Some historical moments in the ICMI history of formation of mathematics teachers
Barbro Grevholm, University of Agder

The historical development of mathematics teacher education

In trying to discern some general trends over 100 years in the development of mathematics teachers we could say that it went

• from training to education, a professionalisation of the mathematics teacher
• from teacher college or pedagogical seminar to university, an academization or an inclusion in the university system of the education
• from education for an elite to education for all, a massification of education with consequences for teacher education
• from experience based to research based, from valuing skilled practice to theoretical professional knowledge

The tension between the academic foundations of mathematics teacher education and well grounded experience in what constitutes a good teacher is visible in many documents over the years. Already in one of the early reports ordered by ICMI and written by Loria in 1933 we find formulations about this. He says, in a free translation, that in the preparation of future teachers you must distinguish between the scientific preparation and the professional preparation (Loria, 1933, p. 9). The education of teachers is seen as consisting of two separate parts, the scientific part, which has to be the mathematics education at university and the professional part, which probably means what was seen as the more practical knowledge that is specific to the profession of teachers. Later, in the same report, Loria explains what is included in that part and describes it as the techniques the future teacher needs. Thus this part was not seen as scientific knowledge but as techniques, procedures for the professional acts of the teacher. The professional preparation of the technique of future professors includes pedagogy and its history, psychology, history of teaching, legal aspects of schooling and similar things (ibid, p. 13). The report intended to give a picture of the structure and design of teacher education in some countries around the world and indicates that ICMI showed interest in teacher education from its very beginning. The report by Loria was based on reworking of results of a questionnaire initiated by ICMI in 1915, which was first reported in L’Enseignement Mathématiques, 17 nr 1. The study was called ‘Inquiry into the training of teachers of mathematics in secondary schools in the various countries’ (ibid, 1915).

The terminological shift from talking about teacher training to teacher education is also an indication of the change to a profession. Training again indicates practical knowledge while education is more general. This has in some countries happened parallel to the move of teacher education from a teacher college or teacher education seminar into the universities. This academization has then lead to the demand that teacher education must be research based as all education is at universities. Important changes in society have often been going on at the same time such as the democratization of the general education. In most societies in the developed part of the world nowadays the same kind of education is offered to all pupils for at least nine years of schooling. In many countries this is true for up to twelve years. What we could call a massification of education has been taking place and today most professions demand a long education, often at university. Many simpler practical professions do not exist any more in the modern society. For teacher education this has lead to a more demanding situation. To teach all children from a year group means that the teacher has to deal with a heterogeneous group of pupils and make some efforts to individualise the teaching and learning. It also means that the demand for more teachers is growing at the same time as the work of the teacher is becoming more difficult.
The growing societal demands on schooling and teachers have lead to the situation that the profession of mathematics teacher is not a popular choice of work. It seems as if young students try to avoid becoming a teacher (see e.g. Ceretkova). (In this paper references given with only a name refer to paper contributions to the working group 2 in the Rome symposium, see list at the end of the paper). One new social aspect is that many societies are getting more multicultural and this fact increases the demands on the teacher. Tensions between groups in the population might add to the problems teachers experience here.

We have also seen the changes in the structures of mathematics teacher education (see e.g. Bjarnardottir). The division between practice and theory has changed and the demand for research based teacher education has been emphasised more and more, also as a consequence of the growing body of research knowledge about teaching and learning mathematics. Other historical perspectives were also present in working group 2 (Malloy).

Glimpses about mathematics teacher education from ICME congresses over the years

Documentation from ICME1 in Lyon in August 1969 was published in Educational Studies in Mathematics, volume 2 (1969-70). Among papers that related to teacher education we find for example one by Bent Christiansen called ‘Induction and deduction in the learning of mathematics and in mathematics teaching’ (pp. 139). Delessert is writing about ‘De quelques problèmes touchant à la formation des maîtres de mathématiques’ (pp. 245).

