

# **Cultural differences and the teaching of proof for all**

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## **Aims**

Two aims will guide the work of the symposium: coming to a better understanding of cultural differences in the teaching of proof, especially as they relate to access to learning about proof in different cultural contexts, and discussion of the need for universal access to instruction in proof and proving.

## **Rationale**

While mathematical reasoning is given a central role in mathematics education worldwide there exist substantial differences in curricula and educational practices across and within countries. For example, in Germany there are different curricula for different types of schools and not all curricula include proof and the teaching of proof. In parts of Canada the same curriculum applies to everyone, but lower achieving students are not expected to prove. In France there is just one curriculum for all students; but differences exist in French schools concerning the role, the form and importance of mathematical reasoning and proof. Such differences are apparent whenever education systems in different cultural contexts are compared.

Some factors that might relate to these differences on a national level include differing priorities and opportunities in rich and poor countries, different philosophical histories in Eastern and Western culture, and the influence of linguistic structures on reasoning patterns and the role of reasoning. Within countries variations occur regionally, in public and private school systems, in urban, suburban and rural areas, in different types of public schools (e.g., in Germany and China), and in areas with students from mono-cultural or multi-cultural backgrounds. Even within a single school of classroom differences can occur, related to the backgrounds of students (e.g., poor or rich, academic or non-academic families, or by class) and the way they have been classified by the school system (e.g., "gifted" or "non-gifted").

Work has been done on describing differences in mathematical achievement and curricula across cultures, but there are issues in both the way such comparisons have been done and used, and in the attention (or lack of it) paid to proof and proving, that suggest that more work is needed on cultural differences in the teaching of proof.

Studies such as TIMSS focus on differences in mathematical achievement and the production of "league tables" comparing national scores. This means that their results can be used to support efforts to reduce education policy to a service for business and market forces and to view education as a tradable good with an exchangeable value. They can also nurture the myth of the possibility of global education standardisation and hence to push convergence of curricula

across cultures. This can lead to the undervaluing of diversity in teaching, with negative implications for efforts to use culturally appropriate approaches to support the learning of students from varied social and cultural backgrounds (Keitel 2000).

There is also a gap between research on social and cultural issues, and research on proof and proving. Proof and proving are rarely mentioned in discussions of social and cultural influences on teaching and learning, except occasionally in a stereotypical way presenting proof as a uniquely European/Western practice that supports an image of mathematics as authoritarian and culturally blind. It is equally the case that research into proof and proving rarely addresses social or cultural differences. Results from work with students from specific background in specific cultural contexts is often treated as if they apply generally.

This symposium will bring together educators from a range of cultural contexts with insights into practices in a wide range of milieus in order to promote exchange and communication. We seek to create a context for the acknowledgement of cultural diversity and different cultural, social and political contexts, beliefs and attitudes; the valuing of the teaching traditions of countries and cultural/social groups that have not, as yet, had any voice in education, and the promotion of the goal of "education for all".

Two central questions arise from consideration of the above issues:

To what extent are practices advocated in one context are suited for other contexts?

Should all students have access to instruction in mathematical reasoning, proof and proving?

Differences between cultures raise the question to the extent to which practices advocated in one context are suited for other contexts (see, e.g., Kai-Ming 2000). For example, teaching of proof in France and the US has emphasised argumentation in a "debate" format (Balacheff, 1991;Krummheuer, 1995), but this format seems to be unsuitable in contexts like Japan where open disagreement is discouraged (Sekiguchi & Mayazaki). This symposium will provide an opportunity for discussion of the relation of the role of proving in mathematics to larger cultural contexts.

That all students should have the opportunity to learn to prove is by no means universally acknowledged, and even when it is, the implications of such a goal are not fully explored. For example, access to instruction in proof and proving might look different for lower v higher achieving students, students from mono-cultural v multi-cultural backgrounds, students from academic v non-academic families and students classified as "gifted" or "non gifted". Given such differences, what does the claim for a need for universal access to instruction in proof and proving imply? What kind of goals and practices do we envisage? How might this conflict with other goals of mathematics education (e.g., emphasis on "real-world" mathematics problems and applications)?

## How the symposium will be conducted

The symposium is planned to occur over two sessions. Prior to MES 3 information will be shared by the organisers and prospective participants about the teaching of proving in contexts with which they are familiar. This will be done via the Web. Early in 2002 the organisers will call for contributions and provide examples of short written descriptions of practices with which they are acquainted. From this information a summary of differences in practices will be generated and the sessions at MES will open with exploration of the reasoning behind these differences. This in turn will provide a basis for discussion of the extent to which expectations for the teaching of proving can be extended across cultures, and the implications this has for comparisons of achievement and movement in people between cultures.

The information gathered and the discussions of the symposium will be summarised after MES on a Web page, both to make the findings of the symposium available to a larger audience, and as a focus for a network of collaboration on this and related topics.

## References

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