

CHAPTER 8

CONCLUSIONS

OVERVIEW

This work was concerned with exploring the field of mathematics teacher professional development from a teachers' perspective. At first, the topic was approached theoretically while providing an overview on the relevant research literature from an international perspective. At second, one chapter was clearly dedicated to outline the specific situation in Germany. At third, a concrete mathematics teacher professional development program was presented and discussed against the theoretical background. Finally, the field of professional development was empirically brought into focus, from both a quantitative and a qualitative perspective.

GENERAL REMARKS

As made explicit in the introduction, the statement made by Krainer (2005a) that teachers have to work all the time for what constitutes good mathematics teaching, has also been crucial for the approach in this work. Ultimately, the teacher him- or herself decides what constitutes appropriate professional development. Weinert (1998) provides an analogous comment when arguing that "good teaching can be realized in quite different, anything but arbitrary ways" (p. 17). However, from its very connotation, the term *good* can only be interpreted subjectively, and teacher educators need to be cautious and self-critical with respect to their own understanding of professional development. While referring to Weinert's statement, Elsbeth Stern in a talk at Hamburg in 2007 argued that what research can only contribute is knowledge about issues that are hindering and do *not* work.

Lessons Learnt from Teachers

The rich data portrayed in this work gives some information on what does not work for teachers regarding their professional development. However, it has proved to be worthwhile and necessary to further elucidate what issues teachers consider as essential in the field. In total, the results provide a complimentary insight in terms of promoting and hindering factors. The empirical findings shed light on interesting aspects relevant for teachers in the broad contexts of professional development in general and in-service education in specific. Teachers discussed their interpretations on professional development and expressed their understanding. The diversity of viewpoints, attitudes and opinions, as well as experiences and expectations contributes to a bigger picture framing teachers' *reality* of *professional development*.

The leading objective of this work has been to fathom some *hidden dimensions* in this *reality of professional development* that have not been in the research focus so far. Much information has been provided by recent research that of course contributes a catalog of dimensions relevant in the field of teacher professional development. In total, the situation can be characterized as a '*professional development iceberg*' symbolizing that there are many decisive dimensions, which are not visible at first sight.

In the following, some theses will be listed that, on the one hand, trace a path through the empirical findings and can be understood as lessons learnt directly from teachers. On the other hand, these theses are inextricably linked to experiences made in the course of the professional development program *Mathematics Done Differently*, which built the context for the research that was reported in this work. Thus, the aspects mentioned below also present what we have learnt from our ongoing project and related research on teachers' views on professional development.

As mentioned in chapter one, innovative approaches are sensitive to teachers' needs and their conceptions, and are not of the type '*either/or*' but '*both/and*', as Ann Lieberman from Carnegie Foundation for the Advancement of Teaching formulated at a conference in Germany. All following aspects thus refer to such either/or-patterns, i.e., duality aspects. Alluding to this duality opens a new view on professional development that is more likely to understand any offer as being of the type '*both/and*'.

Understanding professional development as continuous learning between theory and practice. Mostly teachers do not possess an elaborated view on their professional learning, or a conception of professional development as a permanent learning endeavor that is not at least, initiated by learning daily through practice. They remain rather vague with respect to their own learning processes (cf. chapter one). The question that is left unanswered is what conception teachers really possess concerning their own long-term professional development. Any developmental processes need a kind of vision or commitment as initiating forces. When such a view on professional development is missing, events are partly conceived as being of punctual character, which might further explain that in the best case only gradual changes can take place.

