Educating educators to work in the field of mathematics teaching development

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Teaching development of practicing mathematics teachers

- Key to improving students' opportunities to learn mathematics.
- Supporting practicing teachers’ learning is not a trivial task.
- It involves educators working with practicing teachers on developing their teaching.
- Growing interest in the education of these educators.

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Challenges associated with educating educators to work in the field of mathematics teaching development of practicing teachers

Relevant issues

- The nature of the field of mathematics teaching development of practicing teachers.
- The practice of mathematics educators who work in this field.
- The professional education and development of these educators.

The **nature of the field** of mathematics teaching development of practicing teachers

The nature of the field

- Ill defined

The nature of the field: ill defined (1)

- Teaching development of practicing teachers is not part of a systematic institutionalized practice.
- In many countries:
  - insightful and innovative initiatives,
  - local and temporary,
  - dependent on the particular individuals who initiate, design, lead, and operate them.
- In contrast to teaching children at school.

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- Teaching development of practicing teachers is not part of a systematic institutionalized practice.
- In many countries:
  - insightful and innovative initiatives,
  - local and temporary,
  - dependent on the particular individuals who initiate, design, lead, and operate them.
- Some countries adopt a different approach.

Teaching development of practicing teachers as a systematic institutionalized practice

- Lesson study in Japan.
- Teaching research system in China.

Teaching research system in China

- “Well-established, multi-tiered teaching research system through which teachers and teaching researchers work together to design, deliver, and revise lessons to promote a high quality of student learning” (Huang, Su, & Xu, 2014).
- *Mathematics teaching researchers* work with and help teachers improve their teaching by mentoring and assessing teaching, conducting teaching research activities, and supporting implementation of new curricula.

The nature of the field: ill defined (2)

No agreed-upon name for those working in the field:

- Teachers of teachers
- Teacher educators
- Teacher mentors
- Facilitators
- Professional development (PD) leaders
- Professional development (PD) providers
- Teacher-leaders
- Teaching researchers (China)
- Coaches
- Didacticians
- מנחים, מדריכים, מורים מובילים...

No agreed-upon name

These people are not recognized as members of an identifiable group whose members share a profession, by:

- Others.
- Themselves.

- In contrast to the name *teachers* in the field of teaching children at school.

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An attempt to change current situation

Didacticians:

"…mathematics (teacher–) educators who work with practising teachers to promote developments in teaching and learning mathematics: the term includes university faculty, teaching researchers, curriculum development coordinators, master teachers, mathematics coaches, and so on".

Jaworski & Huang, 2014

The name *Didacticians*

- Calls attention to the problem of lack of a shared identity.
- Proposes a means of altering current situation.
- Does not straightforwardly convey the meaning associated with it.
- Time will tell whether the community at large will adopt the proposed name.

The nature of the field

We need to better understand:

- The characteristics of different teaching development systems.
- Who educates practicing teachers of mathematics in different countries.
- The advantages and the disadvantages of different systems.
- The extent to which they relate to cultural and societal factors.

The **practice of mathematics educators who work in the field** of mathematics teaching development of practicing teachers

The practice of those working in the field

Substantial increase in scholarship on teaching development of practicing mathematics teachers:

- Rich descriptions of successful programs and activities.
- Limited empirical research-based information about the practice of those working in the field.

Some practices of those working in the field (ZDM, 2014)

- Engaging teachers in analyzing videos of classroom instruction.
- Inviting groups of teachers to compare and contrast public presentations of same content lessons.
- Modeling teaching.
- Providing positive feedback to teachers.
- Engaging teachers in examining student work.
- Engaging teachers in studying curriculum materials.
- Encouraging teachers' systematic gathering and analysis of evidence from their classes.
- Presenting math tasks with the potential to stimulate discussions among teachers of all grade levels.

Limited empirical research-based information

Problem 1: Research focus

- Teacher learning.
- Not the practice of those working in the field.

- In contrast to research on school teaching.

Limited empirical research-based information

Problem 2: Sources of information

- Those working in the field on their own work.
- Those who publish in scholarly publications.
- Mainly from countries where English is a national language.
- Adler et al. (2005), Gellert et al. (2013).

- In contrast to research on school teaching.

Limited empirical research-based information

Problem 3: Nature of information

- Lack of information on practices that are not effective for facilitating teaching development.

- In contrast to research on school teaching.

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The practice of those working in the field

We need to better understand:

- What practices are common.
- What practices facilitate teaching development.
- What practices impede teaching development.
- Advantages and disadvantages of different practices.
- Supporting and obstructing conditions.
- The extent to which effective practices are related to cultural and societal factors.

The **professional education and development of educators working in the field** of mathematics teaching development of practicing teachers

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The professional education and development of **mathematics teachers**

The professional education and development of **mathematics teachers**

Immense international attention in the last three decades:

- Establishment of the international *Journal of Mathematics Teacher Education* (1998).
- Plenary sessions at ICME meetings (since 2004).
- One of five research domains in the 2nd PME milestone book (2006); missing in the 1st (1990).
- ICMI study 15 (Conference 2005,Volume 2009).

