsamir (2004) the genesis of an abstraction passes through: the need for a new structure; the construction of a new abstract entity; and the consolidation of the abstract entity through repeated recognition of the new structure and building-with it with increasing ease in further activities. They put emphasis on consolidation. Tsamir and Dreyfus (2005) explained the characteristics of consolidation as follows: Immediacy refers to the speed and directness with which a structure is recognized or made use of in order to achieve a goal; self-evidence refers to the obviousness that the use of a structure has for the student; obviousness implies that the student feels no need to justify or explain the use of the structure, though (s)he is able to justify and explain it. Self-evidence is directly related to the confidence or certainty with which a structure is used. Confidence refers to be sure about activity and not to be in doubt. Frequent use of a structure is likely to support the establishment of connections, and thus contribute to the flexibility of its use. A student may be quite proficient in using a structure, even using it flexibly, but without being consciously aware that s(he)is doing so. The awareness of a structure enables the student to reflect on related mathematical and instructional issues, add to the depth of her or his theoretical knowledge and power and ease when using the structure.

Most of the researches on abstraction in context analyzed the Recognizing, Building-with and Constructing actions (Hershkowitz, Schwarz, & Dreyfus, 2001; Dreyfus, Hershkowitz, & Schwarz, 2001; Kidron & Dreyfus, 2010) several research effort has been invested in investigating the consolidation process (Dreyfus & Tsamir, 2004; Tabach, Hershkowitz & Schwarz, 2006; Monaghan & Ozmantar, 2006; Dreyfus, Hadas, Hershkowitz & Schwarz, 2006 ) and in terms of characteristics of consolidation (Dreyfus & Tsamir, 2004; Tsamir & Dreyfus, 2005).

Dreyfus and Tsamir (2004) developed an empirically based, theoretical analysis of consolidation that emerges from a sequence of interviews about the comparison of infinite sets with a talented student. Their analysis showed that consolidation can be identified by means of the psychological and cognitive characteristics of self-evidence, confidence, immediacy, flexibility and awareness. They proposed to take the combination of five characteristics as definition for consolidation. Tsamir and Dreyfus (2005) investigated how stable or fragile consolidated knowledge may be. They showed that under slight variations of context, knowledge structures that have apparently been well – consolidated may become inactive and subordinate to more primitive ones. Dreyfus, Hadas, Hershkowitz and Schwarz (2006), investigated that constructing processes and consolidating processes are often narrowly intertwined. With the aim of identifying mechanisms for consolidating recent knowledge constructs they analyzed