Chapter 9

Assessing Authentic Intellectual Work in Mathematics Tasks

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ABSTRACT

This paper reports an analysis of the tasks included in the Mathematical Challenges book. The analysis was based on the proposals of the Authentic Intellectual Work (AIW). The purpose of the study focuses on assessing the potential of the mathematical challenges to promote in-depth and meaningful learning through the connection with different contexts, and other features including purpose, multiple-solution pathways, construction of knowledge and higher order thinking. Participants in this study were 3 elementary school teachers, 2 mathematics specialists and the authors of this paper; they assessed the Mathematical Challenges through a questionnaire based on specific rubrics. The study used a mixed methods approach. The analysis produced two main findings. First, challenges vary in their connections to students’ lives according to the context they come from. Second, almost all mathematical challenges are related to the highest levels of others AIW criteria.

INTRODUCTION

Tasks are essential for any learning processes. Students’ academic achievement is influenced by what happens in the classroom, by the interaction of teachers and students with the curriculum through learning tasks. However, it has been asserted that many of the tasks teachers offer to their students as part of the educational processes tend to focus on issues that do not stimulate active learning, since they require students to perform isolated exercises (Newmann, King & Carmichael, 2007).

Newmann and Wehlage (1993) note that in most classrooms it is possible to identify two persistent problems in relation to the type of tasks that teachers suggest students carry out: a) tasks that do not...
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capitalize students’ learning potential and emphasize lower order thinking skills; and b) the lack of intrinsic meaning or value for students. The latter point means that tasks are only important for school context, and could be characterized as fictitious situations that could not represent a practical use outside the classroom.

These problems have also been recognized in the Mexican educational system. In order to face them, the current official curriculum has emphasized the importance of implementing tasks that promote meaningful and in-depth learning for students (SEP, 2011). Regarding mathematics education, a new official textbook series, “Desafíos matemáticos” (Mathematical Challenges), has been widely distributed with the aim of supporting the accomplishment of curriculum objectives. Indeed, it has been stated that its aim is to “support teaching practices and provide both teacher and students with attractive, useful, mysterious and clever mathematical challenges” to solve (SEP, 2012b, p. 7).

Free and widely distributed textbooks in Mexican basic education, printed by the Ministry of Education, have been found to be the main resource that guides teaching practices in other subjects (Larios, 2001; Shield, 2012). This means that teachers in their classrooms frequently implement tasks suggested in these textbooks; it also means that textbooks are seen as the most important tools in guiding teachers’ teaching. They are thus a major teaching tool and important learning experiences for students (Van den Heuvel-Panhuizen, 2000, p. 10)

Accordingly, the purpose of this paper is to analyze the tasks suggested in these textbooks, particularly their potential to promote in-depth and meaningful learning. Criteria developed by the pedagogical perspective of Authentic Intellectual Work (Newmann & Wehlage, 1993; Newmann, Marks & Gamoran, 1996; Newmann, Lopez & Bryk, 1998) was used in the analysis of the tasks proposed in the “Desafíos matemáticos” textbook for sixth-grade in elementary school. This perspective postulates that tasks that have a value beyond school, which promote knowledge construction and are carried out through disciplined inquiry, lead to meaningful learning for students and improve their achievement.

Newmann, Lopez and Bryck (1998) argue that tasks tackled by students in their classrooms are the most direct evidence of their learning opportunities. Classroom activities were not analyzed in this project, however; since textbooks are an important reference for teaching practices, the tasks included in them might eventually become classroom activities.

The following research questions guide this study:

1. How are Mathematical Challenges related to students’ contexts?
2. What type of thinking skills do Mathematical Challenges require from students to solve them?
3. In which way do Mathematical Challenges promote collaborative work?

A mixed methods approach was used to answer the research questions, since the analysis of data requires both qualitative and quantitative techniques. The unit of analysis was each Mathematical Challenge included in the textbook.

LITERATURE REVIEW

In the last decades, the Mexican Educational System has gone through educational reforms aimed at improving education quality. These reforms have involved the adoption of approaches and methodolo-