GROUP 3
FROM A STUDY OF TEACHING PRACTICES TO
ISSUES IN TEACHER EDUCATION

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Separate Group-Publication:


On the following pages you will find “A Short Preview of the Book”.

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ON RESEARCH IN MATHEMATICS TEACHER EDUCATION - A SHORT PREVIEW OF THE BOOK

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\textbf{Abstract:} The following text includes the preface and a short preview of all chapters of the book “On Research in Mathematics Teacher Education. From a Study of Teaching Practices to Issues in Teacher Education”. This book is a product of Thematic Group 3 “From a Study of Teaching Practices to Issues in Teacher Education” of the First Conference of the European Society for Research in Mathematics Education (CERME 1), held in Osnabrück, Germany, from 27\textsuperscript{th} till 31\textsuperscript{st} August, 1998. The editors gratefully thank Elmar Cohors-Fresenborg and Inge Schwank from the University of Osnabrück for their collaboration.

\textbf{Keywords:} -

1. Some remarks on “practice”, “teacher education”, and “research in teacher education”

A central point of discussion in teacher education is “practice”. We often speak about teaching practice(s), classroom practice(s), teachers’ practice(s), etc., sometimes meaning the same and sometimes seeing differences. Similarly, we have different understandings of “teacher education”. In both cases, our interpretation is influenced by our own working background: for example, it makes a difference whether someone mainly works in pre-service education for primary teachers (e.g. being a teacher educator in a country where much more emphasis is laid on pre-service education than on in-service) or someone mainly works in in-service education for secondary teachers (e.g. being involved in a national teacher professional development programme). Whereas, for example, in pre-service education the creation of learning environments where student teachers get involved with practice (in order to learn more than “the big
theories” about their future practice), is very essential, the challenge in in-service education is often more to use classroom practice as a learning environment where the teachers get involved with theories (in order to learn a “language” to speak about their practice). Different links between theory and practice will appear several times as a motif throughout this book. In the following, we briefly reflect on the terms “practice” and “teacher education” in order to make our understanding and usage of these terms explicit.

The most prominent part of teachers’ professional work is done in classrooms, designing, managing, and evaluating content-related and social learning processes of students, dealing with a broad range of interactions, communications, assessments, pedagogical situations, etc. For that, in most cases, the terms “teaching practice” and “classroom practice” are used. Sometimes the plural “teaching practices” is used to indicate that different teachers have different ways to design their teaching. In its singular form, both, “teaching practice” and “classroom practice” not only refer to an individual teacher’s way of teaching, but more generally indicate the practical field and context where teachers interact with their students – in contrast to the theoretical field and context where e.g. mathematics educators reflect on those practices. However, some people see an important difference between “teaching practice” and “classroom practice”: whereas “teaching practice” more clearly refers to the teacher as a person (maybe mainly expressing an interest in his/her teaching or an interest in studying different teaching styles), “classroom practice” more neutrally refers to the classroom as a system that includes more than the teacher’s actions (e.g. expressing an interest in the interaction process among students or between the teacher and the students). We tend to prefer to use “classroom practice” for two reasons: firstly, in the context of teacher education it is clear anyhow that the teacher plays an important role, and secondly, it expresses the point of view that we are more inclined to see the whole system in which learning and teaching processes are embedded. To some extent, this understanding expresses a shift from viewing classroom processes as mainly determined by the teacher to viewing classroom processes as complex features, where knowledge, meanings, norms, etc. are socially constructed and influenced by a variety of general conditions, as e.g. the importance of education in the society, the curriculum or the school climate.

This leads us to the term “teachers’ practice”. Although the most prominent part of
teachers’ professional work is done in classrooms, or is essentially related to it (preparation, reflection, etc.), it includes more than that. Increasingly the quality of schools has become a permanent issue of public discussion and of scientific investigations in the field of organizational development of schools. There is more and more awareness that a “good school” is more than the sum of “good classroom practices” of the individual teachers of a school, and that it is not only the principals’ responsibility to contribute to the further development of a school, but also the joint responsibility of teachers (and students, parents, etc.). Therefore, “teachers’ practice” cannot be confined to “classroom practice”.

