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TA

Thematic
Afternoon A

TA A: Teachers of mathematics: Recruitment and retention, professional development and identity

Team Chairs: *Glenda Anthony*, Massey University, Palmerston North, New Zealand
Mellony Graven, University of the Witwatersrand, Johannesburg, South Africa

Team Members: *Barbro Grevholm*, Agder College¹, Kristiansand, Norway
Toshiakira Fujii, Tokyo Gakugei University, Japan

Introduction

The focus of this Thematic Afternoon – mathematics teachers – reflected the renewed research interest in mathematics teachers and teaching noted by several of the plenary speakers at ICME-10: The Survey Team, chaired by Jill Adler, reported increased research on teacher development, learning and associated curriculum reform. Anna Sfard also noted, in her talk, the change of research focus from learners to teachers. The acknowledgement of the central role of teachers in students' learning of mathematics has encouraged research to consider more closely the nature of the teaching demands, the ways in which teachers manage these demands in the realities of their classrooms (Stein, 2001, Strässer et al, 2004). With respect to mathematics reform in particular, studies include: investigating teachers as learners, a more critical examination of the pre- and in-service development provisions and the associated formation of teacher identity. Research presented in the Thematic Afternoon reflected this closer examination of the professional formation of teachers. The papers², offering a variety of theoretical frameworks and models, highlighted the collaborative nature of emerging research methodologies.

Recruitment, supply and retention of mathematics teachers

The issue of recruitment, supply and retention of mathematics teachers was addressed by contributions from England and Sweden. The small number of contributions offered for this strand is possibly indicative of the relative scarcity of related research. Collective concerns were the decrease in the number of students studying mathematics courses, the quality of mathematics teachers' qualifications, and teacher attrition related to work conditions and aging teacher populations. Contributors argued that all of these issues impacted on the quality of teaching within schools. An additional concern raised by *Johnston-Wilder* (TA, 2004) related to difficulties of engaging teachers in 'out of school' curriculum development projects. Schools, faced with difficulties finding relief teachers and fears of teachers not wanting to return to school after project involvement, were becoming increasingly reluctant to release quality teachers for curriculum development projects.

Solutions offered within the English context to address recruitment included changes in schools to address workload issues, the adoption of an entitlement of continuing professional development (*Zhang*, TA, 2004), and diversification of routes to qualified teacher status, including flexible training options. *Angier* (TA, 2004), reporting

¹ Now Agder University.

² Papers referenced by (TA, 2004) refer to the Thematic Afternoon presentations and are available on the ICME-10 website (www.icme10.dk/) programme page.



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on the experiences of students completing a flexible Post Graduate Certificate in Education, claimed that such courses may make little impact on recruitment numbers. However, on a positive note she argued that the impact of flexible pedagogies may better equip teachers to “enjoy the complexities and challenges of teaching” and thus improve teacher retention. Using a similar strategy involving changes in initial teacher education programmes, *Thunberg* (TA, 2004) reported a Swedish initiative to combine engineering and teacher training culminating in a double diploma qualification involving practicum experiences in both schools and science centres.

Pre- and in-service education of mathematics teachers

The need to understand and support with appropriate professional development all stages of the teacher professional learning continuum – pre-service, induction, early career, and experienced – was advanced in several contributions within this strand. *Van Zoest* (TA, 2004) posited that the third stage, approximately years 4-7 in a teacher’s career, may well be a time of experimentation and consolidation that shapes the future teacher.

In light of current reforms the need for effective teacher education and increased knowledge about what and how teachers might learn was a central issue addressed by several papers. While some of the papers provided examples of ways in which progress is being made, others also highlighted challenges still to be addressed. *Sztajn, White, Hackenberg, and Alexsah-Snider* (TA, 2004) emphasised the need to develop trust within professional development programmes: trust between the facilitators and the participants. *Van Zoest* warned that the quest for the ideal model of professional development needed to be clearly linked with outcomes, arguing that we need to more clearly understand and articulate the nature of transformation in teachers’ knowledge, understandings, skills and commitments. In this respect, *Morony* (TA, 2004) considered the potential of recently developed professional teaching standards (AAMT, 2002) as a tool for professional development and *Baber* (TA, 2004) noted the role of professional teacher associations in developing “networks of learning”.

Contributions also highlighted the various models of teacher education across the international spectrum. A study by *Peterson* (TA, 2004) compared expectations of pre-service practicum in both Japan and US. Cultural differences at a discipline level were also highlighted within *Groves’* (TA, 2004) discussion of integrated curriculum studies. Initially introduced as a response to a crowded curriculum, the integrated curriculum studies course compounded growing concerns about the adequacy of time available to support mathematics education within initial teacher education. Continued reports such as *Groves’* are needed to monitor this trend and are clearly linked to the wider issues of teacher knowledge expressed in the parallel strand.

Professional development using distance learning and associated technologies was explored by *da Ponte* (TA, 2004). Within the virtual community, the strong presence of collaboration and reflective writing led *da Ponte* to question the impact on teachers’ professional identity: the fundamental roles, norms and values of the mathematics teacher.

Missing from this strand were studies that focused on the early years of teaching. Given the concerns expressed about retention of mathematics teachers there appears to be much scope for studies that examine the nature and effectiveness of support for beginning teachers.



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Mathematics teachers' identity

Contributions in this strand interpreted the issues related to mathematics teachers' identity in many ways, and from a range of theoretical perspectives. Some papers raised issues that mirrored discussions on teacher recruitment, particularly in relation to the potential disjunction of identities and related images of the mathematics teacher:

Alignment with the mathematics community – in the sense of doing well in your degree and taking on the characteristics of a mathematical person – may well be at odds with alignment to school teaching. (Rodd et al., 2003, cited in *Winbourne*, TA, 2004).

