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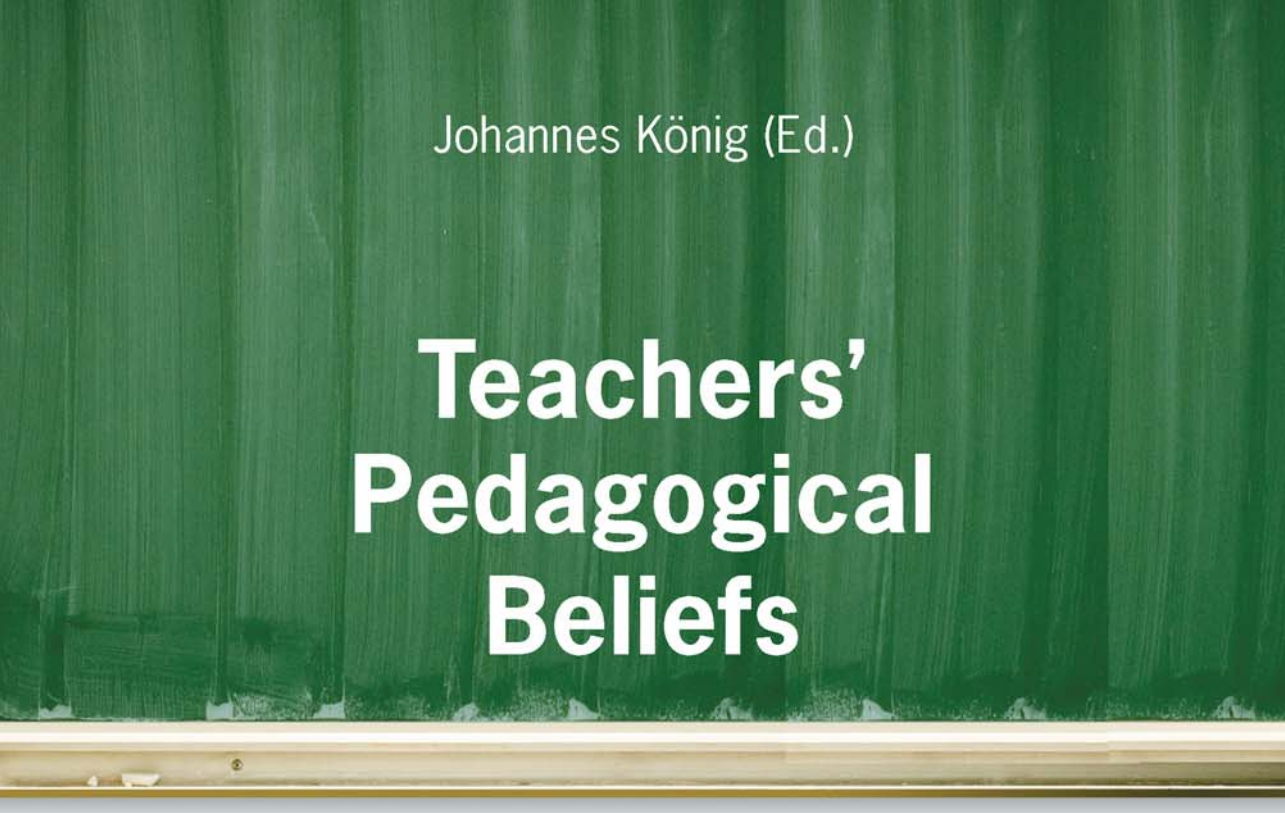

Johannes König (Ed.)

Teachers' Pedagogical Beliefs

Definition and Operationalisation – Connections to Knowledge and Performance – Development and Change

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Contents

Chapter 1
Teachers' Pedagogical Beliefs: Current and Future Research

Johannes König

The professional competences of teachers, both in-service and pre-service, has been the focus of increasing attention in recent years, both in public debates about school education and in related research disciplines such as psychology, pedagogy, and didactics. Teachers are seen as experts who, with their knowledge, know-how and professional ethos have the necessary, cognitive, motivational, volitional and social skills to ensure that their lessons activate the appropriate cognitive learning processes in their pupils and that they are able to support their pupils so as to achieve specific subject and interdisciplinary targets. Professional competences therefore include objective professional knowledge, and – alongside other elements, such as motivational aspects – subjectively expressed beliefs. The latter is of particular importance when trying to better understand what determines the way in which teachers act and the consequences of this action. We know, for instance, that teachers select their teaching targets and approaches on the basis of their beliefs. We also know that teachers' beliefs influence how they interpret and perceive teaching situations as well as affecting the teaching and communication methods they adopt to respond to these situations (see Reusser et al., 2011).

Now, this is all very interesting, but anyone wanting to look at teachers' beliefs in more detail will not get very far by examining the existing specialist literature on the subject. The shortcomings of existing research will be covered here in detail since they were the starting point for a symposium held in autumn 2011 at the University of Cologne, entitled "Teachers' pedagogical beliefs and their relation to knowledge and performance". At the symposium recognised experts were asked to speak about fundamental issues relating to research on teachers' beliefs and to report on their own empirical research. This volume documents the discussion that took place. Even if this volume asks more questions and identifies more research gaps than it gives clear and unambiguous answers, it aims to bring together important insights on teachers' pedagogical beliefs and as a result to take the research discourse forward.

1.1 How can teachers' pedagogical beliefs be defined and operationalised?

There is no clear definition of the term "teachers' belief" (for more detail see the chapters by Horst Biedermann et al., Sigrid Blömeke, Jürgen Seifried and Melanie Taibi in this book). Almost 20 years have passed since Frank Pajares described this

"messy construct" in his well-known essay about teachers' beliefs (1992). In the current *Handbuch der Forschung zum Lehrerberuf* (Handbook on Research into the Teaching Profession), which was published last year, Kurt Reusser and his colleagues sum up that "despite repeated attempts at establishing a definition (…) very little has changed to this day" (Reusser et al., 2011, p. 479). It is unclear to what extent beliefs – referred to by Richardson (1996, p. 103) as "psychologically held understandings, premises or propositions about the world that are felt to be true" – can be distinguished from knowledge, values, motivational orientations, attitudes and behaviour. It is also unclear how beliefs should be understood in relation to subjective theories, perceptions, views or ideas.

In the individual chapters of this volume it becomes clear that – at least in terms of content – teachers' pedagogical beliefs can indeed cover a broad field. On the basis of existing classifications (for more detail see, among others, the chapters by Sigrid Blömeke, Melanie Taibi, and Inka Wischmeier), teachers' beliefs can be roughly divided into the following two areas:

1) Beliefs about teaching and learning;
2) Beliefs about professional development.

The first area generally focuses on the interaction between teachers and pupils. In the second area teachers' professionalism comes to the foreground, in particular its effect on the interaction between teachers and pupils. Although these areas are differentiated they are intertwined rather than isolated from each other.

Beliefs on the interaction between teachers and pupils are the primary focus of the majority of contributions in this volume. Sigrid Blömeke, Horst Biedermann et al., Lorraine Gilleece and Jürgen Seifried make use of a well-known concept that differentiates between teachers' constructivist beliefs and their direct transmission beliefs. This concept looks at the interaction between teachers and their learning group as a whole and is differentiated for particular teaching subjects. The chapter by Peggy Ertmer et al. explores beliefs about teaching and learning related to the integration of technology into the classroom. The question of how teaching is enriched through the intelligent use of technology such as computers or the internet is of great importance. In contrast, the broad theme of diverse pupil populations is taken into consideration by Johannes König et al. and Inka Wischmeier. König et al. focus on teachers' pedagogical beliefs on retention (repeating a school year) in schools and examine how these beliefs are related to aspects of teaching quality such as adaptive teaching strategies. Wischmeier looks at the impact of culturally and linguistically diverse classes and analyses teachers' beliefs about bilingual language acquisition.

Teachers' professionalism, the second of the two content areas, is the focus of the chapters by Martin Rothland and Melanie Taibi. Martin Rothland examines the beliefs of pre-service teachers about their professional development using the *FIT-Choice* Instrument on career-choice motivations and views about the teaching profession. It is clear that beliefs relating to the teaching profession and the work of teachers are of importance even during university courses, and that there can be differences between pre-service teachers' attitudes towards their professional development. Melanie Taibi

also examines beliefs held about teaching as a career, but also draws on other content fields such as beliefs about teaching and learning. Her contribution thus provides a particularly broad view of teachers' pedagogical beliefs.

1.2 How are teachers' pedagogical beliefs connected to knowledge and performance?

Besides the need to define teachers' pedagogical beliefs, it is necessary to decide whether and to what extent the knowledge and beliefs of teachers affect their actions and, in particular, the effect this has on teaching outcomes, such as pupil performance. Existing research repeatedly asserts that teachers' beliefs play a bridging role between job-related knowledge and teachers' conduct in difficult professional situations, which can eventually have an impact on the school and teaching outcomes.

For a profession such as teaching, which is characterised by its complexity and uncertainty, it is highly plausible that teachers' behaviour is not only affected by their knowledge. On the contrary, it is likely that beliefs become important in challenging situations where the teacher's knowledge is insufficient or where the necessary knowledge is not available to deal with the situation. Therefore, generally beliefs are seen as a factor which influences the structure of lessons. With this in mind, the contributions that examine the relationship between beliefs and either knowledge or other indicators are particularly interesting, as they can help explain the actions of teachers in teaching and learning situations.

In her chapter, Sigrid Blömeke analyses how the content knowledge and pedagogical content knowledge of future mathematics teachers relate to their beliefs about the nature of mathematics and about teaching and learning mathematics. Using an international comparative study she concludes that teachers' knowledge and beliefs are clearly intertwined. Professional knowledge in mathematics "increases dynamic beliefs on the nature of mathematics and decreases static beliefs and the belief that being good at mathematics is a talent which someone is born with, rather than a skill which can be learnt. These beliefs, in turn, influence how a teacher regards teaching and learning, either from a more constructivist or transmission point of view" (see Chapter 2, p. 32).

Peggy Ertmer et al., Jürgen Seifried and Johannes König et al. have contributed important chapters on the performance of in-service teachers. They provide information on how beliefs relate to actual teaching practice. The analysis conducted by Peggy Ertmer et al. demonstrates that pedagogical beliefs do influence specific classroom practice; "teachers' beliefs and attitudes about the relevance of technology for students' learning were perceived as having the biggest impact on their success" (see Chapter 9, p. 149). Seifried looks at teachers at business schools and examines the connection between teachers' beliefs and the way in which their lessons are organised. Among other findings, the teachers with constructivist views tended to opt for more pupil-centred teaching methods, such as group work. König et al. show that teachers

who favour grade retention as a measure for excluding students from learning groups in order to improve the level of their groups are less committed to provide individual learning support to their pupils in class. If we consider that the effects of teachers' beliefs can be seen not just in the teaching approach taken, but that they also have an effect on pupils' performance, then Lorraine Gilleece's analysis is enlightening. In combination with previous works, the results of her analysis throw light on systematic relationships between teachers' direct transmission beliefs and pupil achievement on the basis of international data.

1.3 How can teachers' pedagogical beliefs be developed and changed?

In view of the important role that beliefs play in the teaching profession and bearing in mind that they are a part of professional teaching competences, researchers need to examine how the beliefs of pre-service teachers and in-service teachers can be modified through teacher training and professional development programmes.

In Germany, as in many other European countries, teacher training is currently undergoing a transformation. There is a move away from established course structures towards new BA and MA degree courses for teachers. This brings with it a new structure for the teacher training curriculum with a stronger emphasis on competences and a greater focus on teaching practice in schools during the course. What is interesting here is deciding the beliefs which should be promoted in the training courses because they will facilitate teachers' work in the future. Ultimately, this issue involves understanding whether beliefs can even be modified, for instance through courses during training. Existing studies, in particular Anglo-American ones, repeatedly make the sobering suggestion that beliefs, by their nature, are stable and therefore prove to be very difficult to influence through opportunities to learn.

Horst Biedermann et al. and Melanie Taibi tackle this issue in their contributions to this volume. Biedermann et al. investigate the extent to which students' beliefs about teaching and learning change over the course of their teacher training programmes. Their results suggest that during teacher training students do indeed adopt constructivist-oriented beliefs regarding mathematics teaching. The authors attribute these results to the existence of opportunities to learn, which provide trainee teachers with situational learning opportunities. Taibi uses a case study to illustrate that the development of beliefs is triggered and promoted primarily through reflecting on personal achievement and career development with regard to school-related issues during teacher training. These results, as well as the chapter by Ingelore Mammes et al., provide a strong case for integrating the development of beliefs into the teacher training curriculum and consciously adapting opportunities to learn to the development and discussion of existing beliefs.

1.4 Looking forward

The findings compiled in this book indicate areas to be covered by future research on teachers' pedagogical beliefs, which include the following:

1) Conceptual definition and empirical operationalisation of teachers' pedagogical beliefs;
2) Distinction between teachers' pedagogical knowledge and pedagogical beliefs;
3) Complex analysis of the potentially concurrent influence of knowledge and beliefs on teaching and learning, as well as on student outcomes;
4) Theoretical and empirical research on the development and change of teachers' pedagogical beliefs.

The different chapters in this book approach these areas in various ways, as outlined in this short introduction. The chapters are divided into two sections, one dealing with research into pre-service teachers and the other with their in-service counterparts. While the chapters on pre-service teachers primarily reflect and analyse whether and how teachers' beliefs can evolve, the second section on in-service teachers contains an analysis of the possible effects of beliefs on a teacher in the classroom and on the pupils. Both sections present important findings in terms of definitions, in particular specific definitions of teachers' beliefs and their demarcation, together with the operationalisation of the empirical research which is significant for the respective chapter.

I would like to offer my warmest thanks to everyone who has been involved in this book, in particular the speakers at the symposium who have contributed as authors. I would also like to extend my thanks to *Max-Träger-Stiftung*, *Zeit Stiftung Ebelin und Gerd Bucerius,* and *Bergmoser + Höller Verlag* for their financial support. My thanks also go to the organising team for their energetic preparation of the symposium on 26 November 2011 at the University of Cologne: Christina Baur, Kerstin Darge, Catrin Pitton, Melanie Schreiber, Lutz Strecha, Melanie Taibi, Gisela Wagner and everyone else at the Institute for General Didactics and School Research who played a supporting role. The thorough revision of the English-language version was carried out by Anne Forder and Fran Lawrence, and the meticulous compilation of the book manuscript was done by Andrea Aretz, all of whom receive my warmest thanks.

References

Pajares, F. M. (1992). Teachers' beliefs and educational research. Cleaning up a messy construct. *Educational Researcher, Vol. 62,* 307-332.

Reusser, K., Pauli, C., & Elmer, A. (2011). Berufsbezogene Überzeugungen von Lehrerinnen und Lehrern [Work-related beliefs of teachers]. In E. Terhart, H. Bennewitz, & M. Rothland (Ed.), *Handbuch der Forschung zum Lehrerberuf* [Handbook on research into teaching profession]. (pp. 478-495) Münster, Germany: Waxmann.

Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. *Handbook of Research on Teacher Education,* 102-119.

I
PRE-SERVICE TEACHERS

Chapter 2
Does Greater Teacher Knowledge Lead to Student Orientation? The Relationship between Teacher Knowledge and Teacher Beliefs

Sigrid Blömeke

Abstract

In this paper, the relationship between teacher knowledge and teacher beliefs is examined across countries. We assume cultural patterns in this relationship, in particular differences between the "East" represented by Asian countries with a Confucian Heritage like Taiwan or Singapore and the "West" represented by Western European countries like Germany or Norway (Leung, 2006). The data reveal that teacher knowledge can vary significantly between these countries and, in addition, within each country. The data reveal at the same time that teacher knowledge and teacher beliefs are related. The pattern of this relationship is more universal than we had expected – at least in Taiwan and Singapore, Germany and Norway: Higher MCK and MPCK increases dynamic beliefs on the nature of mathematics and decreases static beliefs as well as the belief that being good at mathematics is a talent which someone is born with, rather than a skill which can be learnt. These beliefs, in turn, influence how a teacher regards teaching and learning, either from a more constructivist or from a transmission point of view.

Keywords:
Comparative study, teacher education, professional competencies, mathematics teachers

In many countries, standardised data about teachers' competencies at the end of their training has been almost non-existent for a long time (Blömeke, 2004; Cochran-Smith & Zeichner, 2005). Even in the area covered by most studies – the training of mathematics teachers – there was a lack of data. The studies which existed did not have a shared conceptual framework which makes it difficult to relate the results. They were mostly short-term and non-cumulative and were conducted within the researchers' own training institutions (Lerman, 2001; Adler et al., 2005). Furthermore, most of the studies only examined beliefs or neglected subject-specific measures. There were no large-scale assessments or studies including tests of teacher knowledge (Brouwer, 2010).

The comparative Teacher Education and Development Study: Learning to Teach Mathematics (TEDS-M), carried out under the supervision of the International Association for the Evaluation of Educational Achievement (IEA), provided the opportunity

to examine the outcomes of teacher training in terms of teacher knowledge and teacher beliefs both across countries and subject-specifically for the first time (for the core results see Blömeke et al., 2011, 2012; Tatto et al., 2012).[1] TEDS-M was the first large-scale comparative assessment of higher education that included direct testing. Graduates from 16 countries were surveyed. The study broadens existing research in many respects.

Teacher training institutions structure their provision of opportunities to learn (OTLs) in a way that is consistent with their particular philosophy of what teachers need to know and be able to do. The need to increase teachers' content knowledge is one of the dominant ideas that has guided reform efforts in teacher training in many countries over the past 20 years (Darling-Hammond, 2000; Shulman, 1987). Evaluating whether these reforms have in fact been successful is an important step towards assuring the professional quality of those working in teaching.

In addition, international comparisons provide benchmarks for national teacher training systems. Countries that do better in TEDS-M may have more effective teacher training programmes than countries at the bottom end of the ranking. A comparative teacher training study carried out by the Educational Testing Service (Wang et al., 2003) revealed, for example, that countries which outperformed the USA in studies on student achievement, applied rigorous selection criteria at the beginning of teacher training.

Studying teacher training in an international context is a challenge though. Differences in the structure of teacher training and in the importance attached to different aspects of the curriculum means there is a risk that any data gathered in different countries may not be comparable because teacher training varies too much (Akiba, LeTendre & Scribner, 2007). At the same time, this is precisely what gives comparative research its added value. The variety of results makes hidden national assumptions visible. Like everyone else, researchers are embedded in their own culture and as such are often not able to recognise cultural issues which affect their way of approaching research (Schmidt et al., 1997; Blömeke & Paine, 2008).

Against this background, this paper examines teacher training and teacher competencies for lower-secondary schools across countries. How are teacher training systems in different countries structured? What is a typical teacher like at the end of the training? What level of knowledge and what beliefs does s/he have and how are these related to one other? The paper focuses on the latter research question, the relationship between teacher knowledge and teacher beliefs. We assume cultural patterns in this relationship because the research points to various traditions in different parts of the world, in particular to differences between the "East" represented by Asian countries with a Confucian Heritage like Taiwan or Singapore and the "West" represented by Western European countries like Germany or Norway (Leung, 2006).

1 TEDS-M was funded by the IEA, the National Science Foundation (REC 0514431) and the participating countries. In Germany, the German Research Foundation funded TEDS-M (DFG, BL 548/3-1). The instruments are copyrighted by the TEDS-M International Study Center at MSU (ISC). The analyses prepared for this paper and the views expressed are those of the author and do not necessarily reflect the views of the IEA, the ISC, the participating countries or the funding agencies.

2.1 Conceptual framework

In TEDS-M the measurement of teacher training outcomes is based on the notion of "professional competencies". Competencies are defined as those latent dispositions that enable teachers to master their professional tasks (see Weinert, 2001). These dispositions include cognitive abilities – in terms of professional knowledge – as well as professional convictions and values – in terms of beliefs. It is assumed that such dispositions underlie teacher performance in the classroom.

2.1.1 Teacher knowledge

Professional knowledge can be subdivided into different facets which have been frequently discussed (Shulman, 1985; Blömeke, 2002; Baumert & Kunter, 2006). In his initial work, Shulman identifies two subject-related facets and one generic facet of teacher knowledge, namely content knowledge, pedagogical content knowledge and general pedagogical knowledge. A teacher has to develop all three of these in order to be able to deal effectively with the various challenges of professional life: classroom management, assessment, supporting pupils' social and moral development, counselling and participating in school activities.

These three aspects are defined as follows in TEDS-M (for further details, see Tatto, Schwille, Senk, Ingvarson, Peck, & Rowley, 2008):

1) *Content knowledge* becomes future teachers' mathematics content knowledge (MCK). MCK includes fundamental mathematical definitions, concepts, and procedures.

2) *Pedagogical content knowledge* is mathematics pedagogical content knowledge (MPCK). This includes knowledge about how to present fundamental mathematical concepts to pupils, some of whom may have learning difficulties. Lesson planning knowledge is essential before instruction in the classroom can begin. The content must be selected appropriately, simplified and connected to teaching strategies (Krauthausen & Scherer, 2007; Vollrath, 2001). Knowledge about the way in which pupils learn has an effect on the teaching strategies used in the classroom. Such knowledge requires teachers to view pupils' answers, verbal or written, in the context of the tasks or questions given them. Teachers should ask questions of varying complexity, identify common misconceptions, provide feedback and react with appropriate intervention strategies. Teachers have to consider issues such as the consequences for future lessons if a key topic in the lower secondary curriculum were removed or taught in a different context as well.

MCK and MPCK both cover mathematics, but from different perspectives. Studies by Schilling, Blunk, and Hill (2007) and Krauss et al. (2008) demonstrate that while it is possible to distinguish between MCK and MPCK, the two are closely related.