In addition, there is another systemic interconnection that should not be underestimated: it is our pre-service and in-service education that has a big influence on the learning process of teachers. For this reason, also our “teacher education practice” should increasingly become an object of (self-) evaluation and investigation.

This leads us to “teacher education”. We understand teacher education as an interaction process (embedded in a social, organizational, cultural, ... context), mainly between teacher educators and (student) teachers, but also including systematic interactions among teachers aiming at professional growth. At the same time, we can see teacher education as a learning environment for all people involved in this interaction process.

The overall goal is the improvement of teachers’ practice (in the case of institutionalized in-service education or other forms of promoting teachers’ professional growth) or the adequate preparation for that practice (pre-service education). In both cases it is combined with an improvement of a complex network of (student) teachers’ knowledge, beliefs, etc. The most prominent part of mathematics teachers’ practice deals with interaction processes between the teacher and the students, focusing on students’ learning of mathematics. Therefore we see the goal of mathematics teacher education as promoting (student) teachers’ efforts to establish or to improve their quality of teaching mathematics, and the task of teacher educators as designing adequate learning environments to reach this goal in a joint effort with the (student) teachers. Designing and evaluating mathematics teacher education courses is one important part of mathematics educators’ professional work. However, all over the world there are big differences concerning mathematics educators’ responsibility for pre-service education, in-service education, administrative and management work or
research activities.

Summing up, the title of *Thematic Group 3* can be interpreted in two ways. Firstly, it indicates a progress in the following sense: research in teacher education no longer confines itself to investigating teaching practice, but increasingly includes investigations on the broader complexity of teachers’ practice and on investigations into our own teacher education practice.

Secondly, it indicates a progress in quite another sense: the study of teaching practice is no longer only a domain for academic researchers, but increasingly also one of student teachers and practicing teachers; learning environments where they can investigate classroom practice are more and more seen as effective elements of teacher education. The new possibilities of multimedia systems support this development.

A major focus of this conference was *research*. Concerning teacher education one might ask the question: Should we e.g. speak about research *in* teacher education or about research *on* teacher education? The situation is even more complex than that as we will see below.

*Research in teacher education can be interpreted as a general term* for investigations carried out within the framework of teacher education or at least with the goal or a clear potential of using its results in teacher education.

A kind of research coupled relatively loosely with teacher education we call *research in the perspective of teacher education*. The investigations are not done in the context of teacher education and do not focus on interaction processes within teacher education. In the past, most research projects in teacher education, and even a considerable part of recent initiatives, fall into this category. One prominent example is the investigation of (student) teachers’ beliefs, knowledge, and practice (see chapters 2, 3, and 4). There is much diversity concerning researchers’ inclination to draw explicit conclusions for designs of teacher education. It has to be added that a variety of research – not explicitly aiming at drawing conclusions for teacher education – is often the basis for creating powerful learning environments in teacher education.

Generally closer to drawing conclusions in the field of teacher education is *research in the context of teacher education*. Here investigations (e.g. on teachers’ beliefs, knowledge, practice, etc.) are done in the context of teacher education (e.g. within the
framework of an in-service education course) but they do not focus explicitly on the interaction process (within this course). In general, researchers are inclined to draw explicit conclusions for designs of teacher education, in particular concerning e.g. the course in which the investigations take place. Increasingly, (student) teachers are supported to do investigations on teachers’ beliefs, knowledge, practice, etc. (see e.g. subchapter 4.3). We tend to subsume such investigations in the field of “research in teacher education” (here the question is less whether it fits to teacher education but more whether it can be titled as (traditional) “research”, as “alternative research”, as “action research”, as carrying out “mini-research-tasks”, etc.). For the purpose of this book, we use the term “investigations” as a generic term that includes all kinds of research, inquiry, systematic reflection, etc. However, it is a future challenge for teacher education to discuss this question in more detail.