Unfortunately, there are many contributions and recommendations in teacher education, which do not reach the realm of teachers. Obviously, what is needed is a culture of reciprocally sharing experiences, in the sense that theory informs practice and vice versa. In some of the interviews it was described how even little incitements can serve as initiating motivation and change processes and surely, research already supplies us with many adequate occasions. In the project, a very specific relationship between research and practice is favored while the in-service training courses bring together an academic teacher and a schoolteacher as a trainer *tandem* (cf. chapter four). The former is valued since he or she allows for a widespread theoretical view on the content, while providing an interpretative framework encompassing the experiences from practice. The latter is additionally appreciated in a supportive role, since he or she ensures that all courses are very practice-oriented. The views of teacher educators and teachers typically differ, so that the various accentuations offer a comprehensive picture on the single topic when put together.

Establishing a supportive culture for teachers pursuing their professional development. Undoubtedly, teachers need support in pursuing their professional development. So far, external support provided by school leadership or educational policy, for instance, concerning the allocation of resources has widely been discussed. But teachers' statements in the interviews moved the discussion onto another level as well, i.e., showing appreciation like pointed out in the following was considered as a very valuable approach. The fact that teachers obtain the opportunity to work with mathematicians and mathematics educators of *their* choice and to invite them to *their* own school has been respected highly by the teachers.

One teacher mentioned explicitly how privileged the school staff felt to get this tandem of a university teacher and a schoolteacher to their school, and how they felt supported from outside classroom reality (cf. chapter seven). In another case, a group of teachers applied for a course *on demand*, i.e., a specific theme that was not part of the supply of the project. The teachers already informed themselves and got some information by a research book. Fortunately, we could make it possible to hire the book author as a part of a trainer tandem, who then designed a course with respect to the very needs of this teacher group.

One recent development in Germany has been to delegate more responsibility to the individual school. However, the emerging question is if schools are ready to shoulder the new role. At least, schools and teachers need support, and a market that holds ready interesting and appropriate offers for teachers to choose from. By the project *Mathematics Done Differently* a kind of landscape could be established that also involves expertise from our colleagues from all over Germany since already existing in-service courses are made accessible nationwide (cf. chapter four). Meanwhile, quite different course offers are available via the project homepage that are partly also initiated by specific demands of teachers, for instance, courses that address the interfaces between kindergarten and primary school.

The difficult situation for schools in terms of procuring money for in-service education has been topic in many of the interviews. The options provided by the project are of course exceptional since the funding makes things easily possible. One additional concern has also been to provide all in-service courses in an esteeming atmosphere, e.g., teachers were provided refreshments during the breaks.

Another essential aspect is support by school policy with respect to releasing teachers from teaching. Not only the single in-service training needs time but possibly follow-up meetings and course work to enhance new or different ideas, too. In the interviews, teachers reported about their difficulties to get support for in-service training events that required a whole day and again, the following teacher statement is cited, which so aptly catches the difficult situation:

In advance, I had asked my headmaster if she would allow a daily event. Well, and I said it costs nothing. Anyway, then I just said, it lasts four days and it costs nothing. (cf. chapter seven)

Much of the research discussion related to professional development concentrates on banning short term and single events from the agenda, but in the *reality* of professional development administrative restrictions are a matter of particular concern

and run counter a long-term orientation. Thus, a supportive culture is indispensably needed for teachers engaging in professional development.

Providing professional development offers as needs-based education. Since teachers are assigned a key role in educational affairs, they are naturally and necessarily in the center of reform but the crucial question is whether teachers' needs are, too. Many professional development offers do not explicitly involve teachers in planning, but a crucial point is that in-service education then takes the risk of going beyond what is actually needed. Sometimes the debate on in-service education centers on favoring either *supply* or *demand* oriented approaches, but actually, needs are the roots of motivation (Hannula, 2006). Consequently it is important to pay attention to teachers concerns and to focus on their needs, instead of nurturing such an unhelpful dichotomy. Some teacher groups may find interesting offers from the course supply while others do not, who then need a very specific course designed according to their concerns.