Thornton (TA, 2004), provided an official version derived from teacher input of teachers' identities (AAMT, 2002). Integrating the standards document into assessment and portfolio tasks, Thornton argued that the signposts and guidelines enable student teachers to effectively map their developing teacher identity against a vision of what it means to be an excellent teacher. Likewise, *Wilson* (TA, 2004) provided observations on teacher excellence in relation to a sense of self in terms of motivation, commitment and feelings about teaching. However, both *Proulx* (TA, 2004) and *Parker* (TA, 2004) challenged the use of pre-designed official identities. Proulx suggested that student teachers appropriate teacher education programs in unique ways – their identities continuously unfold as new opportunities and possibilities are realised. Based on a series of interviews, Proulx provided a range of characterisations of pre-service teacher as 'Technician', 'Mimic', 'Self-assured', 'Reflective practitioner' and 'Natural teacher'. Applying Bernstein's theory Parker argued that local teacher identities emerge within specific pedagogic contexts as a 'form of consciousness' embedded in the social practices of a community. Within the context of South Africa Parker discussed the duality of identity formation experienced by novice teachers: that of a mathematics teacher and a mathematics learner. Also mindful of the multiplicity of identities, Winbourne applied Wenger's (1998) theory of participation with the notion of 'figured worlds' (Holland et al., 2001) to develop a theory of identity formation within a community of practice.

The question of how the emerging work on teacher identities might be usefully used within teacher education was a recurring focus. Reflection on the characterisations offered in the papers was seen as a positive way of increasing student teachers awareness of the development of identity, not only enabling teachers to become the teacher they want to be, but also being able to articulate and justify this.

The mathematical competency of teachers

Today, in a climate of reform, many teachers are being asked to teach in ways that are very different from how they learned, and the expectations of teacher knowledge often outstrips that which teachers, especially those in generalist roles, can confidently realise. While acknowledging the many factors involved in effective teaching, the papers in this strand addressed the central role of teacher knowledge, both in terms of classroom practices and issues of competency related to expectations of professional standards. Case studies (e.g., *Christiansen*, TA, 2004; *Kaldrimidou, Sakonidis, & Tzekaki*, TA, 2004) focusing on the complexity of the teaching process highlighted the importance of effective teacher scaffolding, interactions and the creation of space and time for student learning. Explorations centred on teachers' ability to 'notice' – to have a sense of when something happens that can carry the learning forward – and the nature of interventions



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in relation to student difficulties and errors. Kaldrimidou et al. noted the need to focus on the subject-matter structure within lessons, claiming an interplay between the epistemological organisation of the mathematical content and the organisation of the mathematics classroom.

While the majority of papers focused on mathematical knowledge and pedagogy, Forgasz (TA, 2004) presented research from the Australian context indicating the need to address teachers' beliefs. Reviewing studies from a range of school sectors Forgasz noted that despite changes in contemporary students' beliefs about the gendering of mathematics (Leder & Forgasz, 2002), gender-stereotype expectations remain prevalent among teachers, especially in relation to the interaction of technology and mathematics.

Assessment of teachers' competency is increasingly becoming a focus of government agency within a range of countries. Fraser and Morony (TA, 2004) discussed the AAMT *Teaching Standards Assessment Evaluation Project* aimed at the development of a process for acknowledging outstanding teachers. Assessed through a portfolio and interview, knowledge of students, knowledge of mathematics and knowledge of students' learning of mathematics all contributed to the professional knowledge domain. Concerns about pre-service teachers' mathematical knowledge base were also addressed in several papers (e.g., Oh, TA, 2004; Arvidson, TA, 2004). Amoto (TA, 2004) reported an action research project involving pre-service teachers' exploration of a series of children's activities. Increases in mathematical understanding were attributed to the unlearning and re-learning process that facilitated student teachers ability to work backwards from their symbolic ways of representing mathematics to more informal representations.

Conclusions

The papers in the thematic afternoon provided a snapshot of the issues and directions that we as a community are concerned with. This focus on mathematics teachers, their knowledge, their identity and their learning will play a critical role in ensuring quality teaching and effective learning of mathematics. However, the papers also indicate gaps and questions still to be addressed. Despite advances in our research capability and increased focus on reform teaching practices, there remains the interminable challenge to provide equitable mathematical access to all children irrespective of culture, ethnicity, gender, economic and social positions.

The panel debate triggered important questions from participants, such as "We talk about 'beneficial, efficient, excellent, improve, change, develop' without making clear what we mean by these words. Teachers are not good but need to become good. Do we know what we are aiming at?" Future research needs to listen to such questions and try to include them and address them in the work.

This challenge makes issues of recruitment, teacher education and retention of quality teachers all the more pressing. Using a metaphor of teachers "cleaning the path on which they walk" van Zoest (TA, 2004) reminded us that the journey to reform is difficult and exhausting. For example, within current reforms in South Africa, Parker (TA, 2004) argued that the focus on mathematical practices (e.g., investigating, making conjectures, justifying, generalising etc.) and on making meaning, rather than simply skills and product, has created new demands on mathematical competencies to teachers. Within this context, teachers need to develop new images of 'good practice' for mathematics teaching and new pedagogic identities. Although our research efforts must clearly

be directed to making the pathway less hazardous, it is evident that we must be patient in our efforts to reach the destination. The interest expressed and generated in this thematic strand bodes well for the forthcoming ICMI Study: *The Professional Education and Development of Teachers of Mathematics*.

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This report was written by Glenda Anthony and Barbro Grevholm They will be happy to be contacted at g.j.anthony@massey.ac.nz and barbro.grevholm@uia.no for further information on the work of this Thematic Afternoon.



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