Very close to drawing conclusions is research on teacher education courses, programmes or other forms of promoting teachers’ professional growth. Here the focus is directly on teacher education and means investigations on the interaction between e.g. teacher educators and (student) teachers, the achievements of the participants, side-effects for the school, etc. One prominent reason to do that kind of research is to evaluate the success of teacher education courses or programmes, mostly with the intention to draw consequences from that internal or/and external evaluation (e.g. improving the course or stopping the programme). A special way of evaluation is self-evaluation on the basis of teacher educators’ action research in order to improve their (teacher education) practice. Another reason is to understand better the interactions between teacher educators and (student) teachers, e.g. investigating which kind of teacher educators’ interventions or teachers’ beliefs influenced the process. In this latter case, the intention is – at least not explicitly – the improvement of one particular course or programme, but it is assumed that the results – because they really focus on teacher education – are a good basis for drawing conclusions for designing teacher education.

A direct connection to the improvement of teachers’ practice is given in the case of research as teacher education (or teacher education as research, see chapter 6). A concrete form is (teachers’) action research, understood e.g. as the systematic and self-critical reflection of practitioners into their own practice (see chapter 5). Research as teacher education means a close interconnection between understanding and
improving teachers’ practice. The joint reflection on the learning process (e.g. interactions, improvement of practice, ...) plays a crucial role. In principle, teachers’ action research can be done among professional teachers themselves, everyone being the teacher educator (and “critical friend”) for the others. In most cases, however, action research is initiated and promoted in the context of a teacher education course or programme where teacher educators act as “facilitators” of action research but also have more traditional roles in their interaction with the participants (teacher education with research, see chapter 6). The borders between teacher education with research and teacher education as research are fluid.

A very special kind of research is meta-research on teacher education which means analyses of research activities or general conditions in the field of teacher education (or parts of it), for example working towards “state of the art”-reports.

All these kinds of investigations can be subsumed under research in teacher education. They also can be combined: for example, embedding investigations of (student) teachers in learning environments of teacher education courses might be a starting point to investigate how successful these investigations are concerning (student) teachers’ beliefs, knowledge, practice, etc.

2. Some remarks on the work of Thematic Group 3

The work of Thematic Group 3 (TG 3), “From a study of teaching practices to issues in teacher education”, was characterized by a considerable amount of diversity that distinguished it from the other six thematic groups of the First Conference of the European Society for Research in Mathematics Education (CERME 1). We confine ourselves to sketch four aspects.

Firstly, the theme of the group covers a very broad field of relevant issues. As expressed by the title, teacher education includes much more than the study of teaching practices, for there are many factors influencing those practices, e.g. teachers’ beliefs and knowledge, students’ abilities and motivation, school climate and professional communication among teachers, general conditions of teaching (class size, space, time, ...), curriculum and assessment, structure and political orientation of the school system,
internal and external support systems for the improvement of teaching (through different kinds of in-service education) or teachers’ socialization process, starting from their own classroom experience, over participating in pre-service education and school practice to a fully responsible work as a practicing teacher at a specific school.

Secondly, progress in teacher education not only means that we (as mathematics educators) confine ourselves to investigate more intensively teachers’ practices (and beliefs, knowledge, ...) and make suggestions for its improvement but we also have to take our own (teaching, research, ...) practice etc. as a matter of reflection and investigation. Teacher education has to do with self-application of our theories, and therefore has another quality of challenge for our field. Our activities in teacher (pre- and in-service) education and our research activities are embedded into the whole system of further development of teachers’ practice. We are not (only) external investigators and observers of this system, but we are (also) responsible actors within this system. We are not only trying to understand better teachers’ practice (in order to give advise on how teachers, their practice, the curriculum, etc., could improve) but we also have the duty to understand our interventions into teachers’ practice (e.g. through in-service education) or the implications of our pre-service education practice on student teachers’ development (in order to improve our teacher education practice). Given this fact, teacher education – if we understand it as an interaction process between teacher educators and teachers – demands that the processes of understanding and improving (teachers’ and our own practice) get more interwoven than in fields where we investigate situations and processes that do not include such a high personal involvement of ourselves.