Regarding needs-based education, one teacher pointed out that a need for professional development must be there, emerging from inside the teacher, and that the crucial point is to meet teachers where they are (cf. chapter seven). The teacher statement hints at an essential prerequisite for effective in-service training, namely the necessity of an adequate pre-arrangement that teachers and trainers agree upon before the course starts. The issue has been rather neglected until now, but would help to discover the individual needs of the group of teachers that go beyond the designated themes and topics. Actually, meeting the teachers where they are is or should be a trivial axiom. In order to get informed about teachers' requirements and to make the courses fit accordingly, these agreements are needed.

Need identification in the field of in-service education hence adds another point to the single event, that is, the prearrangement, an issue that is also elaborated on later when discussing the role of products and processes. So far, in the research literature little is reported about identifying teacher needs. Even empirically, this research topic is not really accessed. That is why in the run-up of the project *Mathematics Done Differently* huge amounts of data were collected as a mean to firstly approach the field of teacher professional development.

Enabling teachers to develop a sense of ownership and partnership. Closely connected to aspects of needs oriented education are those of agency and ownership. When demands and changes are imposed from outside that do not touch the teachers' needs, they will probably find a way to deal with them. Even when they stay the same, like one teacher mentioned how he and his colleagues tend to comment such a situation with the words "set theory came, set theory went" (cf. chapter seven). That is, teachers are very sensitive regarding hastily placed educational changes. Or as one teacher put it, they very easily react negatively when they feel like someone is stealing their precious time (cf. chapter seven).

In the field of professional development, issues of ownership and the question, *Who has the agency?* also address the discussion about change processes. As already

mentioned (cf. chapter one), the perspective taken in this work is that we cannot change another person, and in particular, that teachers cannot be developed passively. But what we can do is providing rich and substantial professional development opportunities for teachers, who then ultimately hold the ownership of change in their own hands. Addressing teachers' needs involves a paradigm shift from viewing them simply as objects or recipients to clients and designers of their professional development. Engaging in professionalism must be a choice, not only with respect to attending a specific course, but to all other involved levels as well, that in sum contribute to an active participation.

What has been discussed here under the headline of ownership does not in the first place address the individual teacher but groups of teachers working together at one school or neighboring schools. Issues imparted by an in-service training are not likely to be transferred into the classroom when the single teacher obtains no support by colleagues or is even criticized for innovative approaches. It is essential that teachers get the opportunity to swap ideas and to discuss issues that they have encountered. One teacher put it pragmatically, that more ears hear more and more eyes see more (cf. chapter seven). In addition to this, the value of professional collaboration lies in sharing reflective exchange and practice. Necessarily, authenticity contributes to a sense of self as mathematics teacher, which mainly develops in interaction with colleagues (cf. chapter one). Therefore, a concern of in-service education clearly is to aim at initiating or supporting staff development in school.

Offering possibilities for in-service education like we did by our project is no more, no less than an important impetus upon which the involved persons decide what aspects to further take up. However, teacher motifs to participate in a specific event can be distinguished with respect to different levels. It appeared from the teacher statements in the interviews that the motifs to attend in-service education in the favorable case intertwine a micro level, the own progress, and a macro level, the professional growth on a larger scale. Some teachers just remained on the micro level, mainly those whose motifs did not emerge as their own needs but were pushed from outside (cf. chapter seven). Thus, intrinsic motivation is more likely to be tied to aspects of school development.

Acknowledging teacher beliefs and affect in the field of professional development.

In general, beliefs serve as affordances in mathematics teaching and learning, an observation, which encompasses the field of professional development, too. Beliefs are linked to the self-concept of the bearer, and they serve as a kind of self-assertion, which protects him or her against uncomfortable ideas (cf. Goldin, Roesken, Toerner, 2008). Hence, beliefs and affect can clearly impede an open attitude towards new ideas. In this respect, one should consider that teachers mostly possess rich experiences related to in-service education, which undoubtedly establish various expectations.

