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Teachers as Stakeholders in Mathematics Education Research

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Abstract: *This paper states three claims dealing with the relationship between mathematics education researchers and mathematics teachers: (1) Mathematics education research is a highly diverse field; (2) Teachers have various roles as stakeholders in mathematics education research; (3) Regarding teachers as stakeholders in mathematics education research affords reflecting some (fruitful) „cultural differences". The paper claims the necessity to regard researchers as key stakeholders in practice, and teachers as key stakeholders in research.*

Keywords: Mathematics education researchers; Researchers as stakeholders; Mathematics teacher professional development; Practice

Introduction

To organize a conference on the issue of "Teachers as stakeholders in mathematics education research" is taking up an important challenge. It is an ethical responsibility of a scientific community and at the same time a wise strategy to raise questions like: How does the scientific community's knowledge get known, used and reflected by relevant people and institutions? What can be done by researchers apart from writing papers and giving talks (predominantly within the scientific community), and from teaching classes of student teachers and offering professional development courses? (Krainer, 2011)

There have been efforts by individual researchers and groups to address this issue (e.g., Bazzini, 1994; Steinbring, 1994; Lin & Cooney, 2001; Krainer & Llinares, 2010; Kieran, Krainer, & Shaughnessy, 2013). Despite these efforts and continuous claims of how important teacher-researcher collaboration role is, teachers are most often seen as more or less passive recipients of researchers' knowledge production and sometimes as a means to produce knowledge.

What is missing, in particular, is a systematic effort by the scientific community to analyse the potential role of teachers in research and its benefit for teachers and researchers. In order to understand the potential role of teachers, a first step, the diversity of mathematics education research needs to be sketched.

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Mathematics education research is a highly diverse field

Mathematics education deals with the learning and teaching of mathematics. Therefore, at least students, (prospective and practising) teachers and teacher educators (the latter are often also the researchers, see e.g. Adler et al., 2005) are relevant people. In addition, also the relationship between students and teachers as well as teachers and teacher educators might be a focus.

Thus, at least big five research foci are to be taken into consideration:

Student(s)

Student(s) – teacher(s)

Teacher(s)

Teacher(s) – teacher educator(s)

Teacher educator(s)

In each case, research might investigate students, teachers and/or teacher educators' beliefs, their knowledge or their practice, or combinations of these.

The learning of teachers, including all formal kinds of teacher preparation and professional development as well as informal (self-organized) activities, is only one domain of mathematics education research. One part of the diversity of research is based on the diversity of formats of teacher education. Even if we reduce this issue to teacher education for practicing mathematics teachers, the formats of activities – and thus of related research – are highly diverse. They include, for example: formal activities led by externals or informal and self-organized ones; single events or continuous and long-lasting programmes; small-group courses or nation-wide mathematics initiatives; heterogeneous group of participants or a mathematics-focused school development programme at one single school; obligatory participation in courses or voluntary engagement in teacher networks; focus on specific contents or on more general issues; theory-driven seminars at universities or teaching experiments at schools; focus on primary or secondary schooling; teacher education accompanied by extensive research or confined to minimal evaluation (see more detailed in Krainer, 2008a).

Another approach to demonstrate the diversity of research – focusing only on the subfield of teacher education – is to regard the diversity of goals and formats of (teacher education) research. It is a challenge to investigate one teacher's way of teaching in one class during a short period of time. However, it becomes much more complex if we are dealing with more classes of one teacher, or with more teachers, or with investigating teacher change on the basis of an intervention (pre-post-comparisons etc.), or if we also investigate students' change or the interaction between students and teacher. The researcher might be an external university staff member, a school internal expert or the teacher him- or herself.