Thirdly, teacher education has not the same research tradition as many other issues of mathematics education (like e.g. didactics of algebra or geometry). It is assumed that this is to a great extent a consequence of the aspect mentioned above: the high degree of involvement influences our approach to investigation and research. There are at least two approaches that play a prominent role in discussions in teacher education (conferences, journals, ...) all over the world – and also in our Thematic Group: One approach puts an emphasis on research on teachers (in a non teacher education context) in order to understand better teachers’ practice (beliefs, knowledge, etc.), but often such research doesn’t make clear connections to the improvement of (teachers’ or teacher educators’) practice. In this case the question is less whether we speak about research,
but whether there is a close link to teacher education. Another approach takes – to some extent – the other direction: the authors (mostly teacher educators) tell – more or less – “success stories” about pre- or in-service projects at their institutions. Here, the improvement of teachers’ practice, their professional growth etc. is in the foreground, more and more there are also reflections on teacher educators’ learning processes and consequences for improving the project. Often, the weak point here is that we cannot easily find a systematic reflection on the research question, the criteria for success and a presentation of data that helps the reader to duplicate the improvement (e.g. to understand the main relevant factors that are due to the project and less to other influences). Here, the topic is surely teacher education, but the challenge is really to understand and to describe theoretically the processes which lead to the improvement.

Both approaches are important, but in both cases we need a closer relation between understanding and improving. It is clear that an emphasis on research demands an emphasis on understanding, and it is clear that teacher education mainly aims at improving (learners’ knowledge, practice, beliefs, ...). Research in the field of teacher education means to meet both challenges.

Fourthly, and this seems to be an outcome of the broadness of the field, the demand for self-applicability and the challenge of doing research in this field, Thematic Group 3 not only had the largest number of participants, but also had the fewest number of accepted papers of all Thematic Groups of CERME 1. The group was characterized by a broad geographical and cultural diversity which was accompanied by a considerable heterogeneity of participants’ research and development traditions, mother languages and English abilities. This means a context where communication and collaboration during the conference and the process to achieve a joint product (in particular, this book) was a really tough task.

Given the time pressure to finish our chapter, we tried our best to find a compromise between realizing the ERME-principles of communication, co-operation, and collaboration, aiming at scientific quality and coping with the deadline for publication. A lot of arguments could have been expressed more clearly and more interconnections could have been realized. Nevertheless, we are sure that our product marks a good starting point for deeper reflection on teacher education among mathematics educators in Europe and all over the world.

It would not have been possible to produce this chapter without the enormous
motivation and self-discipline of all of its contributors, based on the extraordinary good working and social climate we jointly established at our meetings in Osnabrück. The following 22 people (in alphabetic order), coming from 13 different countries, participated in our Thematic Group, contributing to the quality of processes and products of our work: Michele Artaud (France), Peter Berger (Germany), Lucilla Cannizzaro (Italy), José Carrillo (Spain), François Conne (Switzerland), Luis Carlos Contreras (Spain), Moisés Coriat (Spain), Fred Goffree (The Netherlands), Barbara Jaworski (United Kingdom), Konrad Krainer (Austria), Razia Fakir-Mohammed (Pakistan, at present United Kingdom), Maria Korcz (Poland), Hélia Oliveira (Portugal), Wil Oonk (The Netherlands), Marie-Jeanne Perrin-Glorian (France), João Pedro da Ponte (Portugal), Ildar Safuanov (Russia), Manuel Saraiva (Portugal), Andrei Semenov (Russia), Maria de Lurdes Serrazina (Portugal), Julianna Szendrei (Hungary), and Elisabeth Thoma (Austria). It was a pleasure to co-ordinate efforts within this both professionally and personally fruitful learning community.

Yves Chevallard (France), Fred Goffree (The Netherlands), Konrad Krainer (Co-ordinator, Austria), and Erkki Pehkonen (Finland) were asked by the Programme Committee to lead the group. Unfortunately, Yves Chevallard and Erkki Pehkonen (whom we thank for his contributions during the planning process) had not been able to attend.

We gratefully thank José Carrillo, Moisés Coriat, Barbara Jaworski, and João Pedro da Ponte for their excellent preparation work for their meetings and the co-ordination of the corresponding chapters of the book. Many thanks we express to Peter Berger for his valuable contribution to manage the layout and his help to increase the readability of the text.