3) According to Shulman (1987) *general pedagogical knowledge* involves, "broad principles and strategies for classroom management and organisation that transcend

subject matter" (p. 8), as well as knowledge about learners and learning, assessment and educational contexts and purposes. Future mathematics teachers need to draw on this range of knowledge and transform it into coherent understanding and skills if they are to become competent in dealing with what McDonald (1992) calls the "wild triangle" that connects learner, subject matter and teacher in the classroom.

2.1.2 Teacher beliefs

In TEDS-M, beliefs are defined as "understandings, premises or propositions about the world that are felt to be true" (Richardson, 1996, p. 103). If beliefs are looked at alongside both the subject being taught and a professional task which needs to be mastered, evidence suggests that there is a link between teacher beliefs and pupil achievement (Bromme, 2005). Beliefs are a crucial aspect of a teacher's perception of teaching situations and in their choice of teaching methods in the classroom (Leinhardt & Greeno, 1986; Leder, Pekhonen & Törner, 2002). Thus, they are also an indicator of the type of teaching methods trainee teachers will use in the classroom in the future (Nespor, 1987).

Beliefs are, however, not a well-defined construct. Clear distinctions from terms such as attitudes, perceptions or conceptions are rare. Rodd (1997) points out that beliefs rely on evaluative and affective components. At the same time, the distinction towards knowledge – in particular towards pedagogical content knowledge and general pedagogical knowledge – is more heuristic than that it can strictly be kept up (Furinghetti & Pehkonen, 2002). Several efforts have been made to categorise the belief systems of teachers (see Thompson, 1992, Op't Eynde, De Corte & Verschaffel, 2002). TEDS-M distinguishes between beliefs about the nature of mathematics, beliefs about the teaching and learning of mathematics, and beliefs about teacher training and professional development. Self-related beliefs are not covered in TEDS-M.

With respect to the relationship between teacher knowledge and teacher beliefs, there are theories on the importance of MCK and MPCK when it comes to epistemological beliefs on the nature of mathematics. In line with existing research, we assume that a certain level of knowledge is needed before it is possible to see the dynamic nature of mathematics. These epistemological beliefs, in turn, probably influence beliefs on the teaching and learning of mathematics. The more a teacher is able to see the dynamic nature of mathematics, the more s/he may prefer pupil-oriented teaching methods in which pupils explore mathematics by themselves rather than just listening to the teacher. It remains to be seen whether these hypotheses apply to all countries or whether they only apply in the West. It may well be, for instance, that the knowledge of future teachers in East Asia is high enough on average to recognise the dynamic nature of mathematics given the rigorous selection process at the beginning of teacher training.

2.2 Study Design[2]

2.2.1 Sampling

The target group of TEDS-M was defined as future teachers in their final year of teacher training who were studying to teach mathematics in primary or lower secondary schools (Tatto et al., 2008). A teacher training programme was identified as lower secondary level – the target population of this paper – if the qualification included grade 8 (basic education, cycle 2; UNESCO, 1997).

In a two-stage process, random samples were drawn from these target groups in each participating country. The samples were organised according to important teacher training features such as the type of programme (consecutive vs. concurrent programmes), the school level to be taught (grade range included in the qualification, e.g. grades 7 to 9 vs. grades 7 to 12), the attention paid to learning opportunities (in particular with or without mathematics) and the region where a training is based (for example, federal states) in order to reflect accurately the future teachers' characteristics at the end of their training.

In 2008, more than 8,000 future lower-secondary teachers from 15 countries (see table 2.1) were tested on their MCK and MPCK (and in three countries also on their GPK) with a standardised paper-and-pencil assessment. All countries had to meet the IEA quality requirements. These included controlling translation, monitoring test situations and meeting participation rates. If a country missed the participation benchmark, its results are reported with the annotation "combined participation rate less than 75% (or 60% respectively)".

Table 2.1: Participating countries in the TEDS-M lower-secondary study

Botswana	Chile	Germany	Georgia
Malaysia	Norway	Oman	Philippines
Poland	Russia	Spain	Switzerland
Singapore	Taiwan	Thailand	USA

In most countries, TEDS-M covered the full target population. Only Switzerland, Poland and the United States had to limit their studies for budgetary reasons: Switzerland limited its participation to German-speaking regions, Poland limited its participation to institutions with concurrent programmes (90% of all institutions), and the United States limited its participation to public universities. The situation was particularly complex in Norway. Two data sets were available that were likely to overlap. While information about the extent of a possible overlap was not available, we realised that using only one subsample would lead to strongly biased estimates for this country. After an examination of the Norwegian literature on teacher training, combining TEDS-M data with publicly available evaluation data from Norway (NOKUT,

2 For more details see Blömeke, Kaiser and Lehmann (2010).

2006), and having sought the opinion of experts, we decided to combine the two subsamples in order to present the future teachers' knowledge as accurately as possible. However, the results should be regarded as a rough approximation only.

2.2.2 Data sources

We used the international dataset from the TEDS-M assessment of future lower-secondary teachers in their final year of teacher training for this paper.

Measuring teachers' professional knowledge
TEDS-M sought to measure trainee teachers' MCK and MPCK. For this purpose, a 60-minute paper-and-pencil assessment had to be completed during a standardised and monitored test session. The items were intended to depict classroom performance as closely as possible (National Board for Professional Teaching Standards, 2003; National Council of Teachers of Mathematics, 2000). The lower secondary assessments consisted of three booklets with 103 items in total: 76 mathematics items and 27 mathematics pedagogy items. The items were assigned to booklets following a balanced – incomplete – block design to capture the desired breadth and depth of teacher knowledge.

The mathematics items included the content areas of number (as that part of arithmetic most relevant for teachers), algebra and geometry, with each set of items having roughly equal weight, as well as a small number of items about data (as that part of probability and statistics most relevant for teachers).

The mathematics pedagogy items included aspects of curricular and planning knowledge and knowledge about how to teach mathematics. These two sets of items were given approximately equal weight. The items covered areas such as establishing learning goals, knowing different assessment formats or linking teaching methods and instructional designs, and identifying different approaches for solving mathematical problems. The items relating to knowledge about how to teach mathematics covered, for example, diagnosing typical student responses, including misconceptions, explaining or presenting mathematical concepts or procedures, and providing appropriate feedback.

The majority of items were complex multiple-choice items. Some were partial-credit items. In addition, both tests covered three cognitive dimensions: knowing (recalling and remembering), applying (representing and implementing), and reasoning (analysing and justifying). Another feature that led the development of the items was their level of difficulty (novice, intermediate and expert). Scaled scores were created using item response theory. The achievement scores were transformed to a scale with an international mean of 500 test points and a standard deviation of 100 test points.

The items were developed using the study Mathematics teaching in the 21st Century (MT21) (Schmidt, Blömeke & Tatto, 2011), as well as the two Michigan studies Knowing Mathematics for Teaching Algebra (Ferrini-Mundy, Floden, McCrory,

Burrill, & Sandow, 2005) and Learning Mathematics for Teaching (Hill, Loewenberg Ball, & Schilling, 2008). A full list of the items is available on request by e-mailing tedsm@msu.edu.

Measuring teachers' professional beliefs

The future teachers' beliefs about the nature of mathematics were measured using an instrument developed by Grigutsch, Raatz and Törner (1998). This instrument originally consisted of 75 items, but due to time constraints we reduced it to 12. The 12 items were selected by looking at those items which showed both the highest factor loadings on each scale in the original study and high scale reliability in the TEDS-M pilot studies. The items' two-dimensional structure represented a static and a dynamic view on the nature of mathematics. This structure was confirmed through explorative and confirmatory factor analysis. The future teachers had to express their agreement on a six-point Likert scale (1 = strongly disagree, 6 = strongly agree). The raw data were scaled using a partial credit IRT model (Tatto et al., 2012). For the sake of clarity, individual scores were transformed to a scale with a mean value of 10, which represents a neutral view.

A dynamic view of mathematics sees the subject as a process of enquiry. The scale consists of six items which emphasise the process- and application-related character of mathematics, for example, "in mathematics you can discover and try out new things by yourself" or "many aspects of mathematics are of practical use". A static view of mathematics sees the subject as a set of rules and procedures. This scale consists of six items which stress the importance of definitions, formulae and mathematical facts and procedures, for example, "mathematics is a collection of rules and procedures that prescribe how to solve a problem" or "logical rigour and precision are fundamental to mathematics".

The future teachers' beliefs about the teaching and learning of mathematics were measured with two scales from instructional research (Peterson et al., 1989). The first scale represented a constructivist view. Strong agreement meant that teachers regarded mathematics learning as an active process in which pupils conduct their own enquiries and develop approaches to problem solving. Two examples of these items are: "In addition to getting the right answer, it is important to understand why the answer is correct"; and "Teachers should allow pupils to develop their own ways of solving mathematical problems".

In contrast, teachers who agreed strongly on the second scale tended to see mathematics learning as teacher-centered with the pupil's role being to follow instructions given. Two examples of these items are: "The best way to do well in mathematics is to memorise all the formulae"; and "Pupils need to be taught exact procedures for solving mathematical problems". The scaling happened in the same way as with respect to the nature of mathematics.

All parameter estimations for this paper were carried out using the International Database Analyzer provided by IEA or using the software MPlus. As a consequence all results are based on weighted data (taking unequal selection probabilities into

account as well as non-response adjustments) and using appropriate estimations of standard errors (taking the complex sample design into account by applying the balanced repeated replication technique).

2.3 Results

2.3.1 Structure of lower secondary teacher training

Lower secondary school in most of the TEDS-M countries consists of the grades 7 to 9 (Tatto et al., 2012). Germany is an exception as lower secondary schools in most states (*Länder*) cover grades 5 to 10. Most countries offer two pathways into teaching: a concurrent and a consecutive route with the majority of future teachers enrolled in the former. Germany is also an exception in this respect as its teacher training system offers only one route into teaching that combines features of both approaches. For this reason it is called a "hybrid system".

2.3.2 Characteristics of teachers at the end of their training

Seen across all TEDS-M countries, a typical lower secondary teacher at the end of teacher training is aged 24 and female. The teacher's parents have a degree at level 3 or 4 of the UNESCO (1997) classification and they have between 26 and 100 books at home. They usually have a computer as well. A typical teacher has completed 12 years of mathematics classes and has good or even very good grades compared to his/her peers. The language of the teacher training course is typically the language spoken at home. The majority of students wanted to become teachers for intrinsic pedagogical reasons. Fewer were interested in extrinsic status reasons or intrinsic intellectual reasons.

Not surprisingly there is a huge variation between countries with respect to these characteristics. Teachers in consecutive programmes are on average older than those in concurrent programmes. Whereas the average new teacher in the Philippines and Georgia is only 21 years old at the end of their training, in Germany the average age is 30. Although in most TEDS-M countries the majority of lower secondary teachers in their final training year are women, in three countries – Botswana, Taiwan and Switzerland – the majority are men.

In many TEDS-M countries the educational background of the teachers' mothers and fathers is roughly similar. In Germany however, the mothers of new teachers have on average reached a lower level of higher education than their fathers, whereas in Russia and Poland the mothers have higher-level degrees than the fathers. These differences are probably related to the role of women in these societies.

Several indicators were used to measure the future teachers' cultural capital. These point in the same direction: In Germany, Norway and Switzerland the teachers'

cultural capital is especially high. The cultural capital of teachers in Georgia is high given this country's rank on the UN Human Development Index. The result may reflect the high educational aspirations in Georgian society. In general, teachers' cultural capital is higher than that of their pupils (see, for example, the teacher survey in TIMSS). This result points to a selection effect during schooling: pupils with higher cultural capital may have an advantage in getting access to university.

The countries in the TEDS-M can be divided into two distinct groups when it comes to the language spoken at home compared with the language used in teacher training (the test language of TEDS-M). In one group, including Botswana, Malaysia, the Philippines and Singapore, the tests were carried out in English, which is the language spoken by a minority of the future teachers at home. In Thailand, Taiwan and Oman significant proportions of teachers speak a different language at home to the one used in teacher training as well. In contrast, in the second group there are many countries where almost every teacher speaks the official test language at home – although there are often significant levels of language diversity in these countries as well (for example in Germany and the USA).

When it comes to the future teachers' motivations for becoming a teacher, there are again differences between countries. If one looks at the full set of motives presented in TEDS-M, future teachers in the USA, Switzerland, Norway, Germany, Chile and Singapore particularly strongly select pedagogical motives over intellectual or extrinsic motives to explain their career choice compared to the international average. We assume that this is due to the long tradition of child-orientated pedagogy in these countries (see, for example, Ellen Key's famous book). In contrast, trainee teachers in Poland, Russia and Oman stress more strongly the intellectual challenge of teaching compared to other reasons that had motivated their choice of career. We assume that this is due to the high value placed on mathematics in these countries. In Taiwan, the Philippines, Malaysia, Georgia and Thailand extrinsic motives dominate the reasons given for becoming a teacher.

The future teachers were asked to what extent they felt affected by financial or family constraints during their studies. The result is once again striking because of the split which emerges between the countries. On the one hand, we have countries where teachers stress particularly strongly family obligations over financial worries at the end of their training compare to the international average. This applies to all Asian countries in TEDS-M as well as to Botswana and Chile, which are the only countries from Africa and Latin America included in the study. On the other hand in the Western European countries and the USA financial limitations dominate over family issues. These results can be explained by looking at cultural differences as expressed by the Hofstede continuum of collectivism and individualism (2001).

For more details on the characteristics of future teachers in their final year of teacher training see Blömeke, Kaiser & Lehmann, 2010.

2.3.3 Opportunities to learn in lower-secondary teacher training

The opportunities available to teachers to learn mathematics, mathematics pedagogy and general pedagogy vary considerably between the TEDS-M countries. Nevertheless, it is possible to identify international profiles of opportunities to learn (OTL) for both mathematics and the two pedagogical dimensions. At the end of their training, lower secondary school mathematics teachers in Poland, Russia, Georgia, Taiwan, Oman and Thailand as well as those in Germany, indicated more OTL in mathematics compared to mathematics pedagogy and general pedagogy. In contrast, lower secondary teacher training in Norway, the US, Chile and Botswana focused particularly strongly on pedagogical topics compared to other countries. In the first set of countries the focus was obviously on the content, whereas in the second set the teaching of the content was considered most important.

Compared to other countries teachers in Germany said that they had relatively low OTL in mathematics, mathematics pedagogy and general pedagogy. This is probably due to the fact that teachers have to study two subjects so as to avoid out-of-subject teaching.

With respect to the different areas of mathematics, it is interesting to look at the relationship between the OTL in arithmetic, calculus, data and geometry. The most significant variation is found in calculus. In Botswana, Singapore, Georgia, Malaysia, Oman and Taiwan there are particularly many OTL in calculus compared to the other three fields. This implies that teacher training in these countries focused on the higher grades of lower secondary school. In Norway, Switzerland, the USA and Chile the OTL in calculus were low, which suggests an orientation towards the lower grades.

Overall, lower secondary mathematics teachers, who are also qualified to teach at upper secondary level, had significantly more OTL during their training than their peers who were only going to teach at lower secondary level. In Norway and Chile, where lower secondary teachers are trained as generalists, and in Germany and Singapore, where they are trained in two subjects, the future teachers reported the fewest OTL.

For more details on the OTL provided during teacher training see Blömeke, Kaiser & Lehmann, 2010.

2.3.4 Outcomes of teacher training systems: Professional knowledge

The descriptive results revealed significant mean differences in teacher training outcomes in terms of mathematics content knowledge (MCK) and mathematics pedagogical content knowledge (MPCK) between the countries involved in TEDS-M (Blömeke, Kaiser, & Lehmann 2010). When it comes to MCK, lower secondary teachers from Taiwan achieved the best results at the end of their training (see Table 2.2). The difference between the international mean of 500 test points was huge – more than 1.5 standard deviations.

The results of German lower secondary mathematics teachers were notably above the international mean. They were, however, still a long way behind those of teachers in Taiwan. German teachers also performed less well than teachers from Russia, Singapore, Poland and Switzerland. Taking into account the Human Development Index used by the UN, the performance of lower secondary mathematics teachers from Russia and Poland was remarkable. The results of future teachers in the USA were around the international mean.

With regard to MPCK, future lower secondary teachers in the USA again only performed around the international mean (see Table 2.2). In contrast, the German teachers' results were well above the international mean. Even though Taiwan was still a long way ahead, the gap between Germany and Russia was smaller than in MCK and the difference between Germany, Singapore and Switzerland was not significant.

These results reveal how important it is to distinguish between MCK and MPCK when looking at teacher knowledge. Whereas Malaysian teachers scored only slightly below the international mean in MCK, they had lower scores when it came to MPCK. These differences are worth examining in detail. They may point to specific strengths and weaknesses in teacher training in the different countries.

Table 2.2: The mathematics content knowledge (MCK) and mathematics pedagogical content knowledge (MPCK) of future lower-secondary teachers ranked by country

Country	MCK Mean (SE)	Country	MPCK Mean (SE)
Taiwan	667 (3.9)	Taiwan	649 (5.2)
Russia	594 (12.8)	Russia	566 (10.1)
Singapore	570 (2.8)	Singapore	553 (4.7)
Poland** 1	540 (3.1)	Switzerland*	549 (5.9)
Switzerland*	531 (3.7)	Germany	540 (5.1)
Germany	519 (3.6)	Poland** 1	524 (4.2)
USA*** 1 3	505 (9.7)	USA*** 1 3	502 (8.7)
International	500 (1.5)	International	500 (1.6)
Malaysia	493 (2.4)	Thailand	476 (2.5)
Thailand	479 (1.6)	Oman	474 (3.8)
Oman	472 (2.4)	Malaysia	472 (3.3)
Norway2 n	444 (2.3)	Norway2 n	463 (3.4)
Philippines	442 (4.6)	Philippines	450 (4.7)
Botswana	441 (5.3)	Georgia1	443 (9.6)
Georgia1	424 (8.9)	Botswana	425 (8.2)
Chile1	354 (2.5)	Chile1	394 (3.8)

* German-speaking regions
** Institutions with concurrent programmes
*** Public universities
1 Combined Participation Rate < 75%
2 Combined Participation Rate < 60%
3 High proportion of missing values
n Results for Norway are reported by combining the data sets available to present an accurate country mean.

Because of the IEA's policy orientation, large-scale assessments like TEDS-M take place at national level. This is a valuable approach because it stresses the overall effectiveness of a country's education system regardless of its structure. In addition, there is a lot to be learnt by distinguishing between the different types of teacher training programmes (pure lower secondary programmes, lower and upper secondary programmes). Only then will it be possible to determine how successful a country is in training its teachers without a cultural, societal or economic bias. This approach must, however, be used with caution. The samples, which are already small when it comes to teachers compared with pupils, are even smaller when programme types are examined. The estimates are less precise (for further details see Blömeke, Kaiser & Lehmann, 2010).

The MPCK results provide an illustration of the benefits, but also of the limitations, of such an approach (see Table 2.3). It is interesting that the TEDS-M data do not necessarily support the hypothesis that teachers in consecutive programmes do better than teachers in concurrent programmes. Another important outcome of the TEDS-M data is that test results improve when the future teachers had more opportunities to learn mathematics. German lower secondary teachers who are trained to teach on the upper secondary level as well (up to class 12) showed an outstanding level of MPCK, for example. Their MPCK was, on average, the same as that of Russian teachers and significantly higher than that of teachers from Singapore qualified to teach in lower and upper secondary grades. German mathematics teachers who are qualified to teach up to class 10 do less well.

TEDS-M was the first comparative study to assess general pedagogical knowledge with nationally representative samples. Germany, Taiwan and the USA assessed their lower secondary teachers' knowledge of lesson planning, classroom management and motivation, teaching heterogeneous pupil populations and assessment. The German and Taiwanese teachers significantly outperformed their US counterparts (for further details see, e.g., Blömeke & König, 2010).

Table 2.3: Mathematics pedagogical content knowledge (MPCK) by teacher education programmes

Mathematics teachers up to grade 10	MPCK mean
Taiwan	649 (5.2)
Switzerland	549 (5.9)
Singapore	539 (6.1)
Poland (Bachelor, Full time)	520 (4.6)
Germany (classes 5-10)	518 (6.3)
Germany (classes 1-10)	513 (11.6)
International	498 (1.7)
Norway (with extra mathematics)	480 (6.2)
USA (concurrent)	470 (4.0)
Norway (without extra mathematics)	455 (4.1)
Philippines	450 (4.7)
Botswana	436 (8.5)
Chile (with extra mathematics)	407 (7.9)
Chile (without extra mathematics)	392 (4.1)
Mathematics teachers up to grade 13	**PCK mean**
Germany (classes 5-13)	586 (6.7)
Russia	566 (10.1)
Singapore	562 (6.1)
USA (concurrent)	544 (6.9)
Poland (Master, Full time)	536 (5.3)
USA (consecutive)	535 (10.3)
International	505 (2.8)
Thailand (consecutive)	495 (12.2)
Norway	495 (17.7)
Oman (University)	485 (12.6)
Malaysia (BEd)	476 (6.4)
Thailand (concurrent)	474 (2.6)
Oman (College)	473 (4.3)
Malaysia (BScEd)	471 (3.7)
Georgia (Bachelor)	437 (11.5)
Botswana	409 (15.6)

2.3.5 Outcomes of teacher training systems: Professional beliefs

When it comes to professional beliefs, there is huge variation between and within countries. Despite this, it is possible to identify groups of countries. Whereas future teachers in Germany, Switzerland, Poland and Norway either have a neutral

view of mathematics or even deny its static nature, teachers in the Philippines, Thailand, Malaysia and Botswana agree with statements that mathematics mainly involves algorithms. There is more agreement between teachers in the different countries when it comes to the dynamic nature of mathematics. In all countries future teachers react positively to statements that stress that mathematics is creative and useful.