The professional education and development of **educators working in the field of mathematics teaching development of practicing teachers**

- Almost neglected until recent years.
- Review of JMTE 1998-2002 (prospective & practicing teachers):
  - Halai (1998) – Own work as mentor.
  - Even (1999) – Formal preparation program.

Becoming an educator working in the field of mathematics teaching development

Traditionally

- Through practice.
- No formal education that explicitly aimed at preparing, educating or developing mathematics teacher educators in general, and those working with practicing teachers in particular.

In recent years

- Growing attention to structuring the education and professional development of educators of practicing teachers.

Growing international attention

- Publication of *The International Handbook of Mathematics Teacher Education: The Mathematics Teacher Educator as a Developing Professional (*2008).
- One of three main problems that needs to be addressed, *ICMI Study 15 Volume (*2009).
- Themed issue of ZDM (2014).
- The 3rd ADASHA Symposium (2016).

What should educators working in the field of mathematics teaching development learn?

- Discussions about the preparation of educators tend to start with questions of knowledge:
  What should future educators know?
- Work in the field of teaching development is something one does, not just knows.

Knowtice (*know*ledge+prac*tice*)

- The integration of knowledge, skills, dispositions and practices situated in the practice of mathematics teaching development (Even, 2005, 2008).
- The essence of what needs to be learned and developed.

Construct inception: the invited presidential international panel on *International perspectives on teacher professional development* at AERA-2004.

The case of MANOR (1993-2003)

Main goal

- Preparation of, and support for, practice-based educators working in the field of secondary school mathematics teaching development.

Even (1999, 2005, 2008)

The case of MANOR (1993-2003)

Knowledge base (1)

- Preparation of, and support for, practice-based educators working in the field of secondary school **mathematics** teaching development.

Even (1999, 2005, 2008)

The case of MANOR (1993-2003)

Knowledge base (2)

- Preparation of, and support for, practice-based educators working in the field of secondary school **mathematics teaching** development.

Even (1999, 2005, 2008)

The case of MANOR (1993-2003)

Knowledge base (3)

- Preparation of, and support for, practice-based educators working in the field of secondary school **mathematics teaching development**.

Even (1999, 2005, 2008)

How might practice-based educators in the field of mathematics teaching development develop *knowtice*?

MANOR's main components

- Two-year formal preparation program (450 h).
- Monthly graduate forum.
- Bi-annual national conferences.
- Individual support.
- Resource Files.

Developing *knowtice:* theoretical orientations

Drawing on and inspired by:

- Constructivist and socio-cultural approaches to student learning of mathematics adopted to learning to work with secondary school math teachers on developing their teaching.
- Situated learning approach (Lave & Wenger, 1991).
- Framework of three types of teacher development: personal, professional and social (Bell & Gilbert, 1994).

Developing *knowtice:* MANOR's approach

- Providing a supportive and intellectually and professionally demanding environment.
- Designing activities where participants needed to solve real problems of practice, combined with opportunities for reflecting on and analyzing these solutions, in the light of academic and practical knowledge.
- Developing norms of interaction that encourage the study and critique of one's own and others' practice, combined with the actual enactment of knowledge.

Providing a supportive and **intellectually** and **professionally demanding** environment

Inclusion of an advanced academic component.

Requirements of high commitment and work investment outside formal meetings:

- Experimenting with innovative learning materials.
- Reading research articles.
- Conducting small scale research studies.
- Writing papers.
- Conducting weekly PD activities for teachers.
- Initiating change in school mathematics teaching.
- Preparing portfolios.
- …

Designing activities where participants needed to solve **real problems of practice**, combined with opportunities for reflecting on and analyzing these solutions, in the light of academic and practical knowledge

- What are good problems in school mathematics?
- What are students' learning processes in algebra?
- How might students' difficulties addressed?

- What is teachers' knowledge about functions?
- What PD activities are useful in a specific context?
- How can I work with teachers on change initiatives?

- …

Developing norms of interaction that encourage the **study and critique of one's own and others' practice**, combined with the **actual enactment of knowledge**

- Reflecting on one's own and discussing others' PD activities, and suggesting reasoned modifications.
- Collaborating on planning, implementing and evaluating activities, sharing and discussing ideas, difficulties and challenges related to change initiatives in mathematics teaching and learning.
- Suggesting alternative solutions to problems of practice, explaining reasoning to peers, examining each other's solutions.

The professional education and development of educators working in the field of mathematics teaching development

We need to better understand:

- What “these” people need to learn.
- When and how they should learn that.
- How preparation and continuous development programs might be organized.
- What might be useful learning experiences, and for what purposes.
- What kinds of support are helpful.
- The extent to which effective programs are related to cultural and societal factors.