

Working Group 9: Educating Secondary Mathematics Teachers / La formation des enseignantes et enseignants du secondaire

ELAINE SIMMT, LUIS RADFORD AND HARLEY WESTON, University of Alberta, Université Laurentienne, University of Regina

How can our awareness of the cultural and cognitive conditions of mathematical knowledge genesis and development help us to enhance our teaching and learning practices? The purpose of this group was to address the practical question of the role of psychology, epistemology and history of mathematics in teacher education programs. The working group was split into 3 sessions to address: some of the assumptions underpinning mathematics teacher education; educating awareness in mathematics teacher education; and looking forward to find ways of expanding the possible in teacher education.

Comment la connaissance des conditions culturelles et cognitives de la genèse du savoir mathématique et de son développement peut-elle aider à améliorer la démarche pédagogique en salle de classe? Ce groupe se penchera sur la question pratique du rôle de la psychologie, de l'épistémologie et de l'histoire des mathématiques dans la formation des enseignants.

Session 1: Assumptions currently underpinning mathematics teacher education/ Suppositions contemporaines sous-tendant la formation des enseignantes et des enseignants de mathématiques

Teacher education programs across the country are diverse. From after degree programs which require an undergraduate degree with a specialization or major in mathematics to Bachelor of Education programs where students take mathematics courses from **didacticians**. It appears that, for the most part, the mathematics courses include algebra, calculus, number theory and geometry and offered by the mathematics departments in relatively traditional formats. There are a few universities that have begun to reform some of their standard courses— Brock for example with the integration of technology. However, it appears that much of the exposure to technology that prospective teachers would encounter would appear in education courses rather than the traditional mathematics courses. Absent from most programs is a requirement for students to study the history of mathematics and the philosophy **or epistemology** of mathematics. Notable exceptions with respect to courses in the history of mathematics are SFU and UQAM. From our conversation it appears that the curriculum and methodology courses have been influenced and are underpinned by constructivist philosophies of epistemology. We speculate that these may be the only courses which address issues of the nature of mathematics knowledge and knowing and it is not clear how deep these courses address such issues or whether these courses are simply underpinned by particular philosophies.

Session 2: Educating awareness in mathematics teacher education/ Apprendre à prendre conscience dans la formation des enseignantes et des enseignants de mathématiques

By the end of the first day we had identified some common components of teacher education programs in Canada. However the discussion did reveal that there are differences and maybe significant deficits in our programs. In particular, lacking from most programs are courses focused on the history and philosophy or epistemology of mathematics. At this point it is important to note that one person in our group suggested that pre-service teachers maybe needed more time in schools working with mentor teachers rather than more time in university courses.

On the second day we began the session by trying to create a common experience from which we could base our conversation on possibilities for secondary teacher education. We did this by considering how textbooks from over a period of 50 years introduced and addressed the topic of integers. Implicit in these textbooks are views of what is important and how learners learn. Within the group individuals identified and expressed their own implicit (maybe explicit) philosophies of mathematics knowledge and learning. From those of us who believe that it is useful to teach integers from the perspective of their historical development to those who suggested that concrete experiences either taken from students lives outside of school or created within the classroom through the use of various manipulatives and models to those who understood integers as an extension of the whole numbers and took a set theory oriented 'modern' approach to the teaching of integers where only addition and the additive inverse are needed for operating on integers. This diversity in a very small working group illustrates how significant our personal and communal perspectives are when we make decisions for teaching. In none of these school resources did we find discussions on the history of integers and their significance within mathematics.

The central question addressed on the second day was the practical pedagogical benefits of our awareness of the cultural and cognitive conditions of mathematical knowledge genesis and development.

It was argued that the answer to this question depends on the theory of knowing and learning framing our pedagogical actions. Different underpinning theories may conceptualize differently the link between phylogenesis and ontogenesis. The discussion of this question led the group to another question: Do we think that teachers need to know some elements of the cultural and historical conceptual development of mathematics? The general answer was of an affirmative kind. However, when reasons were provided, differences were noticed. Some reasons focused on the role of culture in cognition. Other reasons were more epistemologically oriented.

Session 3: Expanding the space of the possible in mathematics teacher education/ L'expansion de l'espace du possible dans la formation des enseignantes et des enseignants de mathématiques

The purpose of the third session was to offer participants an opportunity to rethink possibilities for pre-service teacher education courses or programs. An issue that arose was the desire to have information on the variety of mathematics education programs across the country, as well as on the mathematics curricula used in different provinces and territories. Our group offers this challenge to CMS and hopes that it is taken up in the future.

Within the working group session, one participant used the expression “Teachers think they’re baked” when they finish university. In other words, on completing their degree, many teachers feel that they have learned all they need to know and are “finished products” ready to take on the task of educating children youth in the field of mathematics. Yet our experiences as teachers and teacher educators has left us with the knowledge that teachers are not “baked” when they leave teacher education programs. Indeed there is a need for the mathematics teacher to continue to learn. The catch phrase “life-long learning” is of particular relevance to teachers. Another challenge for CMS is to rethink the kinds of opportunities that are available to facilitate life-long learning.

A desire was expressed to find ways of building a community of learners that would involve in-service and pre-service teachers, mathematics education faculty, and mathematics faculty. Math Central hosted by the University of Regina was offered as an illustration of the kinds of support that can be offered to both pre-service and in-service teachers and mathematics students themselves. Such a service also builds bridges to the public and to life-long learners.

Over the three days this working group explored some of the existing and possible practices that serve to both inhibit and facilitate the education of secondary school mathematics teachers. In our view, CMS has a role to play in gathering information and in providing vision for mathematics education.