The presentation by Ed Beagles (pp. 232) ‘The role of research in mathematics education’ is also of interest for teacher education. He gives one example of a study where low achieving students were offered much more time for their studies but otherwise the same as other students. The outcome was that these students could achieve as well as or even better than the normal group of students. Such knowledge must be highly relevant for teacher education. Interestingly, also in the same volume of ESM but not from ICME1, we find in a paper by Genzwein, with the title ‘The system and organization of further training for the mathematics teachers of secondary schools in Budapest’. Here we read: “In order that teachers may perform their duties well, they should have a clear picture of what the time in which they are working wants. Only then will they be in a position to recognize adequately the demands in which the tasks and the character of their age manifest themselves.” (pp. 419). The message is clear that the teacher must be highly aware of the demands of the time he is working in and try to meet these by adapting the content of the mathematics teaching to these demands. Still a number of papers are dealing with questions related to mathematics teaching in school. Thus the interest in teacher education and the work of teachers was much in focus from the very first ICME congress. Resolution nr 4 of the congress dealt with teacher professional development. It states that the rapid development of the content and methods of mathematical education makes it necessary for the teacher of mathematics to be given opportunities to pursue further professional study during his employment (ibid, p. 416). Actually, resolution number 5 is also interesting, although it only indirectly concerns teacher education. It states that the theory of mathematical education is becoming a science in its own right, with its own problems both of mathematical and pedagogical content. The new science should be given a place in the mathematical departments of Universities or Research Institutes, with appropriate academic qualifications available (ibid, p. 416). Such development would create opportunities for mathematics teachers to carry out professional development in these mathematics departments in both the subject and the didactics of the subject. The vision still remains to come true.

At ICME2 in Exeter a working group was devoted to ‘Research in the teaching of mathematics’.
In the proceedings of ICME3 in Karlsruhe 1976 we find (Athen & Kunle, 1977 on pages 194-201) a text on ‘The training and professional life of mathematics teachers’. According to this text there was unanimous agreement to recommend to the Executive Committee of ICMI that “the training and professional life of mathematics teachers should be accepted as a permanent theme for future congresses” (ibid, p. 201). The question of what mathematical training future mathematics teachers should receive produced divergent views. There were those who advocated ‘mathematics for teachers’ with emphasis on those aspects of mathematics which featured in school courses; others pointed to the position of mathematics teachers as members of the mathematical community and felt that two different types of mathematics do not exist. This is likely to remain an unsolved question, but one that required continuous examination (ibid, p. 200).

Thus here we see an embryo of the current discussion about content knowledge and pedagogical content knowledge or mathematics for teaching, MiT (Adler). The didactic divide visible in the document from ICMI still exists and is the object of concern (Bergsten & Grevholm, 2004).

The proceedings also report from an Exeter working group 26 (p. 315-321) named ‘Initial training of primary (elementary teachers)’. This report contains mainly practical and concrete guidelines and advices for teacher training with lists of suggestions.

In the report from ICME5 in Adelaide (Carrs, 1986) we find Theme group 2 ‘The professional life of teachers’ (p 146-158). The group had five sub themes, emphasising some aspects of teachers’ professional life. The sub themes were ‘Using research, Inservice teacher education, Computers and inservice education, Becoming an effective teacher, and Social contexts and philosophies that affect teachers’. More research was asked for in several of the sub themes. From this we can for example conclude that teachers were expected to use research as one source for their knowledge and skills.

Topic area 2 called ‘Research and teaching’ (p 284-292) was organised by Bent Christiansen, Denmark. The overall purpose of the meetings in ‘Research and teaching’ was to contribute to the exploration of frames, forms, and content of systematic cooperation and interaction between the researcher and the teacher in the classroom. Some quotations from the report:

“The researcher produces knowledge but the teacher has to produce decisions and actions within his/her professional activity.”

“...interviewing children should be part of the content of pre-service teacher education. It is within the classroom that the teacher has to support the learners’ construction of mathematical meaning and concepts.”

“The role of the researcher in these projects was to raise questions, to assist teachers in generating their own questions, and finding answers which were manageable in the classroom.” (pp. 284)

Thus the roles of the researcher and of the teachers are seen as different and we can not yet find the co-learning agreements between teachers and didacticians that are mentioned today (Jaworski, Fuglestad, Bjuland, Breiteig, Goodchild & Grevholm, 2007). And the idea of interviewing children as part of the teachers’ research in the classroom is not new (Berg), but has been suggested before.

The proceedings from ICME6 in Budapest reveals a Theme 5.7 called ‘Profession of teaching’ (Lux, 1988a).

On page 87 Susie Groves from Australia writes in her contribution Problem solving in teacher education: “While many teachers have embraced the call to include problem solving as a central part of the mathematics curriculum, the exhortations of the past 20 years have largely fallen of deaf ears. This is not surprising when one considers the training and experience of teachers of mathematics”. (Lux, 1988a)
Jan Nel from South Africa writes: “The traditional and often implicit assumption that mathematics teachers should merely know more mathematics at advanced levels in order to secure their competence in the teaching of mathematics at the secondary level, is reconsidered.” His presentation was about Curricula for the education and training of secondary level mathematics teachers (Lux, 1988b, p. 28). Curricula at all levels were in focus in the congress in Budapest.

