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## TA B: Mathematics education in society and culture

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### Introduction

In this theme the focus was on the complex relationships between mathematics education, society and culture, and it had four sub-themes:

1. Multilingual and multicultural classrooms: Increasing diversity
2. Mathematics education within and across different cultures and traditions
3. Social and political contexts for mathematics education
4. Equity in mathematics education: Culture, gender, and social class.

Within the entire programme structure for this ICME, there were several other programme items which dealt with themes and issues close to those of Theme B, for example, TSG 25 Language and communication in mathematics education, and TSG 26 Gender and mathematics education, among others. However, in the perception of the IPC, it was the task of Theme B to depict the entire *problématique* in relation to mathematics education in science and culture, whereas the other programme elements will address special aspects of that *problématique*.

The four sub-themes which the IPC for ICME-10 determined for this Theme represent significant growth areas, and so, as each of the sub-themes involves both research and development, the aims of the Theme B afternoon were:

- To highlight current foci of research and development in each sub-theme.
- To demonstrate and contrast the various approaches that researchers and developers are currently using.
- To allow practitioners at all levels to engage with, and critique the latest developments in these sub-themes.

The afternoon's program was organised around the four themes, and there were three papers selected for each sub-theme. Their summaries follow:

### Sub-theme 1:

#### Multilingual and multicultural classrooms: Increasing diversity

In the first paper, *Leo Rogers*, from Roehampton University, Surrey, UK, gave a talk entitled "Multicultural classrooms in 4 European countries", in which he described a Comenius Project on teaching and learning mathematics during the transition from primary to secondary school (pupils aged 9 to 14). This project involved UK, Italy, Cyprus and the Czech Republic; and he noted that these countries are experiencing the effects that ethnic 'minorities' are having on their school population. As school classes become less culturally homogeneous, methods of teaching mathematics have to be re-examined. From their experience, the control of the curriculum, and any modifications that teachers may see necessary, have to confront the political ideologies of the governments concerned.



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The second paper in this sub-theme was by *Yun and Tina Zhang*, and was called “The influence of culture and parental guidance: a case study of a group of Chinese students in England”. International comparisons of the mathematical competence of secondary school students have shown that Chinese pupils achieve a higher level than their English counterparts. Some research findings have suggested reasons behind this, in areas including pedagogy, social and cultural factors, and teachers’ knowledge of mathematics. So the Zhangs considered in their talk what happens when Chinese students attend the same schools as English students. They found that the students’ group was a rather selective one, where the parents were willing to spend a great deal of time discussing their children’s school education and helping them with their homework, even to the extent of being able to teach their children Mathematics up to Advanced-level. This was truly unusual in the UK.

The third paper in this sub-theme was by *Alan Bishop* and was called “Immigrant students in transition: dilemmas and decisions”. Being an immigrant school student in a new country is a difficult matter. Language problems predominate, compounded by not knowing which other students to trust in the school, not knowing the school rules (except that you know there are likely to be many school rules), and not knowing the teachers. As well as their own self-imposed pressures to survive in the new environment, there are pressures from their parents who may be ultimately dependent on their ability to earn money for the family. These social pressures are exacerbated by the cultural conflicts experienced by every immigrant person, but particularly by immigrant students. In the talk Bishop explained the particular problems revealed by secondary school mathematics students because of the predominantly cultural nature of mathematics education.

## Sub-theme 2:

### Mathematics education within and across different cultures and traditions

In Sub-theme 2, the first paper was by *Jerry Lipka, Barbara Adams, and Ferdinand Sharp* of the University of Alaska, Fairbanks, USA and *Nancy Sharp*, from the Southwest Region School District, Alaska, USA, and was called “Connecting out of school learning to school mathematics: qualitative and quantitative data from Alaska.” The talk explored the implementation of a culturally-based mathematics module in one Yup’ik Eskimo teacher’s classroom. The development of this module connected Yup’ik cultural activity with school based geometry, and it showed how Nancy Sharp, the Yup’ik teacher, developed a classroom space that connected her home culture to the culture of schooling in some unique ways. On the project’s pre- and post-tests this class performed better than average. She effectively used modelling and joint activity as a means of teaching geometrical relationships as students learn to fold and cut geometrical patterns out of paper.

The second paper was by *Charoula Stathopoulou*, from the University of the Aegean, Greece, entitled “Mathematics education as an acculturation process: the case of a Romany student group in Greece”. She supported the argument that whenever we refer to students from minority and marginal groups, we can only talk about mathematics education as an acculturation process. More specifically she examined the phenomenon of school failure by a Romany group of students in a Greek school in Athens, in relation to their cultural particularities and the cultural conflicts that occur within the school as well as in the classroom. She also expanded the argument about how these cultural conflicts

are connected with equivalent cognitive conflicts and how they influence the learning of mathematics more generally. For the purposes of this project she relied on ethnographic material, some of which she reported at the conference.