When comparing how strongly teachers agree with both notions certain profiles appear. Trainee teachers from countries like Malaysia and Thailand express much more agreement with static beliefs than with dynamic beliefs. Conversely, teachers from countries like Germany and Switzerland agree more strongly with dynamic beliefs than with static beliefs. These results can be linked to Hofstede's index of individualism and collectivism (2001).

When considering constructivist and transmission beliefs on the teaching and learning of mathematics a similar pattern emerges. Lower secondary teachers in Germany, Switzerland and Norway reject teacher-led learning, whereas teachers in the Philippines and Malaysia support it. In contrast, agreement with statements that support student orientation is high in all countries.

In line with the results on the nature of mathematics, correspondence to the countries' positions on Hofstede's scale of individualism and collectivism is revealed when comparing the level of constructivist and transmission view. In Switzerland, Germany, Norway, the USA and Poland – countries characterised by individualism – the future teachers stress the importance of student orientation over teacher orientation particularly strongly. In contrast, teachers in Russia, Singapore, the Philippines and Malaysia stress teacher orientation particularly strongly compared to student orientation. The OECD Teaching and Learning International Study (TALIS; OECD, 2009) of practicing teachers produced similar results.

2.3.6 The relationship between professional knowledge and beliefs

We examine the relationship between professional knowledge and beliefs with a path model. Four countries, two typical Western countries (Germany and Norway) and two typical Eastern countries (Taiwan and Singapore) are taken as examples. As explained in our conceptual framework, we assume that MCK, MPCK, beliefs on the nature of mathematics and beliefs on the teaching and learning of mathematics are significantly associated. We hypothesize that MCK and MPCK serve as predictors, beliefs on the teaching and learning of mathematics as the dependent variables and the epistemological beliefs mediating the relationship. Such a path model fits well to our TEDS-M data set (see Table 2.4). It explains a significant proportion of the variation in future teachers' beliefs on the teaching and learning of mathematics.

Table 2.4: Fit of the path model in Taiwan, Singapore, Germany and Norway

	n	*CFI*	*RMSEA*	R^2_{Const}	R^2_{Trans}
Taiwan	365	.95	.08	.16***	.28***
Singapore	393	1.00	.00	.19***	.28***
Germany	768	.99	.02	.26***	.22***
Norway	549	.99	.04	.22***	.31***

n: sample size; *CFI:* Comparative Fit Index; *RMSEA:* Root Mean Square Error of Approximation (an absolute fit index); R^2_{Const}: variance explained of the scale that measures constructivist beliefs; R^2_{Trans}: variance explained of the scale that measures transmission beliefs; *** $p < .001$.

The parameter estimates reveal country differences as well as indicating shared patterns for Taiwan, Singapore, German and Norway. In all four countries, as expected, a strong positive relationship between MCK and MPCK exists (see Figures 2.1 and 2.2). Also, a significant negative correlation between teaching principles based on constructivist or transmission beliefs appears in all four countries. At the same time, a positive relationship between beliefs on the static nature of mathematics and the belief that mathematics achievement is a fixed ability exists in the four countries. Finally, a significant negative correlation between such a view on mathematics ability and beliefs on the dynamic nature of mathematics is supported by the TEDS-M data in all four countries.

An interesting difference between the countries exists with respect to the relationship between dynamic and static beliefs on the nature of mathematics which may be culturally influenced. In the two East Asian countries this relationship is – unexpectedly – positive. The more a future teacher in Taiwan or Singapore sees mathematics as creative and exploratory, the more s/he is also convinced that mathematics is about algorithms. In contrast, in the two European countries the teachers do not see a link or they see the relationship as negative. The more a future teacher in Norway believes in the dynamic nature of mathematics, the less s/he agrees with its static nature. Thus, the European teachers reject the idea of a dual nature of mathematics, whereas the East Asian teachers agree with it.

The importance of teacher knowledge for the formation of epistemological beliefs is, as expected, higher in the two European countries than in East Asia. In Germany and Norway, MCK is positively associated with dynamic beliefs on the nature of mathematics, whereas this does not apply to Taiwan and Singapore. In Taiwan and Singapore, as well as in Norway, MCK significantly decreases the risk of static beliefs. MPCK is of importance in Germany. The more MPCK a future teacher has, the less s/he believes in mathematics as a fixed ability.

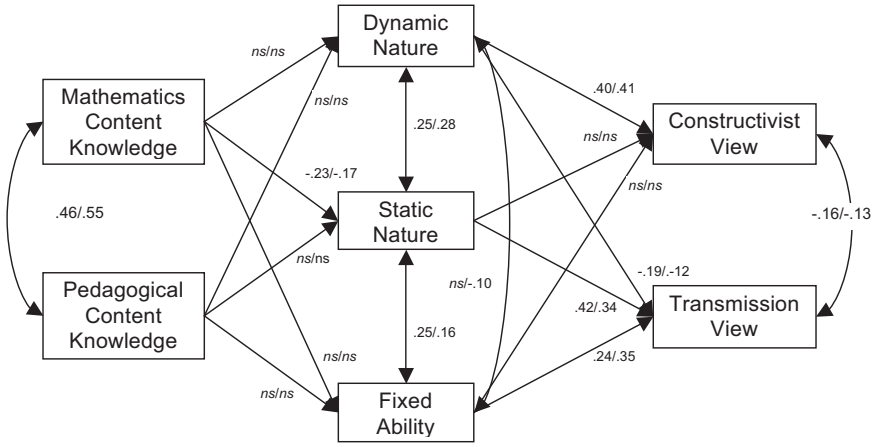

Figure 2.1: Relationship between teacher knowledge and teacher beliefs in Taiwan and Singapore (*ns:* not significant)

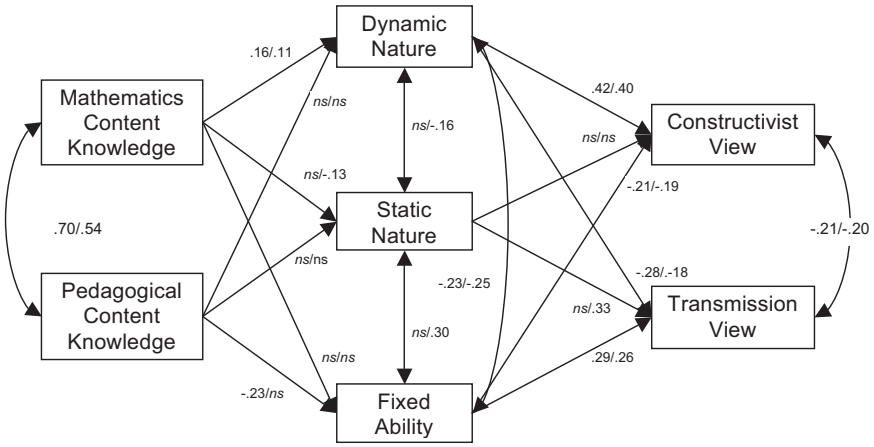

Figure 2.2: Relationship between teacher knowledge and teacher beliefs in Germany and Norway (*ns:* not significant)

The relationship between the different types of belief is very strong, which supports our hypothesis on the mediating role of epistemological beliefs. In all four countries, dynamic beliefs on the nature of mathematics influence constructivist and transmission beliefs on the teaching and learning of mathematics. The more a future teacher believes in the creative, exploratory and practical power of mathematics, the more s/he is willing to let students work independently and the less teacher-oriented his/her lessons are. In contrast, in all four countries future teachers stress a transmission view on teaching and learning processes if they believe in mathematics as a fixed ability.

In addition, in the two European countries, teachers neglect student orientation if they believe that mathematics ability is fixed. The same relationship applies to static beliefs on the nature of mathematics in Taiwan, Singapore and Norway.

These results point to a knowledge and beliefs system that is, on the one hand, strongly interconnected. On the other hand, since knowledge increases substantially during training, we may infer that teacher beliefs can change as a result of knowledge gain. Such a longitudinal view is in stark contrast to existing research which often claims that beliefs are fixed.

2.4 Summary and conclusions

With the publication of comparative studies on student achievement, teacher competencies have become the focus of considerable interest. This is reflected by the TEDS-M which examined the competencies of lower-secondary mathematics teachers in 15 countries at the end of their training. Mathematics teachers play a crucial role in the preparation of future generations of pupils. Mathematics is not only one of the most important academic subjects (Mullis, Martin, & Foy, 2008), but it also teaches skills which are essential for meeting the requirements of the modern job market (Freudenthal, 1983). Thus, it is important to ascertain whether and how teacher training contributes to the development of teacher competencies.

There are methodological and substantive conclusions which can be taken from the results of the TEDS-M lower secondary study. TEDS-M showed that studies in the field of higher education are challenging and difficult to carry out. Several levels of aggregation need to be taken into account: the individual country as well as the teacher training programmes. Each level of aggregation has its own benefits and limits.

From a substantive point of view, we have learned that teachers' knowledge in different areas (content knowledge, pedagogical content knowledge, general pedagogical knowledge) can vary significantly between countries. The performance of teachers from different programmes within a country can vary significantly as well. Here we can see what efforts need to be taken within countries to improve the effectiveness of their teacher training system by comparing the different programmes. Overall, teacher knowledge does not seem to be the exclusive result of a teacher's societal environment, the characteristics of the pupils they teach or of the length, the structure or the content of teacher training programmes. Instead it is a complex amalgam of these aspects.

Teacher knowledge and teacher beliefs are related. The pattern of these relationships is more universal than we had expected. Teacher training programmes have been described as being influenced by the context in which they are implemented (see especially the 13th and the 15th ICMI studies, Leung, Graf, & Lopez-Real, 2006, and Even & Ball, 2009). Prior work on mathematics student achievement in TIMSS had already revealed notable cultural differences between countries (Klieme & Baumert,

2001). However, even when examining four countries with very different educational traditions – two East Asian countries, Taiwan and Singapore, with a Confucian heritage, and two Western European countries, Germany and Norway – some common patterns were revealed by the data (for a similary surprising result in patterns in primary teacher's knowledge and beliefs see Blömeke, Suhl & Döhrmann, 2012, as well as on patterns in opportunities to learn during teacher education see Blömeke, in press):

Higher MCK and MPCK increases dynamic beliefs on the nature of mathematics and decreases static beliefs and the belief that being good at mathematics is a talent which someone is born with, rather than a skill which can be learnt. These beliefs, in turn, influence how a teacher regards teaching and learning, either from a more constructivist or from a transmission point of view. In this sense more knowledge does not equal increased student orientation in a direct way but it is an initial factor. Its effects are mediated by epistemological beliefs on the nature of mathematics. Thus, content knowledge and pedagogical content knowledge are, in fact, related to beliefs on the teaching and learning of mathematics. At the same time, if we were to carry out a longitudinal study, these data would present first evidence that changes in beliefs during teacher training may be possible through gaining knowledge.

2.5 References

Adler, J., Ball, D., Krainer, K., Lin, F.-L., & Novotna, J. (2005). Reflections on an emerging field: Researching mathematics teacher education. *Educational Studies in Mathematics, 60*(3), 359-381.

Akiba, M., LeTendre, G. K., & Scribner, J. P. (2007). Teacher quality, opportunity gap, and achievement gap in 47 countries. *Educational Researcher, 36*(7), 369-387.

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keywords: Professional competence of teachers]. *Zeitschrift für Erziehungswissenschaft, 9*(4), 469-520

Blömeke, S. (2002). *Universität und Lehrerausbildung* [University and Teacher Education]. Bad Heilbrunn/Obb.: Klinkhardt.

Blömeke, S. (2004). Empirische Befunde zur Wirksamkeit der Lehrerbildung [Empirical Findings on the Effectiveness of Teacher Education]. In S. Blömeke, P. Reinhold, G. Tulodziecki, & J. Wildt (Eds.), *Handbuch Lehrerbildung* [Handbook of Teacher Education] (pp. 59–91). Bad Heilbrunn/Braunschweig: Klinkhardt/Westermann.

Blömeke, S. (in press). Content, professional preparation and teaching methods: How diverse is teacher education across countries. In press in *Comparative Education Review.*

Blömeke, S., & König, J. (2010). Messung des pädagogischen Wissens: Theoretischer Rahmen und Teststruktur [Measurement of pedagogical knowledge: Theoretical framework and test structure]. In S. Blömeke, G. Kaiser, & R. Lehmann (Eds.), *TEDS-M 2008 – Professionelle Kompetenz und Lerngelegenheiten angehender Mathematiklehrkräfte im internationalen Vergleich* [Professional competence and learning opportunities of prospective primary school teachers in an international comparison] (pp. 239-269). Münster: Waxmann.

Blömeke, S., & Paine, L. (2008). Getting the fish out of the water: Considering benefits and problems of doing research on teacher education at an international level. *Teaching and Teacher Education, 24*(4), 2027–2037.

Blömeke, S., Kaiser, G., & Lehmann, R. (Eds.) (2010). *TEDS-M 2008 – Professionelle Kompetenz und Lerngelegenheiten angehender Mathematiklehrkräfte der Sekundarstufe I im internationalen Vergleich.* [Professional competencies and opportunities to learning of future lower school teachers in an international comparison] Münster: Waxmann.

Blömeke, S., Suhl, U., & Kaiser, G. (2011). Teacher education effectiveness: Quality and equity of future primary teachers' mathematics and mathematics pedagogical content knowledge. *Journal of Teacher Education, 62*(2), 154-171.

Blömeke, S., Suhl, U., & Döhrmann, M. (2012). Zusammenfügen was zusammengehört. Kompetenzprofile am Ende der Lehrerausbildung im internationalen Vergleich. [Linking what belongs together. Profiles of teacher competencies at the end of teacher education across countries.] *Zeitschrift für Pädagogik, 58*(4), 422–440.

Blömeke, S., Suhl, U., Kaiser, G., & Döhrmann, M. (2012). Family background, entry selectivity and opportunities to learn: What matters in primary teacher education? An international comparison of fifteen countries. *Teaching and Teacher Education, 28* (1), 44-55.

Bromme, R. (2005). Thinking and knowing about knowledge: A plea for and critical remarks on psychological research programs on epistemological beliefs. In M. Hoffmann, J. Lenhard, & F. Seeger, (Eds.), *Activity and sign – Grounding mathematics education* (pp. 191-201). New York: Springer.

Brouwer, C. N. (2010). Determining long term effects of teacher education. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International encyclopedia of education, Vol. 7* (pp. 503-510). Amsterdam: Elsevier.

Cochran-Smith, M., & Zeichner, K.M. (Eds.) (2005). *Studying Teacher Education. The Report of the AERA Panel on Research and Teacher Education.* Mahwah, NJ: Lawrence Erlbaum.

Darling-Hammond, L. (2000). Teacher quality and student achievement: a review of state policy evidence. *Educational Policy Analysis Archives, 8*(1), 1-50.

Even, R., & Ball, D. (Eds.). (2009). *The professional education and development of teachers of mathematics*. New York: Springer.

Ferrini-Mundy, J., Floden, R., McCrory, R., Burrill, G., & Sandow, D. (2005). *Knowledge for teaching school algebra: Challenges in developing an analytic framework.* Paper presented at the annual meeting of the American Educational Research Association, Montreal, Quebec.

Freudenthal, H. (1983). *Didactical phenomenology of mathematical structures.* Dordrecht: D. Reidel.

Furinghetti, F., & Pehkonen, E. (2002). Rethinking characterizations of beliefs. In G. C. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 39–57). Dordrecht/Boston/London: Kluwer Academic Publishers.

Grigutsch, S., Raatz, U., & Törner, G. (1998). Einstellungen gegenüber Mathematik bei Mathematiklehrern. [Mathematics Teachers Attitudes towards Mathematics] *Journal für Mathematik-Didaktik*, *19*(1), 3–45.

Hill, H.C., Loewenberg Ball, D., & Schilling, S.G. (2008). Unpacking Pedagogical Content Knowledge: Conceptualising and Measuring Teachers' Topic-specific Knowledge of Students. *Journal for Research in Mathematics Education, 39*(4), 372–400.

Hofstede, G. (2001). *Culture's Consequences – Comparing Values, Behaviors, Institutions and Organizations Across Nations*. London, New Delhi: Thousand Oaks.

Klieme, E., & Baumert, J. (2001). Identifying national cultures of mathematics education: Analysis of cognitive demands and differential item functioning in TIMMS. *European Journal of Psychology of Education, 16*, 383-400.

Krauss, S., Baumert, J., & Blum, W. (2008). Secondary mathematics teachers' pedagogical content knowledge and content knowledge: validation of the COACTIV constructs. *ZDM – The International Journal on Mathematics Education, 40*(5), 873–892.

Krauthausen, G., & Scherer, P. (2007). *Einführung in die Mathematikdidaktik* [Introductory Guide for Mathematic Didactic] (3rd ed.). Heidelberg: Elsevier.

Leder, C., Pehkonen, E., & Törner, G. (Eds.). (2002). *Beliefs: A Hidden Variable in Mathematics Education?* Dordrecht: Kluwer Academic Publishers.

Leinhardt, G., & Greeno, J. G. (1986). The cognitive skill of teaching. *Journal of Educational Psychology, 78*(2), 75-95.

Lerman, S. (2001). Cultural, discursive psychology: A sociocultural approach to studying the teaching and learning of mathematics. *Educational Studies in Mathematics, 46* (1-3), 87-113.

Leung, F.K.S. (2006). Mathematics Education in East Asia and the West: Does Culture Matter? In F.K.S. Leung, K.-D. Graf, & F.J. Lopez-Real (Eds.), *Mathematics Education in Different Cultural Traditions – A Comparative Study of the East Asia and the West. The 13th ICMI Study* (pp. 21–46). New York: Springer.

Leung, F.K.S., Graf, K.-D., & Lopez-Real, F.J. (Eds.). (2006). *Mathematics Education in Different Cultural Traditions – A Comparative Study of the East Asia and the West. The 13th ICMI Study*. New York: Springer.

McDonald, J.P. (1992). *Teaching: Making sense of an uncertain craft.* New York: Teachers College Press.

Mullis, I.V.S., Martin, M.O. , & Foy, P. (2008). *TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

National Board for Professional Teaching Standards (2003). *Raising the standard.* Southfield, MI: National Board for Professional Teaching Standards.

NCTM National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics.* Reston, VA: NCTM.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies, 19*(4), 317-328.

NOKUT Nasjonalt Organ for Kvalitet i Utdanningen (2006). *Evaluering av allmennlærerutdanningen i Norge 2006. Hovedrapport.* Available online.

OECD (2009). *Creating Effective Teaching and Learning Environments. First Results from TALIS – Teaching and Learning International Survey.* Paris: OECD.

Op 't Eynde, P., De Corte, E., & Verschaffel, L. (2002). Framing students' mathematics-related beliefs. A quest for conceptual clarity and a comprehensive categorization. In G.C. Leder, E. Pehkonen & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 13-37). Netherlands: Kluwer Academic Publishers.

Peterson, P.L., Fennema, E., Carpenter, T., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. *Cognition and Instruction, 6*(1), 1-40.

Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. *Handbook of Research on Teacher Education,* 102-119.

Rodd, M.M. (1997). Beliefs and their warrants in mathematics learning. In E. Pehkonen (Ed.), *Proceedings of the 21st International Conference of the International Group for the Psychology of Mathematics Education (PME). Volume 4* (pp. 64-65). Helsinki: University of Helsinki, Lahti Research and Training Center.

Schilling, S.G., Blunk, M., & Hill, H.C. (2007). Test Validation and the MKT Measures: Generalizations and Conclusions. *Measurement: Interdisciplinary Research and Perspectives, 5*(2-3), 118-127.

Schmidt, W. H., McKnight, C. C., Valverde, G. A., Houang, R. T., & Wiley, D. E. (1997). *Many visions, many aims: A cross-national investigation of curricular intentions in school mathematics.* Dordrecht: Kluwer.

Schmidt, W. H., Blömeke, S., & Tatto, M. T. (2011). *Teacher Education Matters. A Study of The Mathematics Teacher Preparation from Six Countries.* New York: Teacher College Press.

Shulman, L.S. (1985). Paradigms and research programs in the study of teaching: A contemporary perspective. In M.C. Wittrock (Eds.), *Handbook of Research on Teaching* (3rd ed., pp. 3-36). New York: Macmillan.

Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Havard Educational Research, 57*, 1-22.

Tatto, M. T., Schwille, J., Senk, S. L., Ingvarson, L., Rowley, G., Peck, R., et al. (2012). *Policy, practice, and readiness to teach primary and secondary mathematics in 17 countries: Findings from the IEA Teacher Education and Development Study in Mathematics (TEDS-M).* Amsterdam, The Netherlands: IEA.

Tatto, M.T., Schwille, J., Senk, S., Ingvarson, L., Peck, R., & Rowley, G. (2008). *Teacher Education and Development Study in Mathematics (TEDS-M): Policy, Practice, and Readiness to Teach Primary and Secondary Mathematics. Conceptual framework.* East Lansing, MI: Teacher Education and Development International Study Center, College of Education, Michigan State University.

Thompson, A.G. (1992). Teachers' beliefs and conceptions: A synthesis of research. In D.A. Grouws (Eds.), *Handbook of Research on Mathematics Teaching and Learning* (pp. 127-146). New York: Macmillan.

UNESCO (1997). *International Standard Classification of Education.* Retrieved February 11, 2010, from http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm.

Vollrath, H.-J. (2001). *Grundlagen des Mathematikunterrichts in der Sekundarstufe* [Foundations of Mathematics Teaching in Middle Schools]. Heidelberg: Spektrum.

Wang, A., Coleman, A.B., Coley, R.J., & Phelps, R.P. (2003). *Preparing Teachers around the World.* Princeton: ETS.

Weinert, F.E. (2001). Concept of Competence: A Conceptual Clarification. In D.S. Rychen, & L.H. Salgnik (Eds.), *Defining and Selecting Key Competencies* (pp. 45-66). Göttingen: Hogrefe.

