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When communication tasks become tools to enhance learning

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Abstract

Effective communication in the classroom is a key element for learning, yet when and how future teachers should acquire such competence is not clear. In this article we explore students–prospective teachers' written productions of a set of instructions in a learning situation. Through three emblematic cases we illustrate how a communication task focused on a partner selected by the student reveal snot only the student's domain-specific knowledge, but also a mental frame induced by an assumed paradigm, which is both constrained by the student's knowledge level, and purpose oriented by the need of successful social interaction.

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1. Introduction

Investigating in-service and pre-service teachers' strategies for task adaptation, Pelczer, Singer and Voica (2011) noticed that (future) teachers often provide rote procedures and skill-based practice problems in order to ensure their students' short term success in a test (exam)-driven approach. However, students-prospective teachers who develop and implement small scale educational projects during their training manifest a reflective attitude towards teaching and learning (Voica& Singer, 2011). Starting from these research outcomes, we exposed students-prospective teachers to a communication-adaptation task in which they had to communicate effectively a set of instructions.

Mathematical activities build on the use of different semiotic representational systems and require the fluent switch between them (Duval, 2006). This switch is mediated by language and a profitable effect on learning can be obtained by valuing language and mathematics computational properties that our minds naturally share (Singer,

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2008). In general, in communication, the shared context complements the communication with personal elements and references so to make sense of a certain statement. In order to facilitate students' acquisition of the mathematical language, and to integrate it into the general linguistic ability, it might be relevant to create situations where a shared context is missing and the message has to be self-content in order to be understandable; in such a situation, the student is forced to use a commonly adopted, formal mathematical language and precise specifications. In the case of geometry, Duval (2005) argues that at least two different registers need to combine: a verbal register for describing the statements related to a figure, and a visualization register.

Our main interest lies in exploring the potential difficulties encountered by students when they switch registers in order to formulate clear instructions for a third person who does not share the teaching and learning context. We hypothesize that the way of writing the instructions and the changes students make on their first elaborated versions along their own experiment might give an indication on the students' understanding of the topic and can be used as a lever to improve this understanding.

2. Theoretical framework

Our theoretical framework builds on the work of Duval (2005) concerning the functions of a drawing in the context of a geometrical task and the work of Houdement and Kuzniak (2003) concerning geometrical paradigms. Duval (2005) distinguished between iconic and non-iconic visualizations, as opposed ways of cognitive functioning. We put these in a social-constructivist framework of learning (Singer &Moscovici, 2008).

In iconic visualization the drawing is a compact element that is perceived as a whole. Non-iconic visualization is a sequence of operations that allows the recognition of a series of geometrical properties (Duval, 2005). This visualization requires three types of decomposition processes: instrumental (allowing the identification of elements such that the figure can be constructed with tools), heuristic (splitting the shape into parts that can be recombined into the original), and dimensional (breaking the figure into lower dimensional figural units).In addition, Duval (2006) argues that at the core of mathematical comprehension is the coordination of multiple registers and that the inability of such mediation is the source of difficulties for students.

Houdement and Kuzniak(2003)state the idea that elementary geometry can be seen as split into three kinds of geometry: Natural Geometry (G1), Natural Axiomatic Geometry (G2), and Formalist Axiomatic Geometry (G3).G1 concerns material objects and relies on experience and intuition as ways of reasoning. G2 is the study of ideal objects and the reasoning relies on a system of definitions, axiomatic constructions and the rules of logic accepted in the system. G3 cuts any relation to the real-world – it is based on a complete system of axioms that is independent of any real-world referent. The difficulties encountered by students and teachers in passing from G1 to G2 are more evident when the starting points in tasks are real-world objects, yet their exploration requires an abstract description.

3. Method

The data presented in this paper come from a group of students-prospective teachers in year two of their undergraduate studies at the Faculty of Mathematics and Informatics of Bucharest, who followed a Didactics of Mathematics course for one semester. The paper focuses the students' activity and results for a communication task. More precisely, students were presented with the image of Figure 1a, and a "box" which could be obtained from it (Figure1b.). The assignment consisted of the following three steps.