The third paper in this sub-theme was by *Victor Zinger* from University of Alaska Southeast at Ketchikan, USA, and was called “Key issues of teaching mathematics to Alaska Native students”. Victor shared his experience in using the state-wide exit examination (High School Graduation Qualifying Exam-HSGQE) as a valuable and flexible tool to increase the effectiveness of learning and understanding mathematics by native students. He argued that the implementation and further development of the teaching program he described, with classroom practices based on the teacher’s cultural awareness, wide usage of culturally sound mathematics with high expectations, understanding, and community involvement would help eliminate the performance gap of the native students on the HSGQE, and increase their overall level of understanding.

### Sub-theme 3:

#### Social and political contexts for mathematics education

In Sub-theme 3, the first paper was by *Frank Davis*, Lesley University, Cambridge, MA, USA and was entitled “The Algebra Project – social movement and educational intervention”. This talk was about the work of the Algebra Project, Inc., founded by Robert Moses, a noted civil rights activist and mathematics educator in the USA. The talk described the project’s work as both facilitating a social ‘movement’ and mounting an educational intervention. However, these two faces of the project raised different types of evaluation and research questions that are difficult to link. Davis analyzed this difficulty through the idea of ‘communities of practice’, and suggested that a distinction should be made between practices aimed at engineering a solution to an educational problem or creating a new design, and practices aimed at intervening within a current set of practices, or what can be characterized as finding the “what works” solutions.

The second paper in this sub-theme was “International and global contexts in mathematics education: friends or foes?” by *Bill Atweh*, of the Queensland University of Technology, Australia. This paper presented firstly various arguments about the pros and cons of the international and globalised contexts of mathematics education. He also summarised some findings arising from a research study with mathematics educators in many countries on internationalisation and globalisation of mathematics education. Finally Atweh proposed a model of social justice as a useful tool to study international collaborations in mathematics education in global and international contexts. This model involved consideration of the four constructs of Aid, Development, Multiculturalism, and Critical Collaboration.

The third paper in this sub-theme was by *Lena Licon Khisty* from the University of Illinois at Chicago, USA, and was called “Language diversity and language practices: Why should mathematics educators care?” In this paper she discussed the nature of academic discourse and its connection to academic socialization processes and competence in mathematics particularly for linguistically diverse students. She argued that to understand development is to understand the relationship of how language is used in classrooms, which cultural language is used, and how students participate within the language structures. Two studies were reviewed to highlight these ideas. It was suggested that these concepts are crucially linked to effective instruction of mathematics with linguistically diverse students, if they are to be full participants in their respective societies.



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#### Sub-theme 4:

#### Equity in mathematics education: Culture, gender, and social class

For Sub-theme 4, the first paper was by *Marta Civil* of the University of Arizona, USA and was called "Lessons learned from research on the intersection of culture, social class, and mathematics education: implications for equity." This paper drew on research aimed at connecting school mathematics with everyday experiences in low-income, Latino / Hispanic communities in the Southwest of the USA. The author discussed the challenges in developing school learning experiences in mathematics that acknowledge and build on the resources and experiences from the community. Some of these challenges have to do with the different values and beliefs associated with different forms of knowledge and how these differences influence the implementation of certain forms of mathematics in school. There are two groups of people who played a key role in the research approach used: the teachers (i.e., what support mechanisms are needed to help teachers implement these culturally-based teaching innovations?) and the parents (i.e., what do we mean by viewing parents as intellectual resources?).

The second paper was by *Maitree Inprasitha* from Khon Kaen University, Thailand, and was called "Reforming the learning processes in school mathematics in Thailand with an emphasis on mathematical processes." This talk centred around three themes:

- 1) to investigate learning processes in school mathematics of elementary and junior high school students using open-ended problems,
- 2) to construct a model for developing students' learning processes by implementing open-ended problems and meta-cognitive strategy, and
- 3) to disseminate the developed model to mathematics teachers in the Khon Kaen provincial areas.

The third paper in this sub-theme was by *Marcelo Borba*, of the State University of São Paulo at Rio Claro, Brazil, and was called "Social dimensions of internet based distance mathematics education in Brazil". In the education community in Brazil at large, positions have emerged that oppose the haste and superficiality of the distance courses compared with the face-to-face courses. In this presentation the author showed that distance education is important for a country that has 75% of the GNP in just one part of the country. He also showed data about how Internet-based continuing mathematics teacher education is already taking place in Brazil, and he discussed the problems and possibilities of this modality of education as means of mitigating social inequality.

#### Conclusion

The brief descriptions above give little indication of the depth of the papers, and of the interesting discussions which followed in the small group sessions which were organised especially to enable the participants to interact with the speakers. It was exciting and revealing to see the range of social and cultural contexts in which the current research is being carried out, as well as the different foci of the studies. Each paper, as well as each sub-theme, indicated promising agendas for further research. They amply demonstrated the potential and significance of this research area for enabling greater numbers of learners to benefit from a relevant mathematics education instead of suffering and failing under a socially irrelevant and culturally exclusive one.



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