Chapter 3
Making the Impossible Possible? Establishing Beliefs about Teaching and Learning during Teacher Training Courses

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Abstract

This article examines whether there are differences between the beliefs of prospective primary school teachers about the nature of mathematics and about teaching and learning mathematics at the beginning and at the end of their teacher training courses. According to existing literature most students possess solid and almost unchangeable profession-related beliefs before they even start their training. At the same time, in recent years teaching concepts which emphasise a constructivist view of effective learning, aimed at strengthening the relevant beliefs amongst prospective teachers have been developed for teacher training programmes. The present analysis shows that there are in fact significant differences in the beliefs held by students about the nature of mathematics and the acquisition of mathematical knowledge at the beginning and at the end of their training. Newly qualified teachers are more likely to hold a constructivist view of effective learning and believe in the dynamic structure of mathematics than first-year teacher training students. To some extent these differences in prospective teachers' beliefs can be explained by the high number of opportunities to learn (OTLs) provided in mathematics pedagogy during training. In contrast, OTLs in school mathematics and general pedagogy do not explain differences in these beliefs. Although this analysis is based on quasi-longitudinal section data the results support the hypothesis that problem-oriented and authentic OTLs do trigger an evolution in students' beliefs during their teacher training programme.

Keywords:
Teacher education, beliefs, opportunities to learn, teaching and learning

3.1 Introduction

It is a quirk of the teaching profession that by the end of compulsory schooling everybody has a view not only on what "good" teaching involves, but also how successful teaching and learning processes are initiated and how teachers can be best effective. These beliefs are based on many years of direct experience as pupils in schools, at least in developed countries.

If we follow specialised research, which suggests that in many professional fields one becomes an expert after roughly ten years practical experience (Ericsson et al., 2006), school leavers should be able to call themselves experts in education and teaching. However, it is clear that experience as a pupil cannot be considered equal to experience in the teaching profession. Nor is it true that teachers who have gained professional experience automatically become experts (Berliner, 2001; Bromme & Haag, 2004; Hatano & Inagaki, 1986; Hattie, 2003; Hubermann, 1989). On the contrary, expertise requires a process of active reflection and development alongside continuous professional activity, which takes on board the current state of research (Hericks, 2006; Herrmann & Hertramph, 2000; Keller-Schneider, 2008; Sikes et al., 1991).

Nevertheless, prospective teachers often take up their studies with very clear ideas and profound beliefs regarding effective teaching and learning, to the extent that they are less interested in theoretical knowledge and more interested in methods and strategies that prove to be useful in implementing their profession-related beliefs, i.e. those which correspond with their respective system of beliefs (Blömeke, 2005; Wideen, Mayer-Smith & Moon, 1998). For this reason in particular, the general beliefs gained through cumulative school experience, described by Lortie as the "apprenticeship of observation" (1975/2002) over 30 years ago, may hinder professional development. For instance, Lüsebrink (2007) states that what leads a teacher to confirm and possibly adapt his or her profession-related beliefs is not so much the theoretical knowledge taught in training, but their broader everyday educational experiences.

This article deals with this problem by investigating the extent to which students' beliefs about teaching and learning change over the course of their teacher training programmes. This relates to the basic question of whether it is actually possible to change profession-related beliefs that were formed during school education so that they come into line with those promoted in teacher training courses. Both issues will be analysed and discussed on the basis of the respective data.

3.2 Theoretical and empirical basis

The term belief can be understood in a variety of ways. For instance, there are authors who speak about teachers' cognitions, teachers' conceptions, teachers' views or teachers' orientations (Forgasz & Leder, 2008; Reusser, Pauli & Elmer, 2011; Schoenfeld, 1998; Wilson & Cooney, 2002). While there is no commonly accepted definition of belief, and Pajares (1992) calls it a "messy construct", Richardson (1996, p. 103) provides us with a general framework for the term: "understandings, premises, or propositions about the world that are felt to be true". This general definition makes clear that, contrary to knowledge, beliefs are not subject to any claim of justification and only have to meet the individual perception of what is right (Baumert & Kunter, 2006; Fenstermacher, 1994). A narrower definition from Op't Eynde, de Corte & Verschaffel (2002, p. 24) states that "beliefs are implicitly or explicitly held subjective

conceptions (…) that influence (…) learning and problem-solving". Besides providing a narrower focus, this definition also expresses the effectiveness of *beliefs* in teaching and learning. Schoenfeld (2011) emphasises this, adding that teaching must always be understood as a function of resources (knowledge combined with materials), aims and orientations (beliefs and values). Thus, there is broad agreement amongst academics that teachers' beliefs play a part in influencing the common objectives, perceptions and interpretations of educational situations, as well as the expectations of pupils and professional conduct in general (Calderhead, 1996; Goldin, Rösken & Törner, 2009; Hofer, 2001; Reusser et al. 2011; Richardson, 1996; Schommer-Aikins, 2004).

In recent years, the additional classification of beliefs into those about teaching and learning (epistemological: subject-specific concepts, attitudes towards learning), those about oneself (personal: perceived self-efficacy, locus of control) and those about the social environment (contextual: teachers' expectations, pupils' confidence) has become more prevalent, especially in research into these aspects (Hofer & Pintrich, 1997; Op't Eynde et al., 2002; Reusser et al., 2011). In various projects, researchers continue to differentiate more precisely between different types of belief, which is the case in particular for the first category of teaching and learning. Thus for instance, in the field of text comprehension Bråten, Britt, Strømsø and Rouet (2011) have been able to demonstrate that beliefs can mostly be seen in relation to a particular type of teacher conduct and the application of specific teaching methods and results.

Forgasz and Leder (2008) point out that beliefs may not just differ between professional groups, but also within them. In the teaching profession, beliefs may, for instance, vary between teachers at different levels, or with different amounts of professional experience. In comparison with practising teachers, prospective teachers tend to champion "well-tested and common-sense ideas of teachers' work" (Britzman, 1986, p. 443) rather than theoretically based beliefs, as mentioned in the introduction. Amongst researchers there is no consensus on the extent to which these beliefs may further develop as a result of the teacher training course. American research, which is mainly quality-orientated, is extremely rich, but also inconsistent. The results predominantly point to students only developing a few new profession-related beliefs during their training, but at the same time acquiring the skills to defend their existing views with well-selected information (Kane, Sandretto & Heath, 2002; Wideen, Mayer-Smith & Moon, 1998). This research has been criticised, especially because it has generally been conducted over a short period of time and almost always focuses on comprehension (qualitative research) rather than on representative description or explanation (quantitative research) (Biedermann, 2011; Blömeke, Müller, Felbrich & Kaiser, 2008; Reusser et al., 2011). Thus, the few quantitative studies which do exist suggest that the development of beliefs may indeed occur as intended during teacher training programmes. In a study conducted in Constance in the 1970s, a shift away from more conservative convictions towards more liberal beliefs was detected amongst prospective teachers which, subsequently entered the literature under the term *Konstanzer Wanne*, an expression which conjures up the idea of teachers slipping

back into old patterns once they have started to work in the profession (Koch, 1972; Müller-Fohrbrodt, Cloetta & Dann, 1978). In contrast, Blömeke et al. (2008) have recently been able to prove that students at the end of their teacher training course were more consistent in their beliefs about the value of teaching mathematics through active learning and about mathematics as a process of enquiry than teachers at the beginning of a course. Comparing these studies with research in the USA, where different methodological approaches are applied, it is also striking that studies which suggest that a modification of beliefs during teacher training courses is possible originate from countries where the duration of courses tends to be longer, for example in the German-speaking area (Blömeke et al., 2008).

According to existing research, then, the development of beliefs over the course of training programmes may well be possible. Beliefs should develop when the following three preconditions are fulfilled: when teacher training courses are undertaken at the same institution over several semesters; when students are taught by a consistent set of lecturers and when those lecturers share similar beliefs on teaching and learning. Because of the concurrent program-types[1] used by teacher training courses at primary level, the first of these two preconditions are guaranteed in German-speaking Switzerland (the focus of data analysed for this paper). However, there are significant differences between institutions when it comes to the latter point (Steinmann & Oser, 2012). It should be stressed in addition that, in the transition to the 21st century, constructivist teaching and learning methods were said to help effective learning. As a consequence, teaching concepts which emphasise that teaching and learning process are subjective constructivist processes aimed at strengthening the relevant beliefs amongst prospective teachers have been developed for teacher training programmes in Switzerland and in other countries (Reusser et al., 2011). These concepts require an understanding of situated learning and that learning processes are particularly effective when they are problem-oriented and embedded in situations that are as authentic as possible (Lave & Wenger, 1991). A constructivist view of effective learning considers the structure of the subject taught to be more dynamic than it is static. There has been hardly any research (in Switzerland there has been none at all) carried out using representative results to test whether such an evolution of beliefs during teacher training can be empirically confirmed. The present analyses are intended as a contribution to closing the research gap by way of a quasi-longitudinal look at German-speaking Switzerland.

1 In concurrent program-types studies in subject-matter content, pedagogy, and other courses in education are all included within one single phase of post-secondary education and sanctioned by a single credential. In contrast, consecutive program-types require completion of two phases of teacher education: "first, an initial university degree with specialization in the subject-matter that the future teacher is being prepared to teach, followed by a separate second phase focused mostly on pedagogy and practicum and sanctioned by a second credential" (Tatto et al., 2012, p. 33).

3.3 Question and Hypothesis

This article asks whether there are differences between the beliefs of prospective primary school teachers at the beginning and at the end of their training courses in the following two areas: (1) the nature of mathematics as a process of enquiry and a set of rules and procedures and (2) active learning and teacher-led learning in mathematics classes.

The focus was placed on one level of programme-types in teacher education and one subject area so as to limit confounding variables. This explains why only prospective primary school teachers preparing to teach mathematics have been selected.

Data from a partial sample of the TEDS-M (Teacher Education and Development Study: Learning to Teach Mathematics; Tatto, Schwille, Senk, Ingvarson, Peck & Rowley, 2008; Tatto, Schwille, Senk, Ingvarson, Rowley, Peck, Bankov, Rodriguez & Reckase, 2012) were used to examine the participants' epistemological beliefs about mathematics. As beliefs about mathematics have regularly been the focus of research in recent years, there are valuable reference results (Blömeke et al., 2008; Dubberke, Kunter, McElvany, Brunner & Baumert, 2008; Kunter et al., 2007; Leuchter, 2009; Pauli, Reusser & Grob, 2007). The results of several studies point to a tendency among students to believe that mathematics is a process of enquiry which favours active learning, rather than a set of rules and procedures which favour teacher-led teaching (Blömeke et al., 2008; OECD, 2009; Oser, Biedermann, Brühwiler, Kopp, Krattenmacher & Steinmann, 2010). Thus, it seems at first glance that attempts to establish teaching concepts that focus on active learning have been successful.

These teaching concepts are certainly now implemented in primary and secondary schools. Yet, their implementation is the exception rather than the rule. It must be assumed that many pupils still base their beliefs concerning teaching and learning primarily on the "conservative" teaching behaviour they have experienced during their time at school. This view is also seen in teacher trainees at the beginning of their training courses. It is only during teacher training, through the observation of different teaching and learning models, that beliefs in mathematics as a process of enquiry and in an active learning approach become evident as subjective constructions.

This paper also anticipates, firstly, that students at the end of their training programmes believe significantly more strongly that mathematics is a process of enquiry and less that mathematics is a set of rules and procedures in comparison with their colleagues who are starting their studies. Secondly, in contrast to the views held by first-semester students, final-semester students believe that the acquisition of mathematical knowledge should be significantly more focused on active learning and significantly less on following the teacher's instructions. Both assumptions are based on the expectation that, during teacher training, problem-oriented opportunities to learn (OTL) in highly authentic teaching and learning situations also lead to the development of beliefs (Lave & Wenger, 1991). Hence, an analysis, albeit a cross-sectional one, shows that as a result of OTL in mathematics pedagogy during teacher training, students believe more strongly in an active learning approach to mathematics

(Biedermann, Brühwiler & Krattenmacher, 2012). Finally, it is also assumed that many OTLs in mathematics pedagogy are related to the development of beliefs in mathematics as a process of enquiry and which support an active learning approach to mathematics.

3.4 Methodological Procedure

3.4.1 Data basis and sample

The present analyses are based on the data from the TEDS-M 2008 (Tatto et al., 2008, 2012) in German-speaking Switzerland (Oser et al., 2010), and a related national study with first-year students. The sample for this analysis comprises a total of 1,899 prospective primary school teachers, of whom 1,001 are at the beginning and 898 at the end of their training courses (quasi-longitudinal section design). 86 percent of the first-year students and 85 percent of the graduates are women. All 14 teacher training institutions in German-speaking Switzerland offering 23 training courses – also referred to as Teacher Preparation Units (TPU) in TEDS-M – participated in the survey. Two TPUs had to be excluded for the first-year data[2] and two TPUs from one institution had to be merged into one[3]. Thus, there were 20 TPUs represented in the sample under consideration.

3.4.2 Instruments

In order to verify questions and hypotheses, different TEDS-M scales were used. The testing instruments were generated according to the IEA guidelines and submitted to an exploratory and confirmatory factor analysis after every single testing phase (field and main survey). The content-related validity of the scales was also confirmed by an international expert panel (Tatto et al., 2008, 2012).

The survey of graduating students was carried out in spring 2008 and was based on a paper-and-pencil questionnaire. The first-year students were surveyed online in autumn 2008. Rescaling was necessary when the TEDS-M sample was combined with the data for the first-semester students. In contrast to international IRT scales, the beliefs were measured using Likert scales.

Beliefs about the nature of mathematics
The epistemological beliefs about the nature of mathematics are represented by the two-dimensional structure of *mathematics as a process of enquiry* and *mathematics as*

2 Owing to a programming error during the online survey, the data from one TPU were not gathered. In another TPU, unusual circumstances during the collection of data led to an insufficient participation rate among the students.

3 In this institution, training courses for (a) kindergarten and primary school years 1-3 and (b) primary school are merged for first-year students.

a set of rules and procedures. The scale for mathematics as a process of enquiry comprises five items and describes the process-led nature of mathematics (sample item: "In mathematics you can discover and try out many things by yourself"; six-point Likert scale from "strongly disagree" to "strongly agree"; Cronbach's α: first semester α = .73; final semester α = .74). The regularity of mathematics is represented by the scale for mathematics as a set of rules and procedures, consisting of six items (sample item: "Mathematics involves remembering and applying definitions, formulae, mathematical facts and procedures"; six-point Likert scale from "strongly disagree" to "strongly agree"; Cronbach's α: first semester α = .69; final semester α = .71).

Beliefs about learning mathematics

In the scope of epistemological beliefs about the acquisition of mathematical knowledge, two different approaches are evaluated: firstly *active learning* and secondly *following the teacher's instructions*. The active learning scale comprises six items and reflects the fact that learning is a pupil-controlled development process, which is guided by the teachers (sample item: "Time used to investigate why a solution to a mathematical problem works is time well spent"; six-point Likert scale from "strongly disagree" to "strongly agree"; Cronbach's α: first semester α = .71; final semester α = .64).

The scale for analysing the importance of following the teacher's instructions comprises eight items and reflects the idea that teachers impart knowledge (sample item: "Pupils need to be taught exact procedures for solving mathematical problems"; six-point Likert scale from "strongly disagree" to "strongly agree"; Cronbach's α: first semester α = .60; final semester α = .60).

Opportunities to learn (OTLs)

The scale for *OTLs in mathematics pedagogy* comprises 13 items and covers aspects of lesson planning and teaching. As this scale explicitly refers to OTLs provided in teacher training, only graduating students were surveyed on this topic. They were asked to indicate how often in their studies they were provided OTLs on topics such as how to deal with learning difficulties, how to motivate learners with special projects and how to integrate everyday mathematical problems into classes (sample item: "Create projects that motivate all pupils to participate"; four-point Likert scale from "never" to "often"; Cronbach's α = .84).

3.4.3 Analysis method

The present data originate from the Swiss study conducted as an addition to the TEDS-M, in which students from both the first and the final semester were surveyed (see section 3.4.1). This quasi-longitudinal section distinguishes between the beliefs students have on mathematics and mathematics learning at the beginning and at the end of their training courses. Possible differences are statistically confirmed through t-tests. The quasi-longitudinal study design, however, means that only approximate

conclusions can be drawn on whether the beliefs held at the beginning of a student's programme change over the course of training. It must be assumed that both cohorts (students in their first and last semesters) do not differ significantly in their composition, because two full surveys were conducted.

Additionally, an interesting question is whether the changes in beliefs can be attributed to differences in the OTLs of the TPUs. This question cannot be investigated at an individual level using the present data for two reasons: firstly, because two different cohorts and two measurement dates have been used; and secondly, because information regarding OTLs can only be gathered at the end of the training course. Therefore, all the data were aggregated at TPU level in order to obtain a longitudinal data set for the individual TPUs. It becomes apparent that the characteristics of profession-related beliefs at TPU level hardly differ from the individual data (see section 3.5.1). Several regression models were specified on the basis of aggregated data to perform the analyses. In order to adapt the effects of OTLs to the changes in profession-related beliefs, the beliefs held at the end of the training course were used as criterion variables, while the corresponding beliefs held at the beginning of the training course and the OTLs in mathematics pedagogy were introduced as predictors. However, there is a limitation, in that, despite a full survey in German-speaking Switzerland having been carried out, the regression analyses were only able to cover a small sample of 20 TPUs and are therefore only of explorative character.

3.5 Results

3.5.1 Students' beliefs

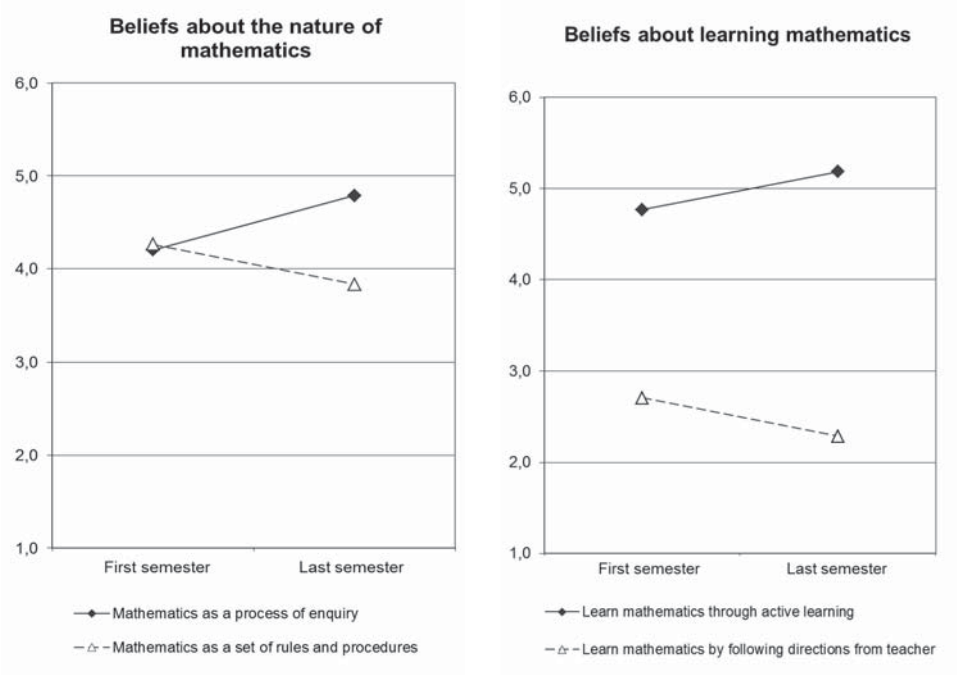
Beliefs about the nature of mathematics

At the beginning of their studies, the students rated the two beliefs about the nature of mathematics almost equally (Figure 3.1, left): the notion of mathematics as a process of enquiry ($M = 4.20$; $SD = 0.76$) and that of mathematics as a set of rules and procedures ($M = 4.26$; $SD = 0.64$). However, at the end of their teacher training programmes, a difference of nearly one rating point between the two beliefs emerged. Students tended to believe significantly more strongly that mathematics should be viewed as a process of enquiry ($M = 4.79$; $SD = 0.67$) rather than as a set of rules and procedures ($M = 3.83$; $SD = 0.68$).[4]

By comparing the students' beliefs at the beginning and the end of their training course, we see that the number of students who view mathematics as a process of enquiry increases more than half a rating point. The effect size of $d = 0.82$ reveals a strong effect ($t(1805) = 17.43$, $p < .001$). While students in the first semester tended to select "generally agree" for this scale, students in the final semester tended towards "agree". A high number of students in the final semester still believe that mathematics

4 The characteristics of the beliefs about the nature of mathematics aggregated at the TPU level differ only slightly from the individual mean values. The maximum difference amounts to 0.06 points.

is a set of rules and procedures, however, they do so less distinctly and with a stronger tendency towards a neutral rating than in the first semester (t (1824) = -13.94, p < .001). The effect size of d = 0.65 suggests a medium effect.



Scale means are represented; six-point Likert scale from "strongly disagree" (1) to "strongly agree" (2); a neutral perspective is recorded as 3.5.

Figure 3.1: Students' beliefs at the beginning and the end of their teacher training courses

Beliefs about learning mathematics

The two epistemological beliefs about how mathematical knowledge is acquired are rated differently by students at the beginning of their studies (Figure 3.1, right). While there is clear support for the active learning approach to learning mathematics (M = 4.77; SD = 0.60), the belief that mathematics should be learned by following the teacher's instructions (M = 2.71; SD = 0.53) tends not to be supported.

This distinction is expressed even more strongly by graduating students. They rate the active learning approach for mathematics 0.42 points higher than first-year students (M = 5.18; SD = 0.49). Statistically, this difference is of great significance (t (1801) = 16.46, p < .001; d = 0.99). Learning mathematics by following the teacher's instructions is viewed by students even more negatively at the end of their studies (M = 2.29; SD = 0.50); by this stage the average response is in the "do not agree" category (t (1805) = -17.32, p < .001, d = 0.82).[5]

5 The characteristics of the *beliefs about the nature of mathematics* aggregated at the TPU level differ only slightly from the individual mean values. The maximum difference amounts to 0.04 points.