Table 1. Levels of teacher education

	Number of M teachers	Relevant environments (in addition to mathematics teacher educators)	Major mathematics education research focus on …
Micro level	1s	Students, Parents, …	Individual teachers, Teams
Meso level	10s	Colleagues, Leaders, …	Communities, Networks, Schools
Macro level	100s	Superintendents, Policy makers, …	Districts, Regions, Nations

In addition, we also have to look at the diversity of interests. Concerning the three levels, quite different people are interested in the impacts of teacher education initiatives (Krainer, 2008): in the case of single classrooms, the students and their parents are the most concerned environments; in contrast, superintendents and (above all) policy makers are more interested to get a whole picture over all classrooms in a country. For example, PISA plays a major role for nations' system monitoring of mathematics teaching, but not so much for individual teachers and parents. They are more interested in the learning progress of their own students. Schools as organizations or networks of dedicated teachers lay somewhat in between. On the one hand, a school is important for teachers and parents since this organizational entity forms a crucial basis and environment for students' learning; for example, this includes important feelings of being accepted, autonomous, cognitively supported, a member of a community, save, taken serious etc. On the other hand, reformers need to see schools as units of educational change since they cannot reach teachers and students directly. All in all, each of the three levels is important and they should be regarded as closely interconnected.

All in all, mathematics education research – in particular when dealing with teacher education – is highly diverse. It has become clear that also teachers' roles can be diverse. The next chapter elaborates this more closely.

Teachers have various roles as stakeholders in mathematics education research

As mentioned above, a systematic effort by the scientific community (societies, commissions, universities, research groups, etc.) is needed to analyse the potential role of teachers in research and its benefit for teachers and researchers. The question is urgent since the increasing economic

pressure on research accompanied by a citation-index-driven accountability will lead to an intensified focus on paper production (in high ranked journals); less efforts are made to "go the complex way" by writing papers together with teachers (in equally important but – from an internal promotion view within the scientific community – less valued sources). To build the bridge from the teaching profession to the scientific community, well-developed organizations like NCTM with high-quality publications (e.g., Handbooks, NCTM-standards) are important. Another strategy is that teacher unions (like the LCH in Switzerland) employ scientists in order to build bridges to the scientific community.

There is a tradition to view teachers as experts (e.g., Bromme, 1992). In particular, they are regarded as researchers (e.g., Stenhouse, 1975; Altrichter & Posch, 1990 – English version: Altrichter, Feldman, Posch, & Somekh, 2008; Elliott, 1991; Crawford & Adler, 1996; Jaworski, Fuglestad, Bjuland, Breiteig, Goodchild, & Grevholm, 2007) and reflective practitioners (e.g., Schön, 1983). Intervention research with teachers as partners and action research by teachers or teacher educators is becoming more prominent in mathematics teacher education, for example: editorials and papers in JMTE 6(2) and 9(3), and in ESM 54(2-3); chapters in the PME-Handbook (e.g. Llinares & Krainer, 2006), chapters in the "International Handbook of Mathematics Teacher Education" (e.g. Benke, Hospesová & Tichá, 2008) and in the "Third International Handbook of Mathematics Education" (e.g. White, Jaworski, Agudelo-Valderrama & Gooya, 2013), and in the International Encyclopedia of Education (e.g. Krainer, Chapman & Zaslavsky, 2012). There is also an increase in studies on teacher educators' learning (see e.g., Jaworski & Wood, 2008; Even & Krainer, 2013). Some researchers claim that they learned enormously from teachers, and even reflect this in papers.

However, research and policy often seem to focus primarily on teachers' weaknesses. For example, often the immediate reaction to bad results in comparative studies is to start professional development initiatives for teachers as if it were the teachers only who need to change. Less attention is paid to the efficacy of the support system for schools, to the teacher education system, to teachers' general conditions and reputation etc. Such reactions indirectly blame teachers and – at the same time – they are unsatisfactory starting points for reform initiatives. If research and policy do not admit that the whole system (including policy, teacher education and research) needs to change, the phrase "teachers are key agents of change" is a threat rather than an indication of their important role.

We need to be aware that research can have hindering or demotivating effects to teachers. For example, studies in mathematics education which emphasize on teachers' low mathematical competencies, their "monoculture" regarding teaching methods or their unwillingness to inform themselves about new research results, have effects that should not be underestimated. It seems more viable to highlight the complexity of teachers' task and also to report strengths and opportunities. It should also be taken into account that teacher educators are co-producers of this lamentable situation by being role models in teacher education courses. Likewise researchers are responsible for offering viable opportunities that encourage teachers to get interested in research.