For instance, when discussing the teacher statements given in the interviews, kind of disappointment was reported when teachers felt like they were wasting their precious time. Another crucial finding was that a teacher's view on his or her learning can influence the general attitude towards an in-service training course (cf. chapter seven). Thus, beliefs about learning and professional development are interrelated

since the view on learning of course shapes the perception of learning offers provided by in-service training.

Some teachers possess an unconciliabile position concerning developmental processes and are therefore easily resistant to any progress. In general, change can either be exciting or frightening depending on how it is viewed, based on hitherto experiences. In a rather negative attitude, like the teachers that at first rather see the problem than the good idea, professional development offers are easily experienced as a me against situation. That is, in order to grow one actually must give up the struggle to remain the same. Obviously, teachers do possess an elaborated value system, which can impede being really open to new ideas and suggestions. Unfortunately, such a critical attitude might lead teachers to miss a chance to gain new incitements and awarenesses.

So far, the focus has been on rather negative influences of beliefs and affective variables but in the following, positive and inspiring effects will be highlighted. For instance, teachers informed about how the in-service training contributed to developing new insights, to looking on the subject from a meta-level, and finally to yielding a new view or a *higher* standpoint. One teacher pointed out how colleagues who were actually not really willing to attend in-service education shifted their mind after attending the course (cf. chapter seven), and how they were then looking forward to the next session. Obviously, one important role of professional development is to provide challenging experiences so that new ways for teachers can open up, like one teacher who was actually not open for the in-service training in the beginning, but then asked his colleagues if they could teach a corresponding lesson together.

There are few if any beliefs with which the bearer associates no affective loading (Goldin, Roesken & Toerner, 2008), like the above-mentioned remarks indicate. Beliefs are interwoven with affective variables, like math is fun or can be fun or even fascinating, as one teacher stressed (cf. chapter seven). Teachers' positive attitudes primarily influence any process that occurs in the aftermath of a specific professional development event. Obviously, an atmosphere of trust as well as emerging enthusiasm are good indicators for pursuing new issues. Teachers from the same department that support each other, who are open and frank, are likely to benefit from professional development.

In his talk at the ICME 11¹ conference in Monterrey, Mexico, Jeremy Kilpatrick discussed the work by Felix Klein on the double discontinuity that teachers encounter on their way from school to university and back to school. Particularly, he stressed that Klein's concern was to provide opportunities for teachers to obtain a *higher* standpoint, a notion that is sometimes labeled as an advanced standpoint. However, the latter English translation does not adequately meet the German expression since the original aim of Klein, as Kilpatrick pointed out, was that he wanted the future teacher to stand above his or her subject, and to arrive at a more panoramic view. Since the results presented in this work give renewed emphasis to the profound relevance of beliefs and affect in the context of professional development, any offer should provide teachers with rich opportunities to obtain such an elaborated view.

Establishing a market view on professional development. As mentioned before, assigning more responsibility to the individual school indispensably calls for providing

an adequate market of professional development. This market can be viewed as being dependant on the law of supply and demand. Consequently, issues of ownership and teacher needs are automatically in the focus, since the approach demands asking the teachers themselves, what their experiences and their concerns are. The project chose a very specific combination of both *supply* and *demand* oriented in-service education. To sum up, the initiative gathers in-service training courses that have already been successfully conducted in parts of Germany, and now makes them available and accessible nationwide. In addition, a particular concern has been to meet the unique needs of teachers by designing courses especially regarding to those requirements. To consider both approaches similarly important enables a good view on teacher education since one avoids the danger to value one on the expense of the other.

However, rather naively, we started by focusing strongly on the products as being crucial on the market and favored offering supply oriented in-service education. Over the course of time, through conversations and discussions with teachers, the demand-oriented approach has become increasingly important, which is characterized as being very close to teachers' needs. Identifying what offers are needed calls for observing the market attentively and for being sensitive for trends or specific topics. Quite recently, we adapted our supply in stochastics to make it, in terms of course modules, more fit to the needs of a specific customer. Nevertheless, to rely only on this course format, i.e., on the themes raised by teachers, is a tough and time-consuming job since it also requires establishing an adequate net of experts in the respective thematic fields. Not at least Simon (2007) reminds us to consider that teachers' prior knowledge also serves as an assimilatory scheme, and that therefore themes provided by teacher education research can help to inform practice. A very good way, hence, is to also supply an offer, e.g., specific courses, and make those adaptable to the very needs of a teacher group.