3.5.2 The relationship between opportunities to learn (OTL) and beliefs

A fundamental aim of this article is to investigate the significance of OTLs in mathematics pedagogy in teacher training programmes for the development of beliefs about the nature of mathematics and about the acquisition of mathematical knowledge. To this end, several regression models were specified at TPU level (see section 3.4.3). In order to model the differences in the beliefs between the beginning and end of the training courses, the beliefs held at the beginning of the courses were used each time in the regression models as predictor variables. The beliefs at the end of the training programmes were used as criterion variables. This procedure allows us to estimate the effect that OTLs in mathematics pedagogy have on differences in beliefs relating specifically to mathematics between first-semester students and graduates.

OTLs in mathematics pedagogy and beliefs about the nature of mathematics
The results of both regression models concerning the prediction of beliefs about the nature of mathematics (see Table 3.1) show that a high number of OTLs in mathematics pedagogy are accompanied by significantly higher levels of support for the idea that mathematics is a process of enquiry (ß = .42) and significantly lower levels of support for the idea of mathematics as a set of rules and procedures (ß = -.52). The beliefs of first-semester students aggregated at TPU level do not correlate significantly with those of prospective teachers at the time of their graduation. This result is not surprising given that beliefs established at school are the ones held at the beginning of the training programme. A little over 30 percent of the variance in the beliefs about the nature of mathematics at graduation can be explained using the two models.

Table 3.1: OTLs in mathematics pedagogy with relation to the prediction of beliefs held at graduation about the nature of mathematics

Dependent variable	Mathematics as a process of enquiry		Mathematics as a set of rules and procedures	
	ß	p	ß	p
Mathematics as a process of enquiry (1st semester)	-.33	.12		
Mathematics as a set of rules and procedures (1st semester)			.09	.69
OTL in mathematics pedagogy	.42	.05	-.52	.03
R^2	.33		.31	

Results at the TPU level (N = 20). Standardised regression coefficients (ß) are indicated.

OTLs in mathematics pedagogy and beliefs about the acquisition of mathematical knowledge

The results regarding beliefs about the acquisition of mathematical knowledge are also as expected (see Table 3.2). In TPUs with a high number of OTLs in mathematics pedagogy, graduating students' beliefs are significantly more focused on an active learning approach to mathematics (ß = .67) and less on following the teacher's instructions (ß = -.69). The variance is 45 percent for the model that illustrates the results for active learning, and it is 51 percent for following the teacher's instructions.

Table 3.2: OTLs in mathematics pedagogy with relation to the prediction of beliefs held at graduation about the nature of mathematics

Dependent variable	Learning mathematics through active learning		Learning mathematics by following the teacher's instructions	
	ß	p	ß	p
Learning mathematics through active learning (1st semester)	-.04	.83		
Learning mathematics by following the teacher's instructions (1st semester)			.15	.38
OTL in mathematics pedagogy	.67	.002	-.69	.001
R^2	.45		.51	

Results at the TPU level (N = 20). Standardised regression coefficients (ß) are indicated.

Competing explanatory criteria were also incorporated into the models in order to further substantiate the validity of these results. In concrete terms this means that the regression models with OTLs in school mathematics and general pedagogy, both of which have little or no effect on beliefs, were specified (not illustrated here). As expected, these non-pedagogical-content OTLs are not directly related to beliefs about the nature of mathematics or beliefs about the acquisition of mathematical knowledge.

3.6 Discussion

There is a significant difference in beliefs about the nature of mathematics and the acquisition of mathematical knowledge held by prospective primary school teachers in German-speaking Switzerland at the beginning and at the end of their training. By way of example, graduating students clearly favour the idea of mathematics as a process of enquiry over the notion of mathematics as a set of rules and procedures in comparison to first-semester students. Furthermore, a preference for active learning approaches in mathematics lessons over an approach which involves following the teacher's instructions is more pronounced in graduating students than first-year students. Thus, our results fit into the series of recent studies, which demonstrate that students tend to adopt beliefs that view mathematics as a process of enquiry. They

consider active learning in mathematics lessons to be more effective than thinking of the subject as a set of rules and procedures to be taught by the teacher (Blömeke et al., 2008; OECD, 2009; Oser et al., 2010).

The results support this hypotheses with just one limitation: contrary to the expectation that students at the beginning of their teacher training course would still hold largely "conservative" beliefs about teaching and learning, the first-year students surveyed supported the active learning approach to mathematics over the approach of following the teacher's instructions. Consequently, it seems that active learning concepts have been implemented in mathematics classes in primary and secondary schools and that this is reflected in pupils' beliefs. Admittedly, reliable explanations for the different belief patterns among the two groups analysed cannot be produced using the quasi-longitudinal section data format. However, using the analyses, it is possible to support, tentatively at least, the assumption stated at the outset that problem-oriented and authentic OTLs both have some part to play in triggering an evolution of students' beliefs during their teacher training programme (situative learning; cf. Lave & Wenger, 1991). Thus, at TPU level it is clear that a high number of OTLs in mathematics pedagogy can explain the differences in student beliefs at the beginning and the end of training courses. On the other hand, OTLs in school mathematics and general pedagogy are insignificant in this context. These latter OTLs may be too far removed from the classroom itself and, therefore, do not encourage an active examination of one's own beliefs as regularly advocated by the literature (Blömeke, 2005). Specific approaches should be sought in research on, for instance, conceptual-change, biographies or the transfer of learning (Reusser & Pauli, 2011).

Whether profession-related beliefs about the nature of mathematics and teaching and learning mathematics can in fact be altered during teacher training courses can only be verified using longitudinal data. The ideal study design would not only cover complete training programmes, but would continue beyond the training course into the initial phase of professional life. This is necessary because current research indicates that changes in profession-related beliefs require consistent efforts over the long term which at the present time are lacking (Blömeke et al., 2008; Reusser et al., 2011).

References

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keyword: Professional competence of teachers]. *Zeitschrift für Erziehungswissenschaft*, *9*(4), 469-520.

Berliner, D. C. (2001). Learning about and learning from expert teachers. *International Journal of Educational Research, 35*(5), 463-482.

Biedermann, H. (2011). *Gebrochene Übergänge: durch professionelle Lernkerne zur professionellen Lehrtätigkeit* [Broken Transfer: Professional Teaching by Professional Learning]. Universität Freiburg (CH), philosophische Fakultät (Habilitationsschrift).

Biedermann, H., Brühwiler, C., & Krattenmacher, S. (2012). Lernangebote in der Lehrerausbildung und Überzeugungen zum Lehren und Lernen. Beziehungsanalysen bei angehenden Lehrpersonen [Learning Opportunities in Teacher Training and Convictions Regarding Teaching and Learning. Relationship analyses among future teachers]. *Zeitschrift für Pädagogik, 58*(4), 460-475.

Blömeke, S. (2005). *Lehrerausbildung – Lehrerhandeln – Schülerleistungen: Perspektiven nationaler und internationaler empirischer Bildungsforschung (Antrittsvorlesung, 10. Dezember 2003)* [Teacher Education – Teacher Performance – Student Achievement. Perspectives of National and International Empirical Educational Research]. Retrieved July 12, 2009, from http://edoc.hu-berlin.de

Blömeke, S., Müller, C. Felbrich, A., & Kaiser, G. (Ed.). (2008). Epistemologische Überzeugungen zur Mathematik [Epistemological beliefs about mathematics]. In S. Blömeke, G. Kaiser, & R. Lehmann (Ed.). *Professionelle Kompetenz angehender Lehrerinnen und Lehrer. Wissen, Überzeugungen und Lerngelegenheiten deutscher Mathematikstudierender und -referendare; erste Ergebnisse zur Wirksamkeit der Lehrerausbildung* (pp. 219-246). Münster: Waxmann.

Bråten, I., Britt, M. A., Strømsø, H. I., & Rouet, J.F. (2011). The role of epistemic beliefs in the comprehension of multiple expository texts: Towards an integrated model. *Educational Psychologist, 46,* 48-70.

Britzman, D.P. (1986). Cultural myths in the making of a teacher: Biography and social structure in teacher education. *Harvard Educational Review, 56*(4), 442-456.

Bromme, R., & Haag, L. (2004). Forschung zur Lehrerpersönlichkeit [Research on Teacher Personality]. In W. Helsper, & J. Böhme (Eds.), *Handbuch der Schulforschung* [Handbook of School Research] (pp. 777-793). Wiesbaden: Verlag für Sozialwissenschaften.

Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. C. Berliner, & R. C. Calfee (Eds.), *Handbook of Educational Psychology* (pp. 709-725). New York: Prentice Hall International.

Dubberke, T., Kunter, M., McElvany, N., Brunner, M., & Baumert, J. (2008). Lerntheoretische Überzeugungen von Mathematiklehrkräften. Einflüsse auf die Unterrichtsgestaltung und den Lernerfolg von Schülerinnen und Schülern. [Mathematics Teachers' Beliefs and Their Impact on Instructional Quality and Student Achievement]. *Zeitschrift für Pädagogische Psychologie, 22*, 193-206.

Ericsson, A. K., Charness, N., Feltovich, P., & Hoffman, R. R. (2006). *Cambridge handbook on expertise and expert performance*. Cambridge, UK: Cambridge University Press.

Fenstermacher, G. D. (1994). The knower and the known: The nature of knowledge in research on teaching. In L. Darling Hammond (Eds.), *Review of Research in Education* (pp. 3-56). Washington, DC: American Educational Research Association.

Forgasz, H. J., & Leder, G. C. (2008). Beliefs about mathematics and mathematics teaching. In P. Sullivan, & T. Wood (Eds.), *International handbook of mathematics teacher education: Vol.1*. Knowledge and beliefs in mathematics teaching and teaching development (pp. 173-192). Rotterdam/Taipei: Sense Publishers.

Goldin, G., Rösken, B., & Törner, G. (2009). Beliefs – no longer a hidden variable in mathematical teaching and learning processes. In J. Maass & W. Schlöglmann (Eds.), *Beliefs and Attitudes in Mathematics Education: New Research Results* (pp. 1-18). Rotterdam: Sense Publishers.

Hatano, G., & Inagaki, K. (1986). Two Courses of Expertise. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), *Child Development and Education in Japan* (pp. 262-272). New York, NY: Freeman.

Hattie, J. (2003). *Teachers make a difference: what is the research evidence?* Retrieved November 11, 2008, from http:www.leadspace.govt.nz/leadership/pdf/john_hattie.pdf

Hericks, U. (2006). *Professionalisierung als Entwicklungsaufgabe* [Professionalisation as Developmental Task]. Wiesbaden: Verlag für Sozialwissenschaften.

Herrmann, U., & Hertramph, H. (2000). Zufallsroutine oder reflektierte Praxis? Herkömmliche Wege in den Berufseinstieg von Lehrern und notwendige Alternativen [Routine at Random or Reflected Practice? Conventional Ways of Teacher Induction and Necessary Alternatives]. *Beiträge zur Lehrerbildung, 18*(2), 172-191.

Hofer, B. K. (2001). Personal epistemology research: Implications for learning and transfer. *Educational Psychology Review, 13*(4), 353-383.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*(1), 88-140.

Hubermann, M. (1989). The professional life cycle of teachers. *Teachers College Record, 91*(1), 31-57.

Kane, R., Sandretto, S., & Heath, C. (2002). Telling half the story: A critical review of research on the teaching beliefs and practices of university academics. *Review of Educational Research, 72*(2), 177-228.

Keller-Schneider, M. (2008). *Herausforderungen im Berufseinstieg von Lehrpersonen: Beanspruchungswahrnehmung und Zusammenhänge mit Merkmalen der Persönlichkeit* [Challenges during Teacher Induction: Subjective Expectation and Correlations with Personality Traits] *(Dissertation)*. Zürich: Zentralbibiothek. Retrieved May 19, 2009, from http://opac.nebis.ch/F?local_base=zbz&func=find-b&find_code=SYS&request=005754138

Koch, J.-J. (1972). *Lehrer-Studium und Beruf. Einstellungswandel in den beiden Phasen der Ausbildung* [Teacher Training and Profession. Change of Beliefs during the Two Phases of Training]. Ulm: Süddeutsche Verlagsgesellschaft.

Kunter, M., Klusmann, U., Dubberke, T., Baumert, J., Blum, W., Brunner, M., Jordan, A., Krauss, S., Löwen, K., Neubrand, M., & Tsai, Y.-M. (2007). Linking aspects of teacher competence to their instruction. Results from the COACTIV project. In M. Prenzel (Ed.), *Studies on the Educational Quality of Schools* (pp. 39-59). Münster: Waxmann Verlag.

Lave, J., & Wenger, E. (1991). *Situated learning: legitimate peripheral participation*. Cambridge: Cambridge University Press.

Leuchter, M. (2009). *Die Rolle der Lehrperson bei der Aufgabenbearbeitung. Unterrichtsbezogene Kognitionen von Lehrpersonen* [Teacher's Role when Mastering Tasks. Teaching-Related Cognitions of Teachers]. Münster: Waxmann Verlag.

Lortie, D. C. (1975/2002). *Schoolteacher*. Chicago: University of Chicago Press.

Lüsebrink, I. (2007). Biografische Gewissheiten statt biografischer Vergewisserung [Biographical Certainty rather than Biographical Assurance]. In D. Lemmermöhle, M. Rothgangel, S. Bögeholz, M. Hasselhorn & R. Watermann (Eds.), *Professionell lehren, erfolgreich lernen* [Professional Teaching, Successful Learning] (pp. 123-131). Münster: Waxmann Verlag.

Müller-Fohrbrodt, G., Cloetta, B., & Dann, H. D. (1978). *Der Praxisschock bei jungen Lehrern* [Young Teachers' Shock of Practice]. Stuttgart: Klett Verlag.

OECD (2009). *Creating Effective Teaching and Learning Environments: First Results from TALIS*. Retrieved November 13, 2011, from http://www.oecd.org/data oecd/17/51/43023606.pdf

Op't Eynde, P., de Corte, E., & Verschaffel, L. (2002). Framing students' mathematics-related beliefs: A quest for conceptual clarity and a comprehensive categorization. In G. Leder, E. Pehkonen & G. Törner (Eds.), *Beliefs – A hidden variable in mathematics education?* (pp. 13-38). Dordrecht: Kluwer Academic Publishers.

Oser, F., Biedermann, H., Brühwiler, C., Kopp, M., Krattenmacher, S., & Steinmann, S. (2010). *Deutschschweizer Lehrerausbildung auf dem Prüfstand. Wie gut werden unsere angehenden Lehrpersonen ausgebildet? Ein internationaler Vergleich* [Assessing Swiss Teacher Education. To What Extend are our Teachers well-trained? An International Comparison]. Retrieved July 15, 2010, from http://www.teds.m.ch

Pajares, M. F. (1992). Teacher's Beliefs and Educational Research: Cleaning Up a Messy Construct. *Review of Educational Research, 62* (3), 307-332.

Pauli, C., Reusser, K., & Grob, U. (2007). Teaching for understanding and/or self-regulated learning? A video-based analysis of reform-oriented mathematics instruction in Switzerland. *International Journal of Educational Research, 46*(5), 294-305.

Reusser, K., Pauli, C., & Elmer, A. (2011). Berufsbezogene Überzeugungen von Lehrerinnen und Lehrern [Work-related beliefs of teachers]. In E. Terhart, H. Bennewitz & M. Rothland (Ed.). *Handbuch der Forschung zum Lehrerberuf* [Handbook of research on the teaching profession] (pp. 478-495). Münster: Waxmann,.

Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula, T. Buttery & E. Guyton (Hrsg.), *Handbook of Research on Teacher Education* (2. Aufl.; S. 102-119). New York: Macmillan.

Schoenfeld, A. H. (1998). Toward a theory of teaching-in-context. *Issues in Education, 4*(1), 1-94.

Schoenfeld, A. H. (2011). Toward professional development for teachers grounded in a theory of decision making. *ZDM Mathematics Education, 43*, 457-469.

Schommer-Aikins, M. (2004). Explaining the epistemological belief system: Introducing the embedded systemic model and coordinated research approach. *Educational Psychologist, 39*(1), 19-29.

Sikes, P. J., Measor, L., & Woods, P. (1991). Berufslaufbahn und Identität im Lehrerberuf [Professional Career and Identity of Teachers]. In E. Terhart (Ed.), *Unterrichten als Beruf. Neuere amerikanische und englische Arbeiten zur Berufskultur und Berufsbiographie von Lehrern und Lehrerinnen* [Teaching as Vocation. Current American and English Work on the Vocational Culture and Biography of Teachers] (pp. 231-248). Köln: Böhlau-Verlag.

Steinmann, S. & Oser, F. (2012). Prägen Lehrerausbildende die Beliefs der angehenden Primarlehrpersonen? Shared Beliefs als Wirkungsgrösse in der Lehrerausbildung. [Are the beliefs of Future Primary Teachers Determined by Teachers in Teacher Training? Shared beliefs as a quantity in teacher training]. *Zeitschrift für Pädagogik, 58*(4), 441-459.

Tatto, M.T., Schwille, J., Senk, S., Ingvarson, L., Peck, R., & Rowley, G. (2008). *Teacher education and development study in mathematics (TEDS-M): Policy, practice, and readiness to teach primary and secondary mathematics. conceptual framework.* East Lansing: Teacher Education and Development International Study Center, College of Education, Michigan State University.

Tatto, M. T., Schwille, J., Senk, S., Ingvarson, L., Rowley, G., Peck, R., Bankov, K., Rodriguez, M., & Reckase, M. (2012). *Policy, practice, and readiness to teach primary and secondary mathematics in 17 countries. Findings from the IEA teacher education and development study in mathematics (TEDS-M)*. Retrieved April 10, 2012, from http://www.iea.nl/fileadmin/user_upload/Publications/Electronic_versions/IEA_TEDS-M.pdf

Wideen, M., Mayer-Smith, J., & Moon, B. (1998). A critical analysis of the research on learning to teach: Making the case for an ecological perspective on inquiry. *Review of Educational Research, 68*(2), 130-178.

Wilson, M., & Cooney, T. (2002). Mathematics teacher change and development. In G.C. Leder, E. Pehkonen, & G. Torner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 127-147). Dordrecht: Kluwer Academic.

Chapter 4
The Development of Professional Beliefs during Teacher Education at University

Melanie Taibi

Abstract

The present article highlights an issue that is yet to be empirically explored, namely the development of future teachers' professional beliefs in the course of their university education. The first results of a qualitative survey conducted on students undertaking different teaching subjects are presented here and are illustrated through an individual case study. As a result, a period of reflection proves to be the key point at which the development of beliefs is triggered. Reflection is used here to refer to the assessment of various forms of information from different teaching and learning contexts with reference to a particular professional topic. This is the point at which corresponding beliefs are formed. University teacher education could make use of these insights to promote the professionalisation of future teachers.

Keywords:
teacher beliefs; preservice teachers; teacher education; teachers' professional competence

4.1 Introduction

According to relevant competence models, professional beliefs are considered to be part of teachers' professional competence (cf. Baumert & Kunter, 2006; Weinert, 2001). They are deemed significant owing to their influence on the decisions made by teachers working in a field characterised by a diversity of demands (Leuchter, Pauli, Reusser & Lipowsky, 2006; Pajares, 1992; Richardson, 1996; Schoenfeld, 2011; Schwarzer & Warner, 2011). Beliefs help to provide a structure for the complex field of activities and to classify the various tasks according to their relevance (cf. Nespor, 1987). Thus, looking at the development of future teachers' skills during their studies, teacher education can benefit from placing greater emphasis on professional beliefs. In addition, research on teacher education should focus more heavily on this field of research in order to provide results that support the optimisation of teacher training, particularly in the light of the current reform of teacher training in Germany.

The majority of surveys dealing with future teachers' professional beliefs come from the field of mathematics, most commonly in the form of baseline studies on existing beliefs, which concern questions about their working methods and a potential

resistance to change (e.g. Blömeke, Kaiser & Lehmann, 2008; 2010; Kunter, Baumert, Blum, Klusmann, Krauss & Neubrand, 2011; Leder, Pehkonen & Törner, 2002). However, one crucial question remains unanswered: how do future teachers develop professional beliefs during their university teacher training course? While some investigations compare beliefs that exist on commencing university studies with those at the end, these are nevertheless conducted on different cohorts and focus on explaining potential changes (for instance MT21 and TEDS-M). The issue of whether the altered beliefs are a product of further developments in existing beliefs or whether they have emerged through completely new processes remains unresolved. The literature on teacher beliefs includes the assertions of Richardson (1996) who claims that personal experience, experience with school and instruction and experience with formal knowledge cause developments in professional beliefs. However, to date, there have been no empirical studies dealing with these assumptions.

The present study seeks to address this shortcoming in the research. Its main focus is to reconstruct and comprehend how professional beliefs are developed during preservice teachers' university education. For this purpose, problem-centred interviews were conducted with students at the end of their first phase of teacher education and analysed using an evaluation method that was tailored to the research question.

The present article begins by framing the study within the theory of teacher beliefs, and then explains the research question and design. Thereafter an individual case study illustrates how professional beliefs may develop during teacher education at university. By way of conclusion, the article makes suggestions on how the knowledge gained from the individual case study can be applied with a view to improving future teacher training.

4.2 Theoretical framework of the study

The following section introduces the theoretical framework which forms the basis of the design of the present study. In this case the main focus rests on research in the German-speaking countries.