At ICME8 in Seville there is a text on ‘Conceptualizing the professional development of teachers’, written by among others Thomas Cooney from USA (Alsina et al, 1998, p. 101). Among other things he says: “Most mathematics educators are involved with teacher education in some way. The teachers may be at the preservice or inservice level and they may be oriented toward elementary, middle, or secondary schools. Regardless of their status or level of teaching most teachers participate in some form of teacher education design to promote ‘better teaching’ however we define that term. As such, teachers are learners.”

We also find 'Some considerations on problems and perspectives of inservice mathematics teacher education’, by Konrad Krainer (p. 303).

Kath Hart from UK expressed herself like this: “What responsibility do researchers have to mathematics teachers and children?” Further she claimed: “In many countries there is little ‘Mathematics Education Research’. Repeatedly we are told that it has little influence on what happens in the classroom. Perhaps this is because it is insufficiently relevant to the classroom, non-generalisable and liable to concerned with theory building.” (Proceedings ICME8, p. 405)

Thus both professional development and further mathematics teacher education was of interest in this congress.

At ICME9 a working group lead by Peter Sullivan was devoted to mathematics teacher education and parts of that work has resulted in a book based on contributions to the group. At ICME10 in Copenhagen a survey team presented an international overview of research on mathematics teacher education. The survey team reported from a recent study carried out on research on mathematics teacher education (Adler, Ball, Krainer, Lin, & Novotna, 2005).

Some issues in the report are related to teacher educators’ professional work. The authors claim that the differences between teacher educators and their ‘learners’ are increasing, that is between prospective and practicing teachers. We are dealing with different kinds of under-preparedness, a phenomenon that extends into the education of practicing teachers.

Teachers need support if the goal of mathematical proficiency for all is to be reached. The demands this makes on teacher educators and the enterprise of teacher education are substantial and often under-appreciated. These, in turn, shape the context in which research on mathematics teacher education is developing. (ibid., p. 361)

The team also reports that ten years ago there was very little research on processes of mathematics teacher education. (ibid., p. 362). They ask in the report what research in the field is contributing to the improvement of the education of teachers of mathematics. In trying to explain why many studies in the field are small scale studies and longitudinal studies following teachers over time are lacking, they claim that research in teacher education is often more complex since it deals not only with the beliefs, knowledge and practices of teachers but also students’ beliefs and knowledge, as well as with the interaction between teachers and students, and the interaction between teacher educators and teachers. (ibid., p. 369)

In addition to the demands mentioned above, the report points to the fact that mathematics teacher educators’ professional responsibilities include both research and teaching. Research is seen as one aspect of teacher educators’ professional development. This kind of
research is also an important part of teacher educators’ learning to improve their practice (ibid., p. 371). Teacher educators have a double role of intervening and investigating, which means that they have to both improve and understand their own practice. The issue of nearness and distance in research is raised in the report. More external research is needed on teacher education and external eyes must be invited to gaze in with the teacher educator in what he/she is doing.

What we notice here is that not only teacher education but also the teacher educators are objects of research. The lack of longitudinal studies was emphasised.

An ICMI-study number 15 took place in 2005 in Águas de Lindóia in Brazil and the work focused on research in mathematics teacher education. The proceedings from this study will appear in 2008.

Concluding remarks
The evidence above clearly indicates that issues about teacher education and teachers’ work in the mathematics classroom have been concerns of ICMI since its start a hundred years ago and continues to be so. We also see that the ICME congresses have always contained a number of important parts in the programme about mathematics teacher education. Keeping in mind the important role of mathematics teachers for the learners in school this is not surprising. Difficult questions and issues in teacher education have been discussed but not resolved and more work is waiting for future efforts of mathematics educators.

References
Enseignement Mathematiques, 17 nr 1 (1915). Inquiry into the training of teachers of mathematics in secondary schools in the various countries, 60-65 & 129-145.


**Papers for working group 2**

**Jill Adler** Empirical and theoretical reflections on researching mathematics for teaching in mathematics teacher education

**Solange Amorim Amato** Student teachers and teacher educators’ pedagogy under construction

**Glenda Anthony** Beginning mathematics teachers’ professional learning

**Claire V. Berg** Mathematics student teachers as participants in a research project: the emergence of critical thinking

**Kristín Bjarnadóttir** Societal demands on the profession of the mathematics teacher in Iceland in a historical context

**Werner Blum & Stefan Krauss** The professional knowledge of German secondary mathematics teachers: Investigations in the context of the COACTIV project

**Janete Bolite Frant & Antonio Mometti** The role of theories in and for the awareness of practice: A case of teaching Calculus at University