It is not surprising to hear critical assessments of mathematics education research with regard to practitioners' learning. For example, Ponte (2009, p. 102) indicates the "view of the 'deficient' teacher, so common in the research literature". In contrast to teachers' lack of knowledge etc., often researchers are seen as the ones where the knowledge is situated. This characterizes a view where knowledge transfer is a one-way street from researchers to teachers. To put it more crudely: Teachers have problems, researchers have solutions; and the latter (and we might include representatives of educational policy and administration) also know the way(s) to disseminate innovations to teachers by means of curricula, standards, tests, material, lectures, seminars etc. This is the classical Research-Development-Dissemination (RDD) model of innovation whose limitations are shown all over the world.

In order to criticize this view, Schön (1983) introduced the term "Technical Rationality" into the educational discourse. It follows three basic assumptions:

- There are general solutions to practical problems.
- These solutions can be developed outside practical situations (in research or administrative centres).
- The solutions can be translated into practitioners' actions by means of publications, training, administrative orders, etc.

Technical Rationality causes a hierarchy of credibility, expressing a genuine mistrust of practitioners: Teachers work at a "low level of theoretical knowledge and are merely applying what has been predefined in the academic and administrative power structure above them" (Altrichter et al., 2008, p. 270). In turn, this evokes resistance by teachers, opposition against reform and a genuine mistrust of researchers (and of education policy and administration people). It is a vicious circle.

In contrast to Technical Rationality, "Reflective Rationality" (see e.g., Posch, 1996; Altrichter et al., 2008, p. 270) follows three very different assumptions:

- Complex practical problems require particular solutions.
- These solutions can only be developed inside the context in which the problem arises and in which the practitioner is a crucial and determining element.
- The solutions can only rarely be successfully applied to other contexts, but they can be made accessible to other practitioners as hypotheses to be tested in practice.

These assumptions imply new types of communication among practitioners and new types of communication between practitioners and researchers (some people speak of theorists). The new communication needs to be built on symmetry rather than on hierarchy – both teachers and researchers have problems (some prefer the term challenges); and both need to find solutions, internal to their practice, but a critical stance and external views can be of support in defining the problem, in finding solutions or better ways to cope with the situation.

Reflective Rationality regards teachers (practitioners) as important producers of knowledge and "practical theories" (see Altrichter et al. 2008, p. 64-72). This production of knowledge can be done with or without external interventions. Regarding the latter option, teachers investigate their own practice in order to improve it (in the sense of action research, see e.g., Altrichter et al., 2008). Teachers doing action research might be supported by other persons, but it is the teachers who decide which problem is chosen, which data are gathered, which interpretations and decisions are taken etc. Action research challenges the assumption that knowledge is separate from and superior to practice. The production of "local knowledge" is seen as equally important as general knowledge, "particularization" (e.g., understanding a specific student's mathematical thinking) as equally important as "generalization" (e.g., working out a classification of typical errors).

The stakeholder approach

In the 1980's, an interesting change of paradigm was taking place in conceptualizing the role of management with respect to its environment (in particular in the USA). The traditional view was the shareholder approach which regarded it the duty of management to fulfil the interests of the shareholder only. Basically in order to prevent having poor social performance hurt the company financially, the management aimed at satisfying clients, consumers, society etc. by specific strategies (e.g., public relations). In contrast, Freeman (1984) and others developed a stakeholder approach, defining "stakeholder" as "any group or individual that can affect or is affected by the achievement of a corporation's purpose" (Freeman, 2004, p. 229). The approach dealt with the practical concerns of managers – "how could they be more effective in identifying, analysing and negotiating with key stakeholder groups?" (p. 230). The stakeholder idea is connected to ethics and values, which are regarded as equally important as the business itself.

Regarding researchers as those having most expertise in research (theory, methodology etc.) and thus heavily setting the trajectories of research, they nevertheless are assumed to form their decisions not only for the sake of the scientific community but more broadly for society as well. Of course, other persons, groups and social systems also have a stake in the development of students' knowledge: for example, parents, principals, superintendents, mathematicians, teacher educators, educational publishers, test developers, companies, (education) policy-makers, and even the whole society can be regarded as "stakeholders" of the (joint societal) "enterprise" to promote students' mathematical knowledge. They all have effects on students' knowledge and at the same time they are affected by their knowledge or lack of knowledge.

Research shows that the "myopic institutions theory" – claiming that companies that invest in stakeholder management will be penalized by investors who are only interested in financial returns – gets little support (Freeman, 2004, p. 237). In other words, it does not hurt a company to look beyond shareholders. In other words: Looking at the whole system (of interests) is beneficial for all parts of a system aiming at sustainable development and peace.