In the course of reforms to teacher education and as a result of attempts to protect the quality of education standards in Germany, the professional competence of teachers has found itself at the centre of numerous academic and public discussions (cf. Baumert & Kunter, 2006). There have been various attempts to illustrate professional competence through theoretical constructs (e.g. KMK, 2004; Oser, 2001; Terhart, 2002). In the meantime, the theoretical construct based on the key tenets of the National Board for Professional Teaching Standards (NBPTS) and the theoretical competence construct of Baumert and Kunter (2006) – which is compatible with Weinert's assertions (2001) – appears to have become widely accepted. Studies from Germany targeted at both the national and international levels (e.g. COACTIV; MT21; TEDS-M) have used this as a reference for research on teacher competence. It comprises the four facets of teacher competence – knowledge, beliefs, motivational orientation

and self-regulation skills – which are considered to be prerequisites for teaching activity. Despite being included as one of the facets of teacher competence, the definition of professional beliefs remains far from clear owing to a wide variety of discussions and many contradictory points of view in the technical literature. In his essay on the "messy construct" of teacher beliefs, Pajares (1992) points to the difficulties posed by terminology definitions and to the fact that inadequate concepts and definitions regularly appear in the current debate on teacher beliefs (Ertmer, 2005; Goldin, Roesken & Törner, 2009; Reusser, Pauli & Elmer, 2011). One recent attempt to define terminology can be found in the current edition of *Handbuch der Forschung zum Lehrerberuf* (2011):

"By using a broad range of literature we define teacher beliefs as sentimentally charged and normative ideas about the essence and nature of teaching and learning processes, learning content, the identities and roles of teacher and learner, and the institutional and social context of education, which are considered to be true and valuable and which provide structure, assurance, security and orientation for their professional ideas and behaviour. Thus, beliefs can be of individual or collective nature, explicit or implicit (intuitive), fragmentary or even contradictory, or they could be associated with personalised, practical and subjective theories or less coherent theory-like systems of action and assumption." (Reusser, Pauli & Elmer, 2011, p. 478)[1]

This definition integrates theoretical assumptions about teacher beliefs and the results of various studies, and is used in this study as a heuristic method for approaching the object of research.

Aside from the need for a consistent definition, the differentiation of the terminology used in discussions on teacher beliefs is another unresolved issue, that is to say, the subdomains which make up professional teacher beliefs need to be determined. In the definition above, the essence and nature of teaching and learning processes, learning content, the identities and roles of teacher and learner and the institutional and social context of education are all mentioned (cf. Reusser, Pauli & Elmer, 2011). Alongside this, systematic attempts at classification can be found in the technical literature on teacher beliefs, which clearly outline the corresponding subdomains (Baumert & Kunter, 2006; Blömeke, Kaiser & Lehmann, 2008; Calderhead, 1996; Ernest, 1989). However, to a certain extent these attempts are carried out independently of one another which leads to additional variations in classification, besides the variations already illustrated in terminology.

The present study is based on the structure of the above-mentioned study, MT21, which provides the most detailed differentiation into subdivisions and is based on the differentiations used in the technical literature (Calderhead, 1996; Ernest, 1989; Hofer & Pintrich, 2002; McLeod, 1992; Op't Eynde, De Corte & Verschaffel, 2002; Thompson, 1992). The MT21 model exclusively refers to the subject of mathematics, whereas in this study all subjects are taken into consideration. Thus, four main areas of pre-service and in-service teachers' beliefs can be distinguished: self-beliefs, beliefs relating to the theory of schooling and professions, beliefs relating to teaching and

1 translated

learning the subject and epistemological beliefs about school subjects (cf. Blömeke, Kaiser & Lehmann, 2008), which are briefly explained below:

1. *Self-beliefs – expectations of self-efficacy and professional motivation*
   Self-beliefs refer to the ideas teachers have about themselves in relation to their (aspired) profession. On the one hand they concern expectations of self-efficacy, which means "teacher's beliefs about his/her ability to cope with difficult requirements despite adverse conditions"[2] (Schwarzer & Jerusalem, 2002, p. 40). On the other hand they relate to professional motivation, or the reasons for choosing to become a teacher.
2. *Beliefs relating to the theory of schooling and professions – the function of schooling, teacher duties, the content of teacher training courses*
   Beliefs relating to the theory of schooling and professions can be considered to be interdisciplinary beliefs. They concern ideas about the function of schooling in our society, for example qualifications and socialisation, about teacher duties, for example tuition or education as a duty, and about teacher education, for example the share of subject discipline, didactics and pedagogy (cf. Müller, Felbrich & Blömeke, 2008a).
3. *Beliefs relating to teaching and learning the subject: subject-related beliefs, attitudes towards learning targets, preferences of teaching methods, classroom management*
   Beliefs relating to teaching and learning the subject refer to actual tuition. They concern teachers' attitudes towards learning targets, for example problem solving or creating routines, and their ideas on the methodical application of targets, for example self-directed learning or directive instruction, as well as their beliefs on classroom management, for example preventive-instructional or reactive punishment approaches (cf. Müller, Felbrich, Blömeke, 2008b).
4. *Epistemological beliefs on school subjects – subject structures, genesis of subject competence*
   Epistemological beliefs refer to the "structure and genesis of knowledge" (Blömeke, Müller, Felbrich & Kaiser, 2008, p. 221).[3] They concern ideas about the structure of the respective subject, for example how static or variable a subject is perceived to be and whether it is considered to be completed or in progress. Additionally, epistemological beliefs include notions on the genesis of subject competence, which means how the subject is learned or can be learned (cf. ibid).

4.3 Problem and method

The present study aims to trace the emergence of pre-service teachers' professional beliefs in the course of their university teacher education. In the process, influential

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factors that can be considered as typical for the professionalisation of students should be highlighted.

In order to collect the data, interviews were conducted with 14 students who were approaching the end of their studies. This provided a retrospective understanding of their entire teacher education. The students were interviewed at the University of Cologne in the period from March to July 2010. The evaluation method selected was the problem-centred interviews proposed by Witzel (2000). This form of interviewing provides a wide scope for articulation in which interviewees can express their beliefs and can recall situations and circumstances which have contributed to their emergence. In addition it forces them to comprehensively challenge their respective beliefs, to explain and account for them, and possibly even correct them. The problem-centred interview is characterised by a combination of story and comprehension-generating communication strategies. Story-generating communication strategies comprise introductory questions, general probing and ad hoc questioning. Introductory questions serve as a means for focusing the dialogue on the issue under investigation and are characterised by their open formulation. General probing serves to expand on the subjective point of view on the issue and is achieved through further questioning on topics already mentioned. As a result, concrete examples taken from experience or personal episodes are recalled, while abstract, missing or indistinct terminology is discussed and clarified, and concrete references to context-related conditions are created. Ad hoc questioning becomes necessary when certain topics that are relevant for the study are left out by the interviewee. They may arise from keywords in the interview guidelines or can contain individual standardised questions. Comprehension-generating communication strategies are formed of explanatory questions in the event that responses have been evasive or contradictory. They challenge the general personal beliefs that are taken for granted by the interviewee. Additionally, reflecting on their statements provides the interviewee with the opportunity to claim their personal perspective and to correct any false statements made by the interviewer. Furthermore, confrontation can encourage the interviewee to give a more detailed description of their point of view (cf. Witzel, 2000).

The interview guidelines for this study were based on the four main beliefs areas in the model described above which provided distinctions in the terminology on teacher beliefs. A story-generating introductory question for each individual belief area was posed and the subsequent narration was not interrupted. During this commentary, interesting statements were noted and discussed via comprehension-generating questions after every response. Furthermore, short complementary questionnaires were used to gather social data, and postscripts were added to describe situational and non-verbal aspects of the interview in particular.

A model tailored to the clarification of the research question was developed in order that individual cases could be evaluated. It comprised parts of the analysis from the Grounded Theory Methodology (Strauss, 1998; Strauss & Corbin, 1996) and further principles rooted in other research traditions. The model encompasses six steps

that are performed in a strict order – in contrast to the ideal of the Grounded Theory Methodology. These are described below:

1. *Identification – detecting and structuring the underlying professional beliefs*
   In the first step of the analysis, the professional beliefs are identified and coded with the help of the definition provided by Reusser, Pauli and Elmer (2011). Thereafter, they are allocated to the different belief areas by using the terminology construct from MT21.
2. *Segmentation – marking the completed units of meaning*
   In the second step the interview is divided into segments, or "units carrying meaning" (Mey & Mruck, 2009, p. 119). The criteria for determining the segments are linguistic indicators that show that the units of meaning are completed. Such indicators are discourse particles that express continuation (such as "so" or "then"), discourse connectives (such as "because" or "whereas"), time markers (such as "still" or "already"), markers showing a lack of plausibility (for example moments of hesitation or self-correction) (cf. Schütze, 1983) and rules on taking turns in conversation (cf. Sacks, Schegloff & Jefferson, 1974; Brinker & Sager, 2006). Besides these elements, content-related points, such as changes in topic or digressions are also taken into account (cf. Detka, 2005).
3. *Content-related segment analysis – defining the thematic contexts of the beliefs within the text segments and writing memos about factors behind developments*
   In the third step, the thematic content within the text segments is assessed. This involves applying elements of Legewie's Global Analysis (1994). In accordance with this, the transcript is marked with notes and a thematic structuring is performed using the main terms derived from the text. This provides information on the contexts in which beliefs are formed. Accordingly, assumptions referring to the moment, place, social configuration and structural condition, etc. can be articulated in connection with the genesis of beliefs. This facilitates the memo writing, which are then elaborated over the course of the evaluation.
4. *Formal segment analysis – defining the forms in which beliefs are presented within the text segments and completing the memos about the factors of development*
   Following a content-related definition of the topics, the forms in which beliefs are presented within the text segments are identified using the definition of discourse types according to Schütze (1983). This differentiates between narration, description, assessments and arguments. The form in which a topic is presented, so the choice of discourse type, provides information about the cognitive representation of beliefs that enable the content and form of knowledge involved in the development of the beliefs to be identified. The memos from the content-related segment analysis are further developed with reference to these beliefs.
5. *Theoretical segment analysis – defining the theoretical content of the text segments and elaborating on the memo*
   After a thematic and formal definition of the text segments, their "theoretical content" (Mey & Mruck, 2009, p. 108) is established. With the help of generative

questions (cf. Strauss & Corbin, 1996), concepts that display "what a particular statement is able to express" (Przyborski & Wohlrab-Sahr, 2008, p. 195) are identified segment by segment. These do not necessarily need to refer to the development of beliefs. In fact, without exception, all statements within the segments are to be taken into account for the analysis, even those which do not show any visible reference of the development of beliefs. This ensures that the view does not remain limited to the factors of development already established through the memos taken. The concepts created are incorporated by adding to the statements made in the memos or making new ones. As a result, the memos contain carefully-phrased assumptions on potential factors of development, as well as concepts dealing with the theoretical content of the text segments. In order to achieve consistent presentation of the memos the carefully-phrased assumptions are supplemented with concepts. Thereafter, all concepts are pooled and brought together in comprehensive categories. Finally, the memos serve as descriptions of the features of the respective category.

6. *Reconstruction of the contexts of development – revealing correlations and interdependencies between the factors of development within and across the text segments*

   From this evaluation step onwards, the present article no longer deals simply with the factors of development, but also with the contexts of development. A context of development refers to a combination of various factors of development. The axial coding technique according to the principles of the Grounded Theory Methodology is used as a frame of reference to display the factors of development. Accordingly, the categories are incorporated into the so-called "coding paradigm" (Strauss, 1998, p. 56) or the "paradigmatic model" (Strauss & Corbin, 1996, p. 78). This brings a central phenomenon into question, together with its causal conditions, intervening conditions, its context and related performance strategies, and its consequences (cf. ibid). The structure of the coding paradigm can be modified according to the individual cases.

4.4 Results in the individual case of Christian Martin[4]

The following chapter presents the results of the Christian Martin case[5]. This individual case has not yet been generalised, which means that it is currently not possible to present the influential factors that are considered typical in the professionalisation of pre-service teachers. Instead, it will be used as an example to illustrate potential causes for the development of professional beliefs.

This chapter will first introduce Christian Martin's case. Thereafter, his professional beliefs will be explained and analysed with reference to their contexts of

4 To protect the anonymity of the participant, all names mentioned in the interview are entirely fictitious.

5 The author can provide copies of the interview transcript.

development. The results will be structured according to the main beliefs areas of the MT21 study, whereby only the main belief areas, which contain beliefs that have been identified in this case, are used.

4.4.1 Contexts for the development of professional beliefs

At the time of the interview Mr Martin (37) was approaching the end of the university course that would allow him to become a teacher of music and English at the *Sekundarstufe I*[6]. He had already passed the majority of his final exams. Alongside his studies, Mr Martin had been working as a support and substitute English teacher at a *Hauptschule*[7] for around one year. The university course in teacher education was his second professional training course. Owing to health issues he was forced to reorientate his professional career which had thus far involved working as a freelance musician for several years after gaining a degree in orchestral music from a music college.

Self belief: expectations of self-efficacy
"How do I see myself as a teacher? This has changed. In fact, it has improved – partly as a result of my experience at the *Hauptschule* (104)."

Mr Martin often mentioned self-assuredness and self-confidence when referring to his expectations of self-efficacy (cf. 158ff.). These terms appeared within the context of his teaching experience, in particular. He reported that he had felt "self-conscious" during his internship (60), and "helpless" (106), "reserved" (ibid.) and "unable to cope" (74) when he started teaching at the *Hauptschule*. Particularly when teaching music he had felt extremely "self-conscious" (160) and stated that he had experienced low "self-confidence" (158), which he ascribed to a lack of teaching experience – he had not been "granted the opportunity to prepare a class in music independently" (ibid.) – and to the fact that there were "no music classes, just English classes" (ibid.) at the *Hauptschule* where he worked. In contrast, he felt he had made progress in his English teaching, which he attributed to more teaching experience (cf. 106). Thus, his self-confidence and his self-assuredness were underdeveloped during the internships and initially in his teaching job, but these were consolidated as a result of more experience as a teacher.

This shows that reflection on the effects of the teaching experience during his internship and in his part-time job during his second professional training course had a crucial influence on the development of his expectations of self-efficacy.

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6 The German *Sekundarstufe I* corresponds to the English secondary school level (up to the end of key stage 4).

7 The German *Hauptschule* is a form of secondary school which prepares pupils for vocational training and apprenticeships.

Beliefs relating to the theory of schooling and professions: beliefs regarding the school system

"Yes, it's obvious that the *tripartite system* of secondary *education* is a problem and that selection on leaving primary school is too early for many [children] (138)."

When questioned about what his ideal school would be like, Mr Martin mentioned the division of the school system in Germany into several parts and the need to change this (cf. 137-140). In order to implement changes he suggested that there should be support for *Gesamtschulen* (comprehensive schools), *Hauptschulen* should be abolished and that the duration of elementary level schooling should be extended (cf. 137-143). Mr Martin explained that his future plans were made in line with his beliefs – he had applied for teacher training at a *Gesamtschule* (cf. 140), although he considered that the *Realschule* provided the "most pleasant form teaching environment" (140). There were various contexts in which it could be seen that Mr Martin questioned the German school system. Firstly, he was clearly aware of the public debate on potential school reform as he began the relevant section of the interview with "as is planned" (120). Furthermore, he reported discussions that had taken place between teachers at the *Hauptschule*. He had heard statements such as, "We can't simply let our *Hauptschule* pupils loose on the other pupils – they'd stop them learning" (138) and "we can't differentiate enough within one school to cover all the pupils' needs" (ibid.). However, he disagreed with these positions and backed up his stance with "enough studies that show it is not like that" (ibid.).

Therefore, Mr Martin's beliefs on the school system stem from reflection on different points of view, taken either from discussions with colleagues or from academic studies/public debates. This reflection mostly occurs at a hypothetical level, without any relevant personal experience.

Beliefs relating to the theory of schooling and professions: beliefs on the functions of schools

"Well, school ought to be both a space to live and a space to learn; that would be an important point (116)."

In line with his ideas on the perfect school, Mr Martin suggested that schools should be a combined living and learning space (cf. 116). This would include various options provided by the school, such as a canteen so "pupils can spend time with each other not only during lessons, but also at times when they are not being taught" (124). In addition, he suggested that a library is supposed to be accessible "so that there is a place for retreat and rest that enables socialising" (ibid.). Furthermore, he stated that there should be better opportunities to "pursue one's interests and hobbies at school" (116), for instance extra-curricular work and voluntary work (cf. ibid.). It is interesting to note how Mr Martin introduced the respective interview section. At first he declared that to ask him about his ideal school was "difficult" (114). He could "only try to reproduce" what he had read or "mention an experience or knowledge of something that somehow exists" (116). Among his various sources, he mainly referred to information taken from discussions on all-day schools, which can be seen by looking

at the topic-related keywords he used. However, it remains unclear as to whether this analysis was taking place on the basis of academic theories or on "everyday-life theory".

Thus, Mr Martin's beliefs on the functions of schools come from a predominantly hypothetical treatment of the topic. A detailed reconstruction of the development is not possible here; however it is clear that his thoughts were triggered by public debates on school reforms.

Beliefs relating to the theory of schooling and professions: beliefs on the content of teacher education

"I've been working at a *Hauptschule* since last year as a support teacher for a few hours once a week. This has helped me to catch up with what I had actually missed. I haven't received proper feedback, but I've gained a lot of experience (72)."

Mr Martin repeatedly expressed his desire to see an increase in the amount of well-supported practical training included in teacher education. Taking his teaching experience during the music internship as an example, he explained that in his degree much less importance was attached to the possibility of teaching, in favour of research-orientated preparation and the evaluation of the internship (cf. 160). Owing to the fact that he "was not allowed to prepare a series of music lessons" (ibid.) he felt that he lacked "self-confidence" (ibid.). In contrast, he was able to gain confidence during his English internship through the opportunity to plan one lesson by himself (cf. 60). In addition, and as mentioned above, Mr Martin reported that one year ago, and without any help he looked for and secured a job as a support and substitute teacher. He was then able to "catch up with what he had missed in the course of his studies" (72).

Consequently, his retrospective reflection on his own teaching experiences during his internship and his part-time job can be seen as the main factors influencing Mr Martin's beliefs on the content of teacher education. These experiences are related to his expectations on self-efficacy in that they have a positive effect on them.

Beliefs on teaching and learning subjects: preferred teaching methods

"As I've said, I'm glad, of course, that I've learnt a few things here that have more to do cooperative learning rather than thinking in terms of achievement (28)."

On the subject of his preferred teaching methods, Mr Martin mentioned cooperative learning, which he felt should have a greater influence in lessons. He stated that he would like to apply this method in "his future work with children" (42). He mentioned this topic in connection with his personal learning experiences at music college and at university. He said that cooperative forms of learning, which he had come across at university, were "healthier than what he had experienced before" (32). He considered this experience to be a liberation for him from particular working methods at music college (cf. 42), where learning was highly individualised and competence-oriented. Aside from these experiences as a student, he had tested a cooperative learning arrangement within the context of his English internship. Apparently, it "worked

out well" (64). When he was asked about what he "takes from" (41) this experience, he demonstrated his intention to adopt and apply such learning methods in his future work as a teacher. In relation to exactly how he would implement cooperative learning, he explained that he was "not entirely sure how to integrate it into the lesson" (54). It had been his "personal experience that [he] had gone through" (ibid.) and he was "quite aware of the fact that it was [his] personal experience" (ibid.).

A comparative reflection on different learning experiences gained in his first and second professional courses and their effects on his well-being can be regarded as central factors influencing the development of his preferred teaching methods. Moreover, personal teaching experiences during his internships had an additional influence on these beliefs, by confirming them.

Beliefs on teaching and learning subjects: beliefs on classroom management

"I believe a good teacher is primarily fair towards his/her students and has a good style of classroom management (84)."

When asked about his ideas of what makes a good teacher, Mr Martin mentioned classroom management. He considered this topic to be of particular importance because he was facing disciplinary problems in his class, which he was trying to deal with. He felt that a teacher's predictability is particularly important; in his opinion, teachers should be consistent in their actions (cf. 94). He had taken note of consistent action taken by other teachers and had set it as a personal target for himself (cf. 106). He did not want to be "harsh and strict" (94) as a result, as had been advised by a colleague who said he should "behave like a dictator" (108). Such behaviour reminded him of a music professor who had taught him during his first degree and who had often intimidated him. He even added that at that time he had been "learning what fear was as well" (94). He saw his own approach, of being consistent but not harsh, as a combination of "a certain kind of strictness" (108) paired with "benevolence" (ibid.). He saw immediate intervention when disturbances occur in the classroom and clear but gentle highlighting of students' misbehaviour as a potential way of implementing this approach (cf. 76). He read about this option in his exam-preparation literature while searching for advice on disciplinary problems (cf. 74). He believed another option was presented through a "compromise"[8] (108): teachers would be strict at first before granting their students more and more freedom later on, or vice versa. Various teachers at his school had told him about this option (cf. 108).

Thus, the following context relating to his beliefs on classroom management emerges: Mr Martin reflected on problems faced during his teaching experiences and, by using information taken from technical literature, receiving suggestions from his colleagues and observing other teachers, he chose the options he considered to be successful and also those which were compatible with the beliefs he already held.

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8 "Compromise" is used as a translation of "Zwischenweg". It can be translated literally as "an intermediate path".

4.4.2 Conclusion

Subsequent to the presentation of the contexts for the development of Christian Martin's professional beliefs via different belief areas in Chapter 4.4.1, these contexts can be summarised and explained using the following diagram and a modified coding paradigm.