**Hilda Borko & Karen Koellner** Situativity: A theoretical lens for designing and studying programs of professional development

**Rita Borromeo Ferri** Insight into teachers’ unconscious behaviour while dealing with mathematical modelling problems and implications for teacher education

**Soňa Čeretková** From John Amos Comenius to COMENIUS Projects

**Olive Chapman** Self-study in mathematics teacher education

**Fiona Ell** Preparing teachers who can improve student learning in mathematics – researching new qualifications

**Ruhama Even** Learning to connect professional development for teachers and change initiatives in school mathematics

**Elham Kazemi** Investigating and supporting teacher learning by attending to the coevolution of participation across settings

**Karen Koellner & Hilda Borko** Professional development that supports the development of teacher knowledge: From design experiments to full-scale evaluation studies

**Donna Kotsopoulos & Susan Lavigne** Teachers’ assumptions about student “learning paths”

**Peter Liljedahl** Teachers’ beliefs as teachers’ knowledge

**Nicolina Malara** Crossed critical reflections as a way of promoting teachers’ awareness and improving their professional development
Carol E. Malloy  A historical perspective on the preparation of mathematics teachers in the areas of student diversity and the education of disadvantaged students
Xin Ma, Richard Millman & Matt Wells  A self and peer assessment intervention in mathematics content courses for pre-service elementary school teachers
John Mason  Notes towards WG2
Denise S. Mewborn  Learning to teach as assisted performance
Francesca Morselli  High school pre-service teachers’ beliefs about proof: some reflections for & from a training course
Shweta Naik  Mathematics teacher education in India – demanding change and reform in teachers’ professional development
Michael Neubrand  Knowledge of teachers – Knowledge of students: Conceptualizations and outcomes of a mathematics teacher education study in Germany
Erkki Pehkonen  Problem solving in mathematics education in Finland
João Pedro da Ponte  Mathematics teacher education and professional development
Jérôme Proulx  Mathematical knowledge, mathematical culture, and mathematics teacher education
D. Potari, T. Zachariades, C. Christou & D. Pitta-Pantazi  The relationship between teachers' mathematical knowledge and teaching in Calculus
Bettina Rösken, Klaus Hoechsmann & Günter Törner  Pedagogies in action: the role of mathematics teachers’ professional routines
Jeppe Skott  A cautionary note – is research still caught up in an implementer approach to the teacher?
Orit Zaslavsky  What knowledge is involved in choosing and generating useful instructional examples?
Leading figures included Pythagoras and Theano, the first female mathematician in history. Read the full story here.

Measuring the Earth with a rod. World map by Gerard van Schagen (1689). Several centuries later, the Greek mathematician Eratosthenes was able to calculate the Earth's diameter using a rod stuck in the ground and the rule of three. And he did it several centuries before it was demonstrated that the planet is round. Read the full story here. Mathematicians and history of mathematics are not in the standards for high school math or the mathematics tests. I think that answers why they aren't taught. Instead, the standards include things like: factoring, completing the square, directrix of a parabola, quadrilaterals inscribed in circles, medians of a triangle meeting at a point, trigonometric sums and differences. History in Mathematics Education book. Read reviews from world's largest community for readers. This text investigates how the learning and teaching of m... Resulting from an international study on behalf of ICMI (the International Commission of Mathematics Instruction), the text draws upon evidence from the experience of teachers as well as national curricula, textbooks, teacher education practices, and research perspectives across the world.; Together with its 300-item annotated bibliography of recent work in the field in eight languages, the book provides firm foundations for future developments. History of mathematics. Quite the same Wikipedia. Just better. History of mathematics. From Wikipedia, the free encyclopedia. A proof from Euclid's Elements, widely considered the most influential textbook of all time.[1]. The area of study known as the history of mathematics is primarily an investigation into the origin of discoveries in mathematics and, to a lesser extent, an investigation into the mathematical methods and notation of the past. Some of these appear to be graded homework.[20]. The earliest evidence of written mathematics dates back to the ancient Sumerians, who built the earliest civilization in Mesopotamia. They developed a complex system of metrology from 3000 BC. The changes in structures of mathematics teacher education, division between practice and theory, the demand for research based teacher education; different conceptions of the mathematical knowledge needed for teaching and how it can be acquired, and its relation to pedagogical knowledge; the attention given to preparing teachers of mathematics to address pupil diversity in culture and language, and the education of disadvantaged pupils. All participants in the Working Group are asked to prepare a short paper (no more than 5 pages). Each contribution will be published on the Symposium Website ... Some historical moments in the ICMI history of formation of mathematics teachers, by Barbro Grevholm.