How might a scientific community reflect on its relationship to practitioners? One strategy is to reflect upon the relationship to those practitioners (teachers) interested in research not participating in meetings of the scientific community. A second strategy is to reflect upon situations where

members of this community act themselves as practitioners (teacher educators). A third strategy is to reflect upon situations where teachers themselves investigate their practice (see e.g. Krainer, 2011).

The question how intensively researchers regard teachers as stakeholders is an expression of the – intended and/or lived – relationship between teachers and researchers. This means that our view on „teachers as stakeholders“ is about „us“, about our beliefs and roles, about our understanding of „research“.

Consequently, reflections before starting a MER project should include at least the following two questions:

How deeply do we expect teachers (and other stakeholders) to have an interest in the process and the result of the project?

How much could/should the project affect teachers (and their practice), and how much could/should teachers (and their practice) affect our project?

Intensifying collaboration with teachers and regarding them as key stakeholders in mathematics education research does not at all mean that teachers and researchers have the same backgrounds, interests, roles etc. The following chapter reflects “cultural differences” that need to be taken into consideration when regarding teachers as key stakeholders, in particular in the context of collaborations between teachers and researchers.

Regarding teachers as stakeholders in mathematics education research affords reflecting some (fruitful) „cultural differences”

Collaborations between teachers and researchers are influenced by the different cultures they stem from. In the following, “cultural differences” are sketched in order to highlight possible dimensions which need to be taken seriously when negotiating interests.

Growth: In general, teachers aim at fostering students’ and both their own (affective, cognitive and personal) growth and those of colleagues at their school, while researchers – in addition to fostering teachers’, teacher students’ and their own growth – put an emphasis on contributing to knowledge growth of the scientific community.

Knowledge: In general, teachers aim at generating local knowledge for people involved in the particular context, while researchers aim at generating global knowledge in order to generalize their findings.

Transfer: In general, teachers aim at applying new knowledge in their practice, while researchers aim at publishing their findings, in particular putting an emphasis on its implications for theory.

Time to reflect: In general, teachers don’t have much time to reflect before taking decisions in their practice but have to react immediately, while researchers have time to analyse (parts of) lessons

(e.g. watching the video again and again) in order to understand the rational and implications of decisions taken.

Sharing knowledge: In general, teachers – given they find time for that – share their knowledge with colleagues orally, while researchers generate and share written artefacts.

Evidence: In general, teachers refer to past experiences by memory not based on data, while researchers base their arguments on (systematically gathered and analysed) present data.

Drawing conclusions: In general, teachers aim at working out practice-relevant assessments in the sense of consequences for their work (things to change etc.), while researchers aim at focusing on theory-driven interpretations (based on accurate descriptions which often miss in teachers' case).

Field approach: In general, teachers – having responsibility for students' learning – are and feel heavily involved in their particular context (involved nearness), while researchers can approach the context more neutral (critical distance).

Attitude: In general, teachers overestimate the immutability of general conditions that frame their work and thus – taking into consideration these constraints – have a rather optimistic view concerning their impact on students' learning, while researchers underestimate the general conditions that frame teachers' work and thus – viewing much more scope of freedom and flexibility for teachers to act – have a rather sceptical view concerning teachers' impact on students' learning.

Of course, these "cultural differences" can vary from context to context and might even be not observable or even be switched. However, the dimensions are a starting point to reflect on these potential differences. Often, progress might be achieved by looking into other's domain: for example, related to sharing knowledge, it would be important to teachers to systematically gather data in order to be able to discuss the situation on the basis of written artefacts. In contrast, researchers might realize the power of sharing experiences orally with teachers in order to get an understanding of relevant information not being gathered so far.

These "cultural differences" are a good starting point for negotiating interests and values, and for building trust between teachers and researchers. Respecting these "cultural differences" and even using them as an advantage for joint growth seems to be a powerful window of opportunity to foster knowledge production for all people concerned.

Final comments

The notion of "teachers as stakeholders in mathematics education research" is marking a movement from regarding teachers as more or less passive recipients of researchers' knowledge production or as a means to produce knowledge towards regarding teachers as producers of knowledge, relevant to them but also to the scientific community.