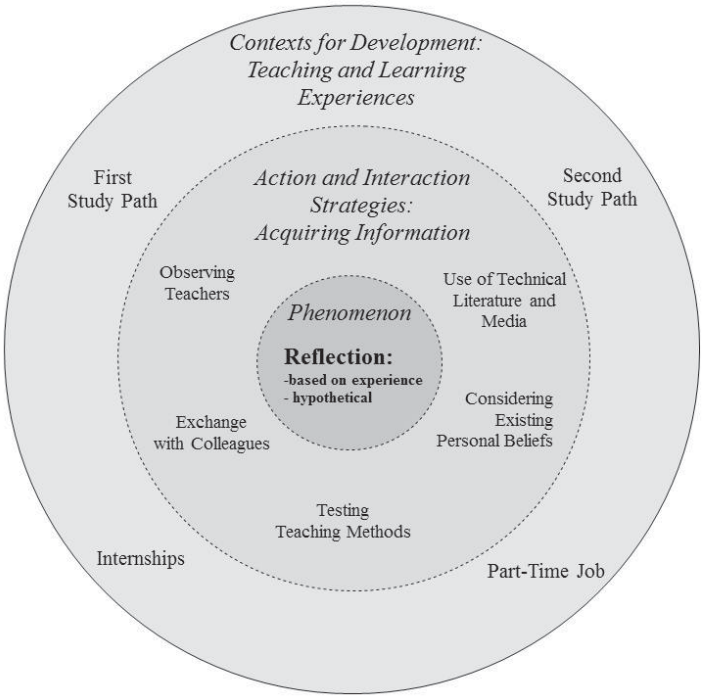

Figure 4.1: Contexts for the development of Christian Martin's professional beliefs

In total four *contexts for the development* of Mr Martin's professional beliefs were identified. The first context was his first degree where he was in the role of learner. The second context was his second degree, where he also gained experience as a learner. The third context comprised both internships, from which he gained experience both as a teacher and as a learner. The last context consisted of his part-time work as a teacher where, again, he had experiences as a teacher. Within these contexts he made use of *actions and interactional strategies* to obtain information on profession-related topics. One of these strategies was observing teachers or professors during their lessons or courses. Additionally, it is worth mentioning that he shared thoughts and views with colleagues when undertaking his part-time job. Another strategy he used was to look things up in technical literature and to pay attention to debates in the media. Finally, Mr Martin fell back on his existing beliefs as a source of

information. Mr Martin reflected on the various pieces of information drawn from the contexts mentioned by comparing them and developing his personal "solutions". *Reflection* took place on two different levels. On the one hand, it was *based on experience*, i.e. Mr Martin referred back to his own teaching and learning experiences and assessed them comparatively. His learning experiences were reflected upon in particular when they were strongly related to emotion. With reference to his teaching experiences, reflection took place when a solution to a concrete issue that had arisen from his lessons needed to be found. A second level of reflection can be characterised as *hypothetical*, i.e. it was conducted without any relevant experience and was encouraged as a result of receiving information from university courses or public debates dealing with current topics in the field of education. Both of these levels of reflection may happen concurrently, for instance when hypothetical assumptions correlate with teaching and learning experiences.

In conclusion, it can be argued that reflection is the key point at which beliefs develop. Reflection processes are marked by a "penetration of comprehension" (Holzkamp, 1995, p. 394) which, in the present analysis, happens when various pieces of information from different contexts on a particular profession-related topic are compared. This eventually leads to the formation of professional beliefs. From the perspective of research on professionalisation, which considers beliefs to be part of professional competence, it is important that certain professional beliefs are developed. In this respect, it is possible to speak of a reflective learning process that should take place in the course of teacher education. Brockbank, McGill and Beech (2002) consider reflective learning to be "a process which involves dialogue with others for improvement or transformation whilst recognising the emotional, social and political context of the learner" (p. 3). Based on this definition, the individual case presented here can be seen as an example of reflective learning because a dialogue took place, which comprised direct conversations with other people and their observations, as well as a consideration of literature, media sources and existing personal beliefs. The contexts this definition refers to are more closely related to the situation of the person in the individual case, i.e. the emotional, social and political contexts always refer to the future profession.

Teacher education at university can use the concept of reflective learning by taking into account the experience contexts during university courses and by providing scientific support for reflection processes which have been triggered as a result. The following outlook provides a more detailed explanation.

4.5 Outlook

The results in the individual case of Christian Martin show how professional beliefs can develop during a teacher education course at university. The additional experiences he gained outside university played a significant role in the development of his professional beliefs, which was certainly a distinctive feature in this case. As a

result of having sought a part-time job for himself as a support and substitute teacher, Mr Martin had an exceptionally high level of teaching experience, beyond the teaching experience normally planned for on teaching education courses. Consequently, he found himself in a very individual process of reflection, which he mainly conducted without professional guidance. This made him feel self-conscious with regard to his performance in class and it also implied a limited repertoire of options for taking action, in particular when faced with problematic situations in his lessons. As he gained additional experience, Mr Martin noticed improvements; however, with professional guidance he could have received more support. Another distinctive feature in Mr Martin's case was the fact that he could look back on his two previous degrees, which he was able compare, and which he found to be in stark contrast to one another. His first degree was focussed on achievement with the aim of beating the competition. In contrast, his second degree had more of an educational character without being so competitive. His learning experiences from both degrees have affected his teaching method preferences and his expectations of self-efficacy. In turn, these expectations of self-efficacy have affected further professional beliefs, for instance those relating to the content of teacher education.

Despite or perhaps because of the distinctive features in this individual case, and with respect to the introduction of the bachelor/master degree system in Germany, these results can be useful for future teacher education. The following are suggestions for the development of future teachers' professional competence:

1. From the beginning of the university course, students should be given the opportunity to undertake practice-oriented phases (internships) so they can gain teaching experience at a steady rate. These phases should be organised in such a way that a systematic reflection on these experiences is possible and so that these reflections are supported by different professions. Exchanges with teaching staff from schools, with professors from universities and colleges, and with other preservice teachers should be made possible so that comparisons can be made between personal teaching experiences and suggestions offered from experts and colleagues using academic theories and findings.
2. The curriculum of the university classes that accompany the internships should deal with the problematic situations which emerge during the practice-oriented phases. This would enable students to share their experiences with each other and discuss possible solutions with the help of professional guidance and with reference to academic theory. Thus, in addition to the positive learning effects, the problematic situations occurring that have a negative effect on the expectations of self-efficacy can be prevented.
3. Universities should provide courses where different teaching and learning methods are applied in order to provide students with the relevant learning experiences. These learning experiences should be reflected upon in relation to the efficiency of the learning processes and should take into account their emotional effectiveness.

In conclusion, it is important to mention that these results are to be considered as preliminary, as they refer exclusively to an individual case and because a generalised analysis of all interviews is not yet available. Thus, the model of the contexts for the development of Christian Martin's professional beliefs has to be supplemented and expanded in the course of further evaluation. Accordingly, it will be possible to further develop the suggestions articulated here on the optimisation of future teacher education after the study has been completed.

References

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keywords: Professional competence of teachers]. *Zeitschrift für Erziehungswissenschaft, 9* (4), 469-520.

Blömeke, S. Kaiser, G., & Lehmann, R. (Ed.) (2008). *Professionelle Kompetenz angehender Lehrerinnen und Lehrer. Wissen, Überzeugungen und Lerngelegenheiten deutscher Mathematikstudierender und -referendare; erste Ergebnisse zur Wirksamkeit der Lehrerausbildung* [Professional competence of prospective teachers. Knowledge, beliefs and learning opportunities of german mathematics students and student teachers; first results on the efficiency of teacher education]. Münster: Waxmann.

Blömeke, S. Kaiser, G., & Lehmann, R. (Ed.) (2010). *TEDS-M 2008. Professionelle Kompetenz und Lerngelegenheiten angehender Primarstufenlehrkräfte im internationalen Vergleich* [TEDS-M 2008. Professional competence and learning opportunities of prospective mathematics teachers in an international comparison]. Münster u.a.: Waxmann.

Blömeke, S., Müller, C. Felbrich, A., & Kaiser, G. (Ed.) (2008). Epistemologische Überzeugungen zur Mathematik [Epistemological beliefs about mathematics]. In S. Blömeke, G. Kaiser, & R. Lehmann (Ed.). *Professionelle Kompetenz angehender Lehrerinnen und Lehrer. Wissen, Überzeugungen und Lerngelegenheiten deutscher Mathematikstudierender und -referendare; erste Ergebnisse zur Wirksamkeit der Lehrerausbildung* [Professional competence of prospective teachers. Knowledge, beliefs and learning opportunities of german mathematics students and student teachers; first results on the efficiency of teacher education] (pp. 219-246). Münster: Waxmann.

Brinker, K., & Sager, S. F. (2006). *Linguistische Gesprächsanalyse. Eine Einführung* [Linguistic conversation analysis. An introduction]. Berlin: Schmidt.

Brockbank, A., McGill, I., & Beech, N. (2002). Reprinted: Our Purpose. In A. Brockbank, I. McGill & N. Beech (Ed.) *Reflective Learning in Practice* (p. 3). Burlington: Gower Publishing Company.

Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D.C. Berliner, & R.C. Calfee *(Eds.), Handbook of Educational Psychology (pp.* 709–725). New York*:* Macmillan.

Detka, C. (2005). Zu den Arbeitsschritten der Segmentierung und der Strukturellen Beschreibung in der Analyse autobiographisch-narrativer Interviews [About the work steps of segmentation and structural description within the analysis of autobiographical narrative interviews]. *Zeitschrift für Qualitative Bildungs-, Beratungs- und Sozialforschung, 6*(2), 351-364.

Ernest, P. (1989). The impact of beliefs on teaching of mathematics. In C. Keitel, P. Damerow, A. J., & P. Gerdes (Ed.), *Mathematics, Education and Society* (pp. 99-101). Paris: UNESCO.

Ertmer, P. A. (2005). Teacher Pedagogical Beliefs: The Final Frontier in Our Quest for Technology Integration? *Educational Technology Research and Development, 53*(4), 25-39.

Goldin, G., Rösken, B., & Törner, G. (2009). Beliefs – No longer a hidden variable in mathematical teaching and learning processes. In J. Maaß, & W. Schlöglmann (Ed.), *Beliefs and Attitudes in Mathematics Education: New Research Results* (pp. 1-18). Rotterdam: Sense Publisher.

Hofer, B. K., & Pintrich, P. R. (2002). *Personal epistemology: The psychology of beliefs about knowledge and knowing.* Mahwah, NJ: Erlbaum.

Holzkamp, K. (1995). *Lernen. Subjektwissenschaftliche Grundlegung. Studien-Ausgabe* [Learning. A subject-scientific groundwork. Student's edition]. Frankfurt am Main; New York: Campus.

KMK (2004). Standards für die Lehrerbildung: Bildungswissenschaften. Beschluss der KMK vom 16.12.2004 [Standards for teacher education: Education. KMK decision of 16.12.2004]. *Zeitschrift für Pädagogik, 51*, 280-290.

Kunter, M., Baumert, J., Blum, W., Klusmann, U., Krauss, S., & Neubrand, M. (Ed.). (2011). *Professionelle Kompetenz von Lehrkräften. Ergebnisse des Forschungsprogramms COACTIV* [Professional competence of teachers. Results of the research program COACTIV]. Münster u.a.: Waxmann.

Leder, G., Pehkonen, E., & Törner, G. (Ed.). (2002). *Beliefs: A hidden variable in mathematics education?* Dordrecht: Kluwer.

Legewie, H. (1994). Globalauswertung von Dokumenten [Global analysis of documents]. In A. Boehm, A. Mengel, & T. Muhr (Ed.). *Texte verstehen: Konzepte, Methoden, Werkzeuge* [Understand texts: concepts, methods, tools] (pp. 177-182). Konstanz: Univ.-Verl. Konstanz.

Leuchter, M., Pauli, C., Reusser, K., & Lipowsky, F. (2006). Unterrichtsbezogene Überzeugungen und handlungsleitende Kognitionen von Lehrpersonen [Instruction-related beliefs and behavior-influencing cognitions of teachers]. *Zeitschrift für Erziehungswissenschaft, 9*(4), 562-579.

McLeod, D. (1992). Research on affect in mathematics education: a reconceptualization. In D.A. Grows (Ed.), *Handbook of Research on Mathematics Teaching and Learning* (pp. 575-596). New York: Macmillan.

Mey, G., & Mruck, K. (2009). Methodologie und Methodik der Grounded Theory [Methodology an methods of Grounded Theory]. In W. Kempf, & M. Kiefer (Ed.), *Forschungsmethoden der Psychologie. Zwischen naturwissenschaftlichem Experiment und sozialwissenschaftlicher Hermeneutik. Band 3: Psychologie als Natur- und Kulturwissenschaft. Die soziale Konstruktion der Wirklichkeit* [Research methods in psychology. Between scientific and social science experiment hermeneutics. Volume 3: psychology as a natural and cultural studies. The social construction of reality] (pp. 100-152). Berlin: Regener.

Müller, C., Felbrich, A., & Blömeke, S. (2008a). Schul- und professionstheoretische Überzeugungen [Education and profession-theoretical beliefs]. In S. Blömeke, G. Kaiser, & R. Lehmann (Eds.), *Professionelle Kompetenz angehender Lehrerinnen und Lehrer. Wissen, Überzeugungen und Lerngelegenheiten deutscher Mathematikstudierender und -referendare; erste Ergebnisse zur Wirksamkeit der Lehrerausbildung* [Professional Competence of Future Teachers. Knowledge, Beliefs and Opportunities to Learn of German Future Teachers of the Second Phase; First Findings on the Effectiveness of Teacher Eudcation] (pp. 277-302). Münster: Waxmann.

Müller, C., Felbrich, A., & Blömeke, S. (2008b). Überzeugungen zum Lehren und Lernen von Mathematik [Beliefs about teaching and learning of mathematics]. In S. Blömeke,

G. Kaiser, & R. Lehmann (Eds.), *Professionelle Kompetenz angehender Lehrerinnen und Lehrer. Wissen, Überzeugungen und Lerngelegenheiten deutscher Mathematikstudierender und -referendare; erste Ergebnisse zur Wirksamkeit der Lehrerausbildung* [Professional Competence of Future Teachers. Knowledge, Beliefs and Opportunities to Learn of German Future Teachers of the Second Phase; First Findings on the Effectiveness of Teacher Eudcation] (pp. 247-276). Münster: Waxmann.

Nespor, J. (1987). The role of Beliefs in practice of teaching. *Journal of Curriculum Studies*, *19*, 317-328.

Op 'T Eynde, P., De Corte, E., & Verschaffel, L. (2002). Framing students' mathematics related beliefs: A quest for conceptual clarity and a comprehensive categorization. In G. Leder, E. Pehkonen, & G. Törner (Ed.), *Beliefs: A Hidden Variable in Mathematics Education* (pp. 13-38). Boston, MA: Kluwer Academic Publishing.

Oser, F. (2001). Modelle der Wirksamkeit in der Lehrer- und Lehrerinnenausbildung [Models of the effectiveness of teachers and teacher training]. In F. Oser, & J. Oelkers (Ed.), *Die Wirksamkeit der Lehrerbildungssysteme* [The effectiveness of teacher education systems] (pp. 67-96). Chur [u.a.]: Rüegger.

Pajares, F. M. (1992). Teachers' beliefs and educational research. Cleaning up a messy construct. *Educational Researcher*, *Vol. 62*, 307-332.

Przyborski, A., & Wohlrab-Sahr, M. (2008). *Qualitative Sozialforschung. Ein Arbeits-Buch* [Qualitative social research. A workbook]. München: Oldenbourg Verlag.

Reusser, K., Pauli, C., & Elmer, A. (2011). Berufsbezogene Überzeugungen von Lehrerinnen und Lehrern [Work-related beliefs of teachers]. In E. Terhart, H. Bennewitz, & M. Rothland (Ed.), *Handbuch der Forschung zum Lehrerberuf* [Handbook of research on the teaching profession]. (pp. 478-495). Münster: Waxmann.

Richardson, V. (1996). The Role of Attitudes and Beliefs in Learning to Teach. In J. Sikula, T. Buttery, & E. Guyton (Ed.), *Handbook of Research on Teacher Education* (2nd ed., pp. 102-106). New York: Macmillan.

Sacks, H., Schegloff, E. A., & Jefferson, G. (1974). A simplest systematics for the organization of turn-taking for conversation. *Language, 50*, 696-735.

Schoenfeld, A. H. (2011). Toward professional development for teachers grounded in a theory of decision making. *ZDM – The International Journal on Mathematics Education*, *43*(4), 457-469.

Schütze, F. (1983): Biographieforschung und narratives Interview [Biography Research and the Narrative Interview]. *Neue Praxis, 13* (3), 283-293.

Schwarzer, R., & Jerusalem, M. (2002). Das Konzept der Selbstwirksamkeit [The concept of self-efficacy]. In M. Jerusalem, & D. Hopf (Ed.), Selbstwirksamkeit und Motivationsprozesse in Bildungssituationen [Self-efficacy and motivation in learning situations]. *Zeitschrift für Pädagogik, 44. Beiheft*, 35.

Schwarzer, R., & Warner, L. M. (2011). Forschung zur Selbstwirksamkeit bei Lehrerinnen und Lehrern [Research on self-efficacy among teachers]. In E. Terhart, H. Bennewitz, & M. Rothland (Ed.), *Handbuch der Forschung zum Lehrerberuf* [Handbook of research on the teaching profession] (pp. 452-466). Münster: Waxmann-Verlag.

Strauss, A. (1998). *Grundlagen qualitativer Sozialforschung* [Basics of Qualitative Research]. München: Wilhelm Fink Verlag.

Strauss, A., & Corbin, J. (1996). Grounded Theory. *Grundlagen qualitativer Sozialforschung* [Grounded Theory. Basics of Qualitative Research]. Weinheim: Beltz.

Terhart, E. (2002). *Standards für die Lehrerbildung: eine Expertise für die Kultus-Ministerkonferenz* [Standards for teacher education: an expertise for the Standing Conference] Münster: Westfälische Wilhelms-Universität.

Thompson, A. G. (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 127 146). New York: Macmillan.

Weinert, F. E. (2001). Concept of Competence: A Conceptual Clarification. In D. S. Rychen, & L.H. Salganik (Ed.), *Defining and Selecting Key Competencies* (pp. 45-66). Göttingen: Hogrefe.

Witzel, A. (2000). Das problemzentrierte Interview [The Problem-centered Interview]. *Forum Qualitative Sozialforschung*, *1*(1), Art. 22, Retrieved January 20, 2012, from http://www.qualitative-research.net/index.php/fqs/article/view/1132

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Chapter 5
The Professional Motivation, Job-related Beliefs and Patterns of Work-related Coping Behaviour of Teacher Training Students

Martin Rothland

Abstract

This article presents the findings of the study entitled "Berufswahl Lehramt. Einflussfaktoren auf die Wahl des Lehrerberufs" (Teaching as a career choice. Factors influencing the choice of teaching as a career). Using the *FIT-Choice Scale* (*Factors influencing teaching as a career choice*) developed by Paul Richardson and Helen Watt, the motivations and beliefs held about teaching that are relevant factors for *choosing teaching as a career* are recorded as part of a survey of n = 1,249 teacher training students at five German universities. In addition, data on the patterns of work-related coping behaviour (in German arbeitsbezogene Verhaltens- und Erlebensmuster – *AVEM*) for the prospective teachers is gathered. In line with the general motivational deficiencies of pattern S (sparing personal investment at work) and risk pattern B (burnout), the teacher training students who were classified in these two patterns also show *job-specific* motivational deficiencies and thus, in comparison to pattern G (good health) and risk pattern A (type A behaviour), they demonstrate a less favourable motivational starting point both for the successful completion of a teacher training course, and when it comes to being effective teachers in the long term. The findings point, firstly, to the significance of differences in patterns of work-related coping behaviour that can already be discerned in students on teacher training courses. Secondly, the results contribute to an enhanced understanding of the relevance of career-choice motivations, as well as job-related beliefs for the processes of "becoming a teacher" and "being a teacher".

Keywords:
teacher beliefs; preservice teachers; teacher education; teachers' professional competence

In existing research on the choice of teaching as a career, descriptive analyses are often limited to a record of the motivations for a degree or career choice, which – depending on the study and the underlying survey instrument – are ranked in lists of varying lengths and of equally differing content. As a rule, the corresponding findings are evaluated in such a way that intrinsic and in particular people and relationship-oriented motivations are generally rated positively when they describe the motivations of

teacher training students, while the motivations described as extrinsic, such as the desire for secure employment, a good salary and the possibility of combining family life with a career are, in principle, viewed as unfavourable premises for career in teaching (cf. Brookhart & Freeman, 1992; Bruinsma & Jansen, 2010; Moran et al., 2001; Richardson & Watt, 2010; Rots et al., 2010; Sinclair, 2008; for the German tradition of research, Rothland, 2011a).

Up until now there has been a focus on recording individual career-choice motivations which means that it is currently not possible to examine whether specific combinations of motivations and job-related beliefs can be identified as favourable or unfavourable prerequisites for training and working as a teacher.

In the present article, the *FIT-Choice Scale* (*Factors influencing teaching as a career choice*) developed by Richardson and Watt (2005; 2006; Watt & Richardson, 2007; 2008) will be used to record the motivations and beliefs held about teaching that are relevant factors for *choosing teaching as a career* as part of a survey of n = 1,249 teacher training students at five German universities. In addition, data on the patterns of work-related coping behaviour (*AVEM*) for the prospective teachers is gathered (cf. Kieschke & Schaarschmidt, 2008) in order to check whether the teacher training students, differentiated into four types of work-related coping behaviour, each demonstrate typically and statistically different expressions of motivation and beliefs, which, in the case of the two risk patterns, point to mental and physical risks in future employment, as early as in the first phase of teacher training.