Meanwhile, we have acknowledged that it is in particular the process around all these products, which is decisive for effective professional development. Pre-arrangement and follow-up support are then essential variables and supplement each in-service training course. The initiated discourse between teacher educators and teachers also adds to providing in-service training as being a *pair* of product and process, a development that is far from just focusing on the individual session. Taking a market view on professional development, as we did in our project *Mathematics Done Differently*, allows for both spreading research knowledge and providing a forum for teachers' needs and concerns.

To sum up, this market of professional development addresses many duality aspects while mediating between providers and customers, demand and supply, products and processes, theory and practice. We also acknowledge that there are competitors in this market, for instance, the federal institutes providing in-service education, and we understand our role to search for sustainable collaborations.

Providing flexibility instead of standardization while offering professional development. Finally, to take teachers' needs seriously puts high demands on the teacher educators responsible for providing professional development activities. Correspondingly, Cochran-Smith and Lytle (2001) conclude that "professional

development is associated more with uncertainty than certainty, more with posing problems and dilemmas than solving them” (p. 56). One might tend to deem the aforementioned statement as disillusioning, but what has made the project so successful is that the offered bouquet is huge and therefore, makes it possible to supply a varied mixture. Such a broad offer is necessary since teachers as learners bring with them diverse mathematical histories, diverse amounts of prior knowledge and thus, diverse concerns and requests. The supply is not restricted to addressing the cognitive domain, but involves the affective as well, since teachers encounter new ideas through their knowledge *and* their beliefs.

The most decisive characteristic has been to keep ready flexibility with respect to both content and context. In case, a school orders a very short in-service training course due to time constraints, it does not help to theoretically argument against. Instead, the specific necessity must be met. Standardization is not helpful when professional development is considered as being needs-based education.

One essential conclusion that has been taken at any point of the project is that we as teacher educators are part of a learning system. According to the teaching triad (Jaworski, 1992, 1994), in the adapted version for mathematics teacher educators by Zaslavsky and Leikin (2004, cf. chapter two), one crucial aspect is the sensitivity to teachers, on which our learning has been build. To design and run a project can by no means be a static endeavor but is indispensably a developing process. Thus, refinement and adjustment are consequently part of the agenda and document our own learning process of revising the initial approach. Throughout the project progression, we have acknowledged that we are professional developers, too and we experienced growing into the practices in which we have been engaged (cf. Jaworski, 2006).

Concluding Remarks

Teachers are crucial to students’ learning of mathematics, thus they play a key role for gaining educational excellence. Undoubtedly, professional competence in a professional role requires adequate professional development opportunities. Continuing professional development then is more than some special events at some days during the school year. A comprehensive understanding considers context factors like the cultures and the organizations in which the teachers work, and addresses all levels in the educational system. The statements listed above provide a concise overview of dimensions relevant for teachers and teacher educators in the field of professional development in general and in-service education in specific. Based on the aforementioned theses, we² propose an overarching research-based model of professional development that is characterized by the following parameters:

- Professional development of mathematics teachers is a continuous and a lifelong process.
- Teachers need a supportive culture for pursuing issues of professional development.
- Professional development must be needs-based education that allows for developing a sense of ownership.

- Professional development for in-service teachers is understood as a market, being dependent on supply and demand.
- The market involves all expertise in the field of teacher education available in the country.
- The market holds ready offers for teachers' continuous learning while balancing theory and practice.
- In-service training courses unite theory and practice, while involving both a university teacher and a schoolteacher as a trainer tandem.
- The in-service training courses take into account the teachers' knowledge and beliefs.
- In-service training addresses groups of teachers working at one school or neighboring ones.
- ...