In order to promote knowledge production at a larger scale, researchers need to support teachers' knowledge production at different levels. However, they can't transmit knowledge or theories

directly to the practitioners; they can only offer them environments in which they are able to further develop their existing knowledge and belief system. Researchers and teachers' knowledge and (practical) theories can have nearly no overlap, or alternatively, a large one (with many positions in between).

It seems worth to reflect on the following three hypotheses:

The more researchers regard practitioners as stakeholders of research, the more their knowledge and theory bases will overlap.

Good collaboration and mutual trust between them increases the further development of both parties.

Since researchers are better internationally and thematically organized (in particular based on written artefacts and conferences), they should assume the responsibility of taking serious steps to promote the negotiation process (e.g., Krainer, 2008), based on both parties' strengths and as a two-way-street.

The ideal way would be to regard researchers as key stakeholders in practice, and teachers as key stakeholders in research.

References

Adler, J. Ball, D., Krainer, K., Lin, F.-L., & Novotna, J. (2005). Mirror images of an emerging field: Researching mathematics teacher education. *Educational Studies in Mathematics*, 60, 359-381.

Altrichter, H. & Posch, P. (1990). *Lehrer erforschen ihren Unterricht*. Bad Heilbrunn, Germany: Klinkhardt. [Chinese translation 1997, Taipeh, Taiwan: Yuan-Liou.] [Extended English version: Altrichter, H., Feldman, A., Posch, P., & Somekh, B. (2008). *Teachers investigate their work; An introduction to action research across the professions*. London, New York: Routledge (2nd edition).]

Bazzini, L. (Ed.) (1994). *Proceedings of the 5th International Conference on Systematic Cooperation between Theory and Practice in Mathematics Education (SCTP 5) in Grado: Theory and Practice in Mathematics Education.* Pavia, Italy: ISDAF.

Benke, G., Hospesová, A., & Tichá, M. (2008). The use of action research in teacher education. In K. Krainer & T. Wood (Eds.), *International Handbook of Mathematics Teacher Education, Vol. 3: Participants in mathematics teacher education: Individuals, teams, communities and networks* (pp. 283-307). Rotterdam, The Netherlands: Sense Publishers.

Bromme, R. (1992). *Der Lehrer als Experte. Zur Psychologie des professionellen Wissens.* Bern: Huber.

Crawford, K. & Adler, J. (1996). Teachers as researchers in mathematics education. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International Handbook of*

Mathematics Education (Part 2, pp. 1187-1205). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Elliott, J. (1991). *Action Research for Educational Change*. Milton Keynes: Open University.

Even, R. & Krainer, K. (2013). Education of Mathematics Teacher Educators. Encyclopedia of Mathematics Education. http://www.springerreference.com/docs/edit/chapterdbid/313234.html, retrieved on date 2013-02-03

Freeman, R.E. (1984). *Strategic management. A stakeholder approach*. Boston: Pitman.

Freeman, R.E. (2004). The stakeholder approach revisited. *Zeitschrift für Wirtschafts- und Unternehmensethik (zfwu)*, 3/5/2004, 228-241.

Fullan, M. (1993). *Change forces. Probing the depths of educational reform*. London, UK: Falmer Press.

Hattie, J. A. (2003). Teachers make a difference: What is the research evidence? *Australian Council for Educational Research Annual Conference on: Building Teacher Quality*.

Jaworski, B., Fuglestad, A-B., Bjuland, R., Breiteig, T., Goodchild, S., & Grevholm, B. (2007). *Learning Communities in Mathematics*. Bergen, Norway: Caspar Forlag.

Jaworski, B. & Wood, T. (Eds.) (2008). *International Handbook of Mathematics Teacher Education: Vol. 4, The mathematics teacher educator as a developing professional.* Rotterdam, The Netherlands: Sense Publishers.

Kieran, C., Krainer, K., & Shaughnessy, M. J. (2013). Linking research to practice: teachers as key stakeholders in mathematics education research. In M. A. Clements, A. Bishop, C. Keitel, J. Kilpatrick, & F. Leung, (Eds.), *Third International Handbook of Mathematics Education, Vol. B* (pp. 361-392). Dordrecht, The Netherlands: Springer.