3. Short preview of the chapters 1 to 6

As mentioned before, as a result of the papers and posters submitted to Thematic Group 3, the meetings were structured along the following research interests in teacher education: What, how, why, etc. (student) teachers believe, know, act/do, and reflect/investigate? However, it was also intended to reflect on the corresponding results as being useful for teacher education practice. Therefore, chapters 2 to 5 aim at
finding a bridge between teacher education and investigations into teachers’ beliefs, knowledge, practice(s), and reflections. We use the term “investigations” – which is broader than research – in order to be able, for example, to include student teachers’ inquiry into teachers’ practice.

- **Chapter 1**, “Teacher Education and Investigations into Teacher Education: A Conference as a Learning Environment” (written by Konrad Krainer), firstly describes teacher education as a complex field, highlights fundamental shifts, recent research foci and innovative forms of teacher education. This is followed by a description of how the CERME 1 context was used as a learning environment in Thematic Group 3, focusing on its first meeting.

- **Chapter 2**, “Teacher education and investigations into teachers’ beliefs” (co-ordinated by João Pedro da Ponte, with contributions also from Peter Berger, Lucilla Cannizzaro, José Carrillo, Nuria Climent, Luis Carlos Contreras, and Ildar Safuanov), firstly gives an introduction to the broad field of research on teachers’ beliefs, highlighting “beliefs” and “conceptions” as foundational topics in teacher education. Then two empirical studies on teachers’ beliefs are presented. The first one looks at teacher’s beliefs about problem solving and its relation to beliefs about mathematics teaching and learning in general, indicating a clear interconnection. The second one investigates teachers’ beliefs concerning the computer, as a technical, personal, and pedagogical object, working out the importance of affective components of teachers’ beliefs. The chapter concludes with a brief survey of methodological approaches and necessary research tools and sketches some directions for future work in this field.

- **Chapter 3**, “Teacher education and investigations into teachers’ knowledge” (co-ordinated by José Carrillo and Moisés Coriat, with contributions also from Hélia Oliveira), firstly gives an introduction to the topic and some challenges, and then sketches different approaches to a characterization of teachers’ knowledge (e.g. expert and prospective teachers knowledge, components of knowledge). This is followed by the question of how teachers’ knowledge can be promoted through teacher education, pointing out the importance of action research, situated learning, the use of narratives and the need for an integration of knowledge. The chapter concludes with open questions and a plea for viewing teacher education as an open process and argues for more communication,
co-operation, and collaboration among teacher educators and researchers.

- **Chapter 4**, “Teacher education and investigations into teachers’ practice(s)” (co-ordinated by Fred Goffree, with contributions also from Marie-Jeanne Perrin-Glorian, Hélia Oliveira, Will Oonk, Maria de Lurdes Serrazina, and Julianna Szendrei), firstly gives an introduction to “good practice”, sketching different examples from Hungary and Portugal, where good practice in different contexts is realized or used for reflection. This is followed by a study of five teachers’ practices within the framework of the “theory of situations” and the anthropologic approach of “didactic transposition”, investigating the organization of content and the related didactical approach in secondary classrooms in France. Finally, the chapter presents a multimediad interactive learning environment (MILE) which is used in pre-service teacher education where student teachers construct practical and theoretical knowledge through investigating experienced teachers’ practice.

- **Chapter 5**, “Teacher education through teachers’ investigation into their own practice” (co-ordinated by Barbara Jaworski, with contributions also from Konrad Krainer, Razia Fakir-Mohammed, and Elisabeth Thoma), gives an insight into the work of Thematic Group 3 in the meeting on teachers’ action research. Among others, it highlights the complexity of the teaching process and the variety of influences put on it (society, culture, ...) and presents answers of participants to questions, for example, concerning starting points, ways of involvement and contexts of action research, the theoretical background, or reflects on how action research fits with norms of established educational research. Some brief conclusions and directions for future work close the chapter.

- **Chapter 6**, “Investigations into teacher education: trends, future research, and collaboration” (written by Konrad Krainer and Fred Goffree), sketches some trends of investigations into mathematics teacher education, discusses the complexity of investigations into this field, reflects on learning from investigations, and points out some issues of future research and collaboration.

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