In sum, the model that is shown in [figure 16](#), describes possible growth pathways of teachers through different fields of tension. The underlying philosophy of professional development is driven by a marketization and a humanistic view (cf. chapter one), which allows for pursuing quality management in terms of efficiency and effectiveness, and for meeting the different needs of the people involved:

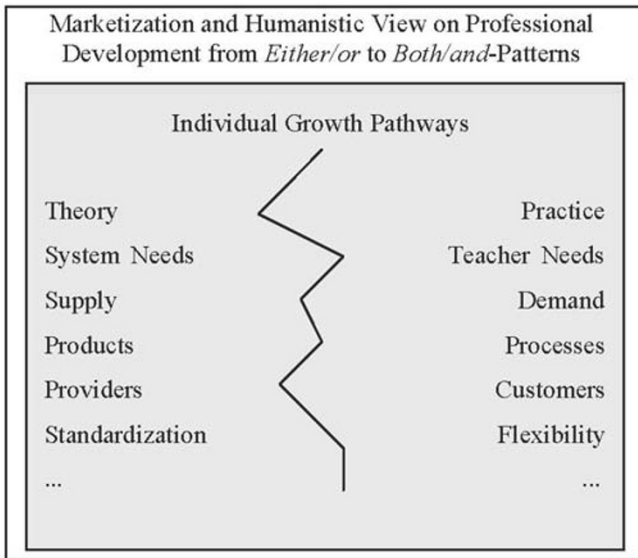


Figure 16. Model of a market for mathematics teachers' continuous professional development.

The model can be understood as providing implications for constructing practices of professional development that are based on what teachers really need. The direction for professional development is guided by the knowledge-of-practice conception as

described in the analytical model by Cochran-Smith & Lytle (1999, cf. chapter one). That is, any offer encompasses both a teacher's experiences in practice and theoretical input given by research.

The model is further characterized by balancing the needs of the system and the needs of the teachers, the relationship between theory and practice, supply and demand oriented education, products and processes in the field of in-service training, and finally by allocating flexibility for the different demands.

Development and change are regarded as processes rather than single events, addressing various levels in the educational system. Correspondingly, sustainable professional development initiatives have an influence on the community and context inside and outside their scope. Teachers professional identities are rich and complex, as is teaching practice, thus diversity and flexibility are crucial on a market of professional development. Hence, the only remaining claim can be to transcend diversity.

The philosophy of the proposed model is primarily determined by a marketization view (cf. chapter one), in terms of the characterization provided by Elliot (1993). Nevertheless, what we strongly advocate is to add a humanistic view on teacher professional development. While discussing different approaches to offer in-service education Cochran-Smith and Lytle (1999) underline that not the methods are decisive, but the views on the teachers. Unfortunately, very often proposed changes and new models for professional development are built around very old conceptions, beliefs and convictions. As a result, these offers center on the position that teachers are rather considered objects that need something.

Clearly, the model concentrates on structural features. Since educational expertise, available in the country and on an international basis, is involved both in terms of already established courses, or in the persons that are actively engaged as trainers, a content discussion is not necessarily required in the first place. Ultimately, the knowledge debate is integrated, since all experts are responsible for the courses that they provide. In a sense, the model leaves untouched the prevailing conception of in-service training as entailing a team of researchers offering a course for which they are the experts in the field. An essential advantage of the proposed model lies in the fact that the marketization view on professional development practices can be realized as an intervention from outside, by simultaneously involving expert knowledge available inside the country. However, such an initiative is from its very conception more likely to provide flexibility to be able to meet the needs of all the people involved.