Krainer, K. (1998). Some considerations on problems and perspectives of mathematics teacher in-service education. In C. Alsina, J. M. Alvarez, B. Hodgson, C. Laborde, & A. Perez (Eds.), *The 8th International Congress on Mathematical Education (ICME 8), Selected Lectures* (pp. 303-321). Sevilla, Spain: S.A.E.M. Thales.

Krainer, K. (2003). Teams, communities & networks. Editorial. *Journal of Mathematics Teacher Education*, 6(2), 93-105.

Krainer, K. (2006). How can schools put mathematics in their centre? Improvement = content + community + context. In J. Novotná, H. Moraová, M. Krátká & N. Stehliková (Eds.), *Proc. of the 30th Conference of the Intern. Group for the Psychology of Mathematics Education*, Vol. 1 (pp. 84-89). Prague: Charles University.

Krainer, K. (2008a). Individuals, teams, communities and networks: Participants and ways of participation in mathematics teacher education: An introduction. In K. Krainer & T. Wood (Eds.), International handbook of mathematics teacher education, Vol. 3: Participants in mathematics teacher education: Individuals, teams, communities and networks (pp. 1-10). Rotterdam, The Netherlands: Sense Publishers.

Krainer, K. (2008b). Researchers and their roles in teacher education. *Journal of Mathematics Teacher Education*, 11(4), 253-257.

Krainer, K. (2011). Teachers as stakeholders in mathematics education research. In B. Ubuz (Ed.), Proceedings of the 35th Conference of the International Group for the Psychology of

Mathematics Education, Volume 1 (pp. 47-62). Ankara, Turkey: Middle East Technical University.

Krainer, K., Chapman, O. & Zaslavsky, O. (2012). Mathematics Teacher Educator as Learner. Encyclopedia of Mathematics Education. http://www.springerreference.com/docs/html/chapterdbid/313287.html, retrieved on date 2013-02-03

Krainer, K. & Llinares, S. (2010). Mathematics Teacher Education. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education* (Vol. 7, pp. 702-705). Oxford, UK: Elsevier.

Lin, F.-L. & Cooney, T. (Eds.) (2001). *Making sense of mathematics teacher education.* Dordrecht, The Netherlands: Kluwer.

Llinares, S. & Krainer, K. (2006). Mathematics (student) teachers and teacher educators as learners. In A. Gutiérrez & P. Boero (Eds.), *Handbook of Research on the Psychology of Mathematics Education. Past, Present and Future* (pp. 429-459). Rotterdam, The Netherlands: Sense Publishers.

Pegg, J. & Krainer, K. (2008). Studies on regional and national reform initiatives as a means to improve mathematics teaching and learning at scale. In K. Krainer & T. Wood (Eds.), *International Handbook of Mathematics Teacher Education: Vol. 3, Participants in mathematics teacher education: Individuals, teams, communities and networks* (pp. 255–280). Rotterdam, The Netherlands: Sense Publishers.

Ponte, J. P. (2009). External, internal and collaborative theories of mathematics teacher education. In M. Tzekaki, M. Kaldrimidou, & H. Sakonidis (Eds.), *Proc. 33rd Conf. of the Int. Group for the Psychology of Mathematics Education* (Vol. 1, pp. 99-103). Thessaloniki, Greece: PME.

Posch, P. (1996). Rahmenbedingungen für Innovationen in der Schule. In H. Altrichter & P. Posch, P. (Eds.), *Mikropolitik der Schulentwicklung* (170-206). Innsbruck, Austria: Studienverlag.

Schön, D. (1983). *The reflective practitioner: How professionals think in action*. London, UK: Temple-Smith.

Steinbring, H. (1994). Dialogue between theory and practice in mathematics education. In: R. Biehler, R. W. Scholz, R. Sträßer, & B. Winkelmann (Eds.), *Didactics of mathematics as a scientific discipline* (pp. 89-102). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Stenhouse, L. (1975). *An introduction to curriculum research and development*. London, UK: Heinemann.

White, A. L., Jaworski, B., Agudelo-Valderrama, C. & Gooya, Z. (2013). Teachers learning from teachers. In M. A. Clements, A. Bishop, C. Keitel, J. Kilpatrick, & F. Leung, (Eds.), Third International Handbook of Mathematics Education, Vol. B (pp. 393-430). Dordrecht, The Netherlands: Springer.