
Colloque de l'unité de recherche éducationnelle en mathématiques
Mathematics Educational Research Unit Symposium

Perspectives on the role of context in the learning and teaching of mathematics / Perspectives du rôle du contexte dans l'enseignement et l'apprentissage des mathématiques

Canadian mathematics curricula encourage both elementary and secondary school students to connect mathematical ideas to contexts outside of mathematics as a way of deepening their understanding of mathematics. The Ontario mathematics curriculum, for example, states:

Making connections between the mathematics they learn at school and its applications in their everyday lives not only helps students understand mathematics but also allows them to see how useful and relevant it is in the world beyond the classroom. (OME, 2005, p. 16)

This idea raises many questions concerning the relationship between school mathematics, students' 'everyday lives' and 'the world beyond the classroom' (see, e.g., Cooper and Dunne, 2000; Nunes, Schliemann, Carraher, 1993; Nyabanyaba, 1999; Staats, 2007; Van Den Heuvel-Panhuizen, 2007). A key issue that lies behind many of these questions is that "students interact with the context of a task in many different and unexpected ways and that this interaction is, by its nature, individual" (Boaler, 1993, p. 16). The first objective of this symposium, therefore, is to share research that explores some of the unexpected, individual ways that students interact with the context of a mathematics task. The interaction between context and mathematical learning is, however, highly complex and challenging to analysis. The second objective of the symposium, therefore, is to illustrate different theoretical perspectives that can fruitfully shed light on different aspects of the role of contexts in the learning and teaching of mathematics. Specifically, these perspectives are sociocultural theory, semiotics and discursive psychology.

Real world contexts, abstract examples, and mathematical reasoning

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To encourage students to make connections between mathematical ideas and to connect them to contexts outside of mathematics, educators and resource developers create problems in "real-world" settings with the assumption that such contextually rich problems deepen students' mathematical understanding. But do they? Research into the effects of real world contexts suggests a more complex picture (Boaler, 1993; Kaminski, Sloutsky & Heckler, 2008; Koedinger and Nathan, 2004; Roth, 1996). In this presentation we explore learners' mathematical reasoning as they engage with two categories of mathematical problems: those developed with a real world context and those problems where the context is the mathematics itself. We orient our work within sociocultural theory that understands cognition as situated, distributed and embodied and provides a framework for describing the actors, interactions and mediators (Cole, 1996; Lemke, 1997; Leon'tev, 1978; Vygotsky, 1978, 1986, Wertsch, 1991). The data come from videotaped classroom observations of grade 5 students in problem-solving discussions. The findings suggest that meaningful contexts that support mathematical reasoning arise in the dynamic interactions of learners as

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they engage with the mathematical ideas rather than with the real world situation.

Contexte de la modélisation algébrique au secondaire

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Durant le processus de modélisation mathématique d'un phénomène physique, l'élève doit passer d'un cadre de rationalité physique à un cadre de rationalité mathématique mobilisant des registres sémiotiques différents. Dans cette présentation, nous allons soulever les problèmes de discontinuité et de rupture des registres sémiotiques (Duval, 1995) inhérents à un changement de cadre de rationalité (Lerouge, 2000) lors d'une activité de modélisation algébrique. Pour ce faire, nous allons situer les activités cognitives de traitement, de conversion et de coordination dans le processus de modélisation mathématique d'un phénomène physique. En nous appuyant sur les recherches de Malafosse, et all. (2000-2001), nous allons démontrer que lors d'un changement d'un cadre de rationalité à un autre, les structures des registres sémiotiques sont instables et discontinues. Dans le contexte actuel de l'enseignement des mathématiques, «les enseignants se placent généralement dans l'hypothèse de continuité des registres sémiotiques entre les mathématiques et la physique, ce qui met les élèves dans l'illusion de continuité quand on change de cadre disciplinaire» (Malafosse, et all., 1999).

The discursive construction of contexts and mathematical thinking

Richard Barwell (University of Ottawa)

Word problems represent a common way in which context is introduced into school mathematics. Word problems have been extensively problematised, however, from a variety of perspectives, including linguistic (e.g. Gerofsky, 1993), sociological (e.g. Cooper and Dunne, 2000) and mathematical (e.g. Verschaffel et al, 2000). As Boaler (1993) implies, however, it is not the problem per se that does or does not provide a (meaningful) context; rather it is the thinking and talking that goes on around the problem. In this paper, I draw on discursive psychology (e.g. Edwards, 1997; Edwards and Potter, 1992; Edwards and Middleton, 1986) to analyse one extended example of two students writing and successfully solving an arithmetic word problem. One of the main (epistemological) aims of discursive psychology is to analyse how cognitive processes, such as mathematical thinking, are produced and deployed in interaction. From the perspective of discursive psychology, reality is discursively produced and interpreted and is situated within the unfolding moments of interaction. Hence the real world contexts of word problems and their interpretation are discursive accomplishments. My analysis of the transcript I have selected focuses on how the two students' mathematical thinking is in part constructed by the students in relation to their joint construction of their own real word context.