Professional development is often determined by *black and white thinking*. Either issues are considered as being good or bad, or statements like *teachers should*, *teachers must* or *teachers need to* are transported. But thereby, it is easily forgotten from which perspective the judgment is taken, surely it is not the teacher's one. Toerner (2008), while referring to a statement of Felix Klein, reminds of the following:

Teacher preservice and in-service education need to be thought from a teacher's perspective, since the efficacy of the personality matters much more than methods or curricula. Not until we succeed in such professionalism, and we are able to create a new approval culture, a real incentive for lifelong learning will be given.

Obviously, what he is referring to, the vision of Felix Klein, articulated 100 years ago is still relevant:

In particular, I would like to let the individuality of a teacher's confer freedom. I believe more in the effectiveness of personalities than that of the sophisticated methods and curricula. (as cited in Schubring, 2000, p. 70)

Profoundly respecting and cherishing the teachers and their needs, allows for arriving at a vision of professional development that is *for* and *with* teachers, instead being simply about them.

FUTURE PROSPECTS

So far, based on theoretical considerations, empirical findings, observations, and experiences in the context of a specific professional development program, some suggestions were provided how to approach the field. Consequently, the next step is pointing to some future directions for ongoing research related to the findings presented in this work. The overriding topic, of course, is supporting the scholarship of teaching by taking the teachers themselves, their needs and concerns seriously. Given that professional development does only make sense when those needs of teachers are explicitly addressed, prearrangement and follow-up support naturally get into the focus and release the sustainability discussion from being restricted to a rather artificial level. Ann Lieberman is quite right when arguing that professional development does not help in terms of *either/or* but needs to be of the type *both/and*, as cited several times in this work. The implication is, that we need a system of variety and diversity while supporting teachers to get articulated about their practical requirements.

Teachers provided rich insight in their interpretations on professional development and expressed their point of view. By means of quantitative and qualitative data, rich information was collected. The quantitative approach indicated that a teacher's view on professional development is structured and, consequently, unravelable. The obtained dimensions could then be characterized with regard to the degree of agreement, and to the relationship between them. Particularly, the latter helps to make transparent the dynamics involved in the interaction of dimensions. However, the qualitative approach provided some supplementary insight in what is relevant for teachers, so that the data can be used to further develop the quantitative approach. That is, the interview data analysis yielded a rich basis for refining items or adding aspects that have not been addressed so far.

The qualitative approach addressed level one of Lipowsky's characterization that was presented in chapter two, who, in this context, already called to mind that some research questions remained unsolved, mainly those dealing with personal parameters. The findings presented here indicated that particularly, teachers' beliefs and affective variables are crucial (cf. chapter seven), and that this field of research needs further clarification.

Many theoretical aspects were discussed and reflected from both perspectives while approaching the field theoretically and empirically. However, Holzkamp (1995)

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provides an interesting statement when concluding that the contribution of the known converges just against zero in view of the unknown. Perhaps, this remark is very pessimistic, but it calls to mind that there are many additional issues to explore. The author's understanding of the contribution of this work to research in the field leans on the following statement by Atkinson (2000):

The purpose of education research is surely not to provide “answers” to the problems of the next decade or so, but to inform discussion among practitioners, researchers and policy-makers about the nature, purpose and content of the educational enterprise. (p. 328)

In this sense, this work is also to be understood, i.e., as informing the educational discourse about the teachers' views in order to get ultimately continuous professional development from their very perspective high on the school improvement agenda. However, by so doing, too, the following remark applies to what has been reported here:

[...] a narrow focus on ‘what works’ will close the door that leads to new possibilities, new strategies, new ways of reframing and reconceiving the educational enterprise. (Atkinson, 2000, p. 328)

This work contributed some interesting and remarkable findings. Nevertheless, future research, either theoretically or empirically oriented, will discover further and different aspects, but what really matters is the view and perspective the researcher takes when exploring the field of professional development.

NOTES

¹ <http://icme11.org/>

² The model was developed together with Prof. Dr. Guenter Toerner, University of Duisburg-Essen.