5.1 The work-related coping behaviour of (prospective) teachers

The starting point for the research topic dealt with in this article is the structure and findings of the Potsdam teacher study, which in recent years has made an important contribution to German academic and public debate on the topic of *Stresses and strains in teaching* (Kieschke & Schaarschmidt, 2008). On the basis of two rounds of comprehensive opportunity sampling (2000-2003: n = 7,693 German teachers; 2004-2006: n = 7,846 German teachers), as well as numerous comparative samples, Schaarschmidt and colleagues identified a sensitive distribution of four distinguishable work-related behaviour styles within the teaching profession. This was done using an instrument that evaluates personalities in order to identify personal job-related characteristic combinations, called the *AVEM* (patterns of work-related coping behaviours, cf. Bauer et al., 2006; Kieschke & Schaarschmidt, 2008; Schaarschmidt & Fischer, 2001, 2008; Voltmer, Kieschke & Spahn, 2007). In the results of both surveys, a particularly high proportion of surveyed teachers were categorised in risk groups compared with other career groups (Schaarschmidt, 2005b; Schaarschmidt & Kieschke, 2007): 28.7% of the teachers in the first study were assigned to risk pattern B (linked with burnout syndrome, cf. Maslach, 1999) (2004-2006: 29.3%) and 30.7% to risk pattern A (type A behaviour concept, cf. Friedman & Rosenman, 1974) (2004-2006: 33%). Both risk patterns can be characterised in the following ways (cf. Kieschke

& Schaarschmidt, 2008; Schaarschmidt & Fischer, 2001; Schaarschmidt, 2005a): for teachers who belong in risk pattern B, typical behaviour includes the constant feeling of being overwhelmed, a reduced capacity to cope and exhaustion, combined with a feeling of resignation, while there are particularly low levels of aggressive problem solving and inner balance. People who are assigned to risk pattern A put a great deal of effort into their work, although this excessive commitment is not accompanied by positive emotions. Work means more to this pattern type than to other groups and people in this group tend to experience exhaustion and strive for perfection. People in this pattern type are the least able to distance themselves from their work. Moreover, both risk patterns, with their respective job-related behaviour style, experience increased feelings of stress, reduced coping mechanisms and health risks, in particular to their mental health (Bauer et al., 2006; Kieschke & Schaarschmidt, 2008).

The situation is different, in particular when it comes to health and stress, for AVEM patterns G (good health) and S (sparing personal investment at work). They seem to be unproblematic, at least in terms of health or experiences with stress. Pattern G is characterised by high levels of commitment to work, as well as a good ability to cope with stress and a generally positive outlook on life, while pattern S is typified by low levels of commitment, a high capacity for distancing oneself from work or, viewed together, a marked tendency to protect oneself from work-related stress. 23.3% of the teachers surveyed are assigned to pattern S (2004-2006: 21.8%) and only 17.3% (2004-2006: 15.9%) to pattern G (Schaarschmidt, 2005b; Schaarschmidt & Kieschke, 2007).

As part of the first survey in the Potsdam teacher study conducted between 2000 and 2003, $n = 622$ German students on teacher training courses were surveyed alongside practising teachers. When comparing the pattern distribution, a higher proportion could be identified as belonging to pattern G (29%) and pattern S (31%) than those already working as teachers. Correspondingly, the number of teacher training students who belonged in the risk patterns (risk pattern A: 15%, risk pattern B: 25%) is lower. Nevertheless, at 40%, the proportion of students from the first phase of teacher training who show behaviour styles that pose risks can still be considered high. In addition to this, the high percentage in the sparing personal investment profile can be highlighted as an indicator of motivational limitations, with male teacher training students in particular belonging to pattern S (39% in comparison with 27% female students) (Schaarschmidt, 2005b, p. 67).

The authors of the Potsdam teacher study conclude from their findings that suitability requirements are a problem for a large number of students on teacher training courses (Schaarschmidt & Kieschke, 2007). Even though the prospective teachers' situations were more favourable in comparison with that of active teachers, the recruitment situation gives cause for concern, in view of the fact that roughly a quarter of the students were assigned to the particularly problematic risk pattern B.

5.2 Job-specific, motivational deficits in the new generation of teachers?

Besides the percentage of students in the two risk patterns (40%), the lack of "job-specific motivation" is raised as a "particular problem" (Schaarschmidt, 2005c, p. 153). Schaarschmidt generalises that more than half of the teacher training students can be characterised as having *motivational deficiencies* (pattern S and risk pattern B) (ibid). When one looks, however, at the limitations linked to patterns S and B (*pattern S:* low significance given to work, low level of professional ambition, low likelihood of becoming exhausted, little inclination to strive for perfection, generally low commitment; *risk pattern B:* low commitment to work, low level of professional ambition), it becomes clear that the *AVEM* questionnaire does not record *teacher-specific* motivational factors, but rather general, job-*un*specific motivational variables.

A subgroup analysis within the framework of the Potsdam teacher study shows a correlation between work-related coping behaviour on the one hand and the job-specific motivation and career-choice motivation of the next generation of teachers on the other, which was replicated in Rothland (2011b). Alongside the pattern combinations within the sample of teacher training students, Schaarschmidt and colleagues were able to draw out a correlation between pattern categorisation and the self-assessment of those surveyed of the appropriateness of career choice as an aspect of job-specific motivation. Teacher training students who have doubts about the appropriateness of their career choice are, to a large extent, found in the work-related behaviour risk types (at the highest uncertainty level[1], patterns B and A made up 75%, of which 60% were risk pattern B), while inversely those who are convinced by the appropriateness of their decision, for the most part belong to the "good health" (G) pattern (at the highest certainty level about the decision[2] with 41%, while pattern B only accounted for 14% (Schaarschmidt, 2005b, p. 67 ff.; cf. Rothland, 2011b).

The present study supports the connections outlined between the aspects involved in choosing teaching as a career (certainty or uncertainty of the decision) and work-related coping behaviours (cf. Schaarschmidt, 2005b; Rothland, 2011b). While the AVEM questionnaire only records general, work-related motivational aspects and the supplementary data on the degree of certainty students have about their decisions constitute only a part of the career-choice motivations specifically related to teaching, the following discussion will cover the job-specific motivations of prospective teachers within a broader empirical scope, using the *FIT-Choice scales* developed by Watt and Richardson (2007), which are based on an elaborated model concept for teaching as a career choice (cf. Figure 5.1).

The main components of the model are the student's own assessment of their individual abilities (related to teaching), individual values as well as an evaluation of the challenges of the profession, its anticipated advantages and salary. In addition to this are external influences and teaching and learning experiences. This model, comprising empirically proven influence factors, forms the basis of the *FIT-Choice*

1 "I am very unsure as to whether teaching is the right career for me."
2 "I am very sure that teaching is the right career for me."

scales. Job-related beliefs (*task demands*; the evaluation of the job's demands and its emotional strain; the evaluation of the importance of job-related expertise and the necessary knowledge) are recorded in the model and the relevant survey instruments, alongside ideas about what is offered by teaching (*task return*), an evaluation of an individual's own ability to teach and to work as a teacher (*perceived teaching ability*), the interest in teaching (*intrinsic career value*), an evaluation of the importance of personal benefits that come with the job (*personal utility value*), an evaluation of the importance for the career choice of the social commitment involved in teaching (*social utility value*), as well as the question of whether choosing teaching as a career is a stopgap solution in the absence of alternatives or a lack of self-confidence (*fallback career*). Further factors for choosing teaching as a career are previous teaching and learning experiences and positive or negative social influences (cf. Richardson & Watt, 2005; 2006; Watt & Richardson, 2007; 2008).

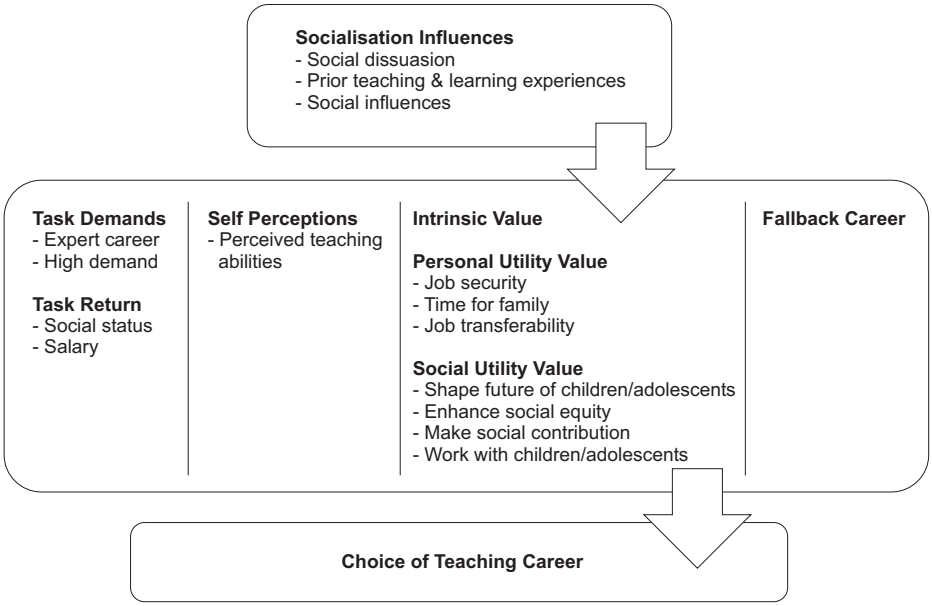


Figure 5.1: The FIT-Choice theoretical model (Watt, Richardson, Klusmann, Kunter, Beyer, Trautwein & Baumert, 2012, p. 793)

Further to expectation-value models (cf. Wigfield & Eccles, 2000; Eccles & Wigfield, 2002), the *FIT-Choice* questionnaire summarises and records, on the one hand, how aspiring teachers evaluate the importance and consequences of choosing teaching as a career. On the other hand, it records how they value their own skills and abilities related to the chosen career and moreover, how they assess the demands or challenges of the career in general.

5.3 Research questions and hypotheses

The main aim of the study is to check, by conducting a survey of the relevant factors for choosing teaching as a career (*FIT-Choice*) and on the patterns of work-related coping behaviour (*AVEM*), whether significant differences related to career-choice motivation emerge as truly job-specific motivation for students on teacher training courses who are differentiated according to the work-related coping behaviour patterns. It also aims to confirm the motivational deficiencies of future teachers observed during the Potsdam teacher study with an empirical approach that is differentiated and specifically targeted towards the teaching profession, whereby the motivation for *and* beliefs about teaching will be taken into account (cf. also Thomson, Turner & Nietfeld, 2012). In general, it will be assumed that, taking into consideration the job-specific motivational factors, teacher training students, in particular those belonging to pattern S and risk pattern B, show motivational deficiencies.

In concrete terms, it is expected that, taking into consideration the career-choice motivations and beliefs reported using the *FIT-Choice Scale* and taking into consideration the characteristics of the pattern for work-related coping behaviour (Kieschke & Schaarschmidt, 2008) (1) in respect of the career-choice-related motivational factors, teacher training students in the sparing personal investment at work pattern and risk pattern B view their capabilities as less good and possess a lower intrinsic career-choice motivation. Furthermore, students from risk pattern B in particular are more likely to have chosen teaching as a result of difficult circumstances or as a stopgap in the absence of alternatives (*fallback career*).

In addition it is assumed that (2) motivational factors that focus on the socital benefits of the profession, and which are therefore an expression of a social commitment, are found at higher than average levels amongst students from pattern G and risk pattern A. In the case of pattern G this could be attributed to the high, but not excessive, levels of commitment this group shows and to the slightly higher importance they attach to their work; while those who belong to risk pattern A typically show exaggerated commitment, high tendencies towards exhaustion and difficulties in distancing themselves from the job.

Furthermore, it is assumed that (3) in comparison to the overall average for teacher training students job-related beliefs, the importance of technical expertise and the demands of the profession are rated lower by teacher training students in pattern S, since those in this pattern type would rather not choose a career which they assume to be demanding and challenging. Finally, (4) the level of satisfaction with the choice of career should be above average for students in pattern G in particular, but below average for students in risk pattern B, in line with their general dissatisfaction with life.

5.4 Method

5.4.1 Sample

In order to record the connections between the job-relevant motivations and beliefs on the one hand and the patterns of work-related coping behaviours on the other, the following discussion will evaluate data, collected as part of the study entitled *"Berufswahl Lehramt. Einflussfaktoren auf die Wahl des Lehrerberufs" (Teaching as a career choice. Factors influencing the choice of teaching as a career)* at five German universities in the summer semester of 2010. This takes into account n = 1,249 surveyed students of teacher training at primary and secondary levels.

The main aim of the research project is to generate (internationally) comparable data, which enable statements to be made on the personal requirements of teacher training students in combination with their career-choice motivations. At the same time, the Erfurt subsample is linked to the *DIDAKTUM* (*Didactic knowledge and career motivation*) project, which is being conducted under the leadership of Johannes König (Cologne), Manfred Lüders (Erfurt) and Martin Rothland (Münster). The aim of this research project is, amongst other things, to examine connections between the knowledge of prospective teachers (*general pedagogical knowledge*) on the one hand and, on the other, the recorded variables for career-choice motivation, taking into consideration general personality traits and work-related behaviour styles. The work seeks to clarify whether different combinations of motivations, personality types and work-related behavioural patterns are linked to the students' job-relevant performance features (cf. König & Rothland, 2012).

The average student surveyed was 23.60 years old (SD = 2.84) and the ages ranged from 19 to 43. On average the students were in their sixth semester, with the responses on the duration of study ranging from one to 16 semesters. The overall sample is made up of students from the following five universities: 16.5% study at the University of Bochum (n = 206), a further 17.1% at the University of Erfurt (n = 215), 47.1% at the University of Münster (n = 590), 12.7% at the University of Osnabrück (n = 160) and 6.2% at the University of Paderborn (n = 78) (other universities: 0.4%). Furthermore, the distribution of students in the overall sample across the different teaching levels was as follows: primary level 37.3% (n = 466), lower secondary level 17.8% (n = 222), secondary level 44.9% (n = 561).

The survey was carried out using a questionnaire with different item scales. It was filled out by the students under supervision during educational studies classes (at lectures in particular). The samples at the individual locations were convenience samples; response rates could not be calculated.

5.4.2 Survey instruments

The job-specific motivation and the job-relevant beliefs were recorded with the German translation of the *FIT-Choice* instrument (cf. Watt et al., 2012), which has already proven to be a good instrument in two studies. In the course of an international comparison the *FIT-Choice* scale proved to be a valid instrument for recording the career-choice motivations of prospective teachers in different national settings, including Germany (ibid). This study included amongst others $n = 210$ teacher training students from the Freie Universität Berlin. On the basis of the sample, which also underpins the present study, König and Rothland (2012) were able to successfully replicate the structure of the *FIT-Choice* scale. The instrument is comprehensively documented in English and German in Watt et al. (2012) and in König and Rothland (2012).

Based on the expectancy-value theory (cf. Eccles & Wigfield, 2002) the following are differentiated: (1) the target achievement value, (2) the intrinsic value, (3) the usefulness and (4) the perceived costs, whereby, in positive terms, the perceived benefits are recorded in the FIT scale and the anticipated costs are taken into account through the evaluation of the challenges and demands (*perceptions about teaching*).

In total there are 17 scales (52 items) for recording the following areas: *motivations for teaching* (11 scales), *perceptions about teaching* (4 scales) and one scale for recording the satisfaction with the choice of teaching as a career, as well as a scale for recording *social dissuasion*.

All the scales show a seven-level response format. In the area of career-choice motivations the items are introduced with the following question: "How important were the following statements when you decided to become a teacher?" (1 = not at all important, 7 = extremely important). In the other two sections those surveyed responded to the following statements: "With regard to your impressions of the teaching profession, please rate the extent to which you agree with the following statements" and "With regard to your decision to become a teacher, please rate the extent to which the following statements apply to you" (1 = not at all, 7 = completely). Table 5.1 contains information on the structure of the FIT-Choice scales, on the internal consistency and on the scale mean values and standard deviations.

The work-related behaviour and experience styles of the teacher training students were recorded with the short form of the AVEM with a total of 44 items. Underpinning the instrument are the eleven dimensions of work-related coping behaviour as described in Table 5.2, with four items each, which have to be rated on a scale from 1 = "not at all applicable" to 5 = "fully applicable". None of the scales or the individual items is specifically related to a career such as teaching. Instead they contain individual attitudes and behaviour styles (ambition, tendency towards exhaustion, striving for perfection, etc.) that are generally relevant for professional situations or (future) working life. An accurate understanding of working life as teacher as seen by those involved is therefore not a prerequisite for a survey of the patterns of work-related coping behaviour for teacher training students (cf. research in the context of medical studies Voltmer, Bochmann, Kieschke & Spahn 2007). All the same, it has not yet

been verified whether and in what ways systematic distortions may arise from the fact that many of the items in the AVEM evaluations relate to teacher training students' anticipated future employment. This is worth taking into account when the pattern distribution for student samples is being reported.

Table 5.1: Reliability, mean values and standard deviations of the *FIT-Choice scales*

	Item	Cronbach's α	*M*	*SD*
Motivations for teaching				
1. Perceived teaching abilities	B5, B19, B43	.845	5.45	.94
2. Intrinsic value	B1, B12	.656	5.76	1.00
3. Fallback career	B11, B48	.604	2.01	1.21
4. Job security	B14, B27, B38	.895	5.02	1.31
5. Time for family	B2, B16, B29	.852	4.27	1.50
6. Shape future	B9, B23	.716	5.64	1.05
7. Enhance social equity	B36, B49	.835	4.95	1.29
8. Make social contribution	B6, B20, B31	.809	5.36	1.13
9. Work with children/adolescents	B13, B26, B37	.923	5.90	1.15
10. Prior teaching and learning experiences	B17, B30, B39	.884	4.64	1.43
11. Social influence	B3, B24, B40	.874	3.35	1.61
Perceptions about teaching				
1. Expert career	C10, C14	.842	5.21	1.13
2. High demand	C2, C7, C11	.666	5.76	.78
3. Social status	C4, C8, C9, C12, C13	.884	3.97	1.16
4. Salary	C1, C3	.948	4.39	1.29
5. Social dissuasion	D2, D4, D6	.672	3.51	1.43
6. Satisfaction	D3, D5	.947	4.63	1.03

Table 5.2: *AVEM* structure, reliability of the subscales, mean scale values and standard deviations

11 Primary factors		Cronbach's α	*M*	*SD*
1.	Subjective significance of work	.785	2.53	.73
2.	Professional ambition	.739	3.41	.68
3.	Tendency to exert	.787	2.99	.77
4.	Striving for perfection	.804	3.52	.75
5.	Emotional distancing	.761	3.30	.72
6.	Resignation tendencies	.758	2.58	.68
7.	Offensive coping with problems	.809	3.34	.63
8.	Balance and mental stability	.686	3.12	.48
9.	Satisfaction with work	.787	3.71	.70
10.	Satisfaction with life	.824	4.06	.65
11.	Experience of social support	.630	4.11	.66

The eleven *AVEM* dimensions can be used to determine the fit between the individual profile and the four work-related coping behaviour reference profiles produced by Schaarschmidt and Fischer (2008) by means of cluster profiles for each teacher training student. This profile correspondence is calculated on the basis of the discriminant function which was determined during the separation of the clusters. The likelihood of a test subject belonging to a particular pattern is calculated in this study using the formula suggested by Schaarschmidt and Fischer (2008, p. 59), the result being that the majority of students do not correspond exclusively to one pattern. They are therefore allocated taking into consideration Schaarschmidt and Fischer's criteria for pattern classification (2008, p. 16) for a general allocation (one pattern larger than 50% and smaller than or equal to 80%, no second pattern larger than 30%). As a result, out of n = 1,294 cases n = 152 cases (12.2%) could not be assigned to any pattern of work-related coping behaviour. This provides an underlying sample of n = 1,142 teacher training students for work-related coping behaviour that could be differentiated according to the four patterns as follows: 35% were allocated to pattern G, 33% to pattern S, 16.5% to risk pattern A and 15.5% to risk pattern B.

5.5 Results

First of all the motivational factors given for choosing teaching as a career are differentiated according to the patterns of work-related coping behaviours and thereafter the stated job-related beliefs are calculated using single-factor analyses of covariance. Gender and the teacher education program were taken as covariates in the variance analysis, since the distribution of the patterns of work-related coping behaviour differed in the overall sample on the basis of these two variables (gender χ^2 = 22.51, df = 3, p < .001; teacher education program χ^2 = 14.06, df = 6, p < .05; the values

were calculated using the absolute frequencies). Table 5.3 contains the mean values and standard deviations of the 11 motivational factors, differentiated according to the AVEM, and it shows the results of the analyses of covariance.

The comparisons show that, depending on the pattern that they belonged to, the teacher training students differed statistically from one another to a significant degree in respect of the following motivational factors: perceived teaching abilities, intrinsic value, fallback career, shape future, enhance social equality, make social contribution and work with children/adolescents. Thus students from pattern G, for instance, estimate their own teaching skills to be particularly good, while the prospective teachers from risk pattern B rate these skills markedly lower. The difference here comes to approximately one standard deviation, and with 12% variance, which can be attributed to the AVEM, can be seen as an effect with medium practical significance.

Table 5.3: Results of the analysis of covariance (motivations for teaching)

		Pattern of work-related coping behaviour						
		G	S	A	B	*ANCOVA*		
Motivations for teaching		*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*F*	h^2	Pairwise comparisons[a]
1.	Perceived teaching abilities	5.85 (.79)	5.35 (.86)	5.57 (.86)	4.86 (1.07)	53.46*	.12	G > A > S > B
2.	Intrinsic value	6.12 (.81)	5.58 (.98)	5.88 (1.01)	5.20 (1.16)	43.75*	.10	G > A > S > B
3.	Fallback career	1.62 (.98)	1.93 (1.08)	2.12 (1.27)	2.83 (1.44)	47.76*	.11	G < A.S < B
4.	Job security	5.01 (1.36)	4.88 (1.30)	5.18 (1.27)	5.10 (1.25)	2.32†	.00	
5.	Time for family	4.09 (1.56)	4.32 (1.44)	4.44 (1.43)	4.42 (1.56)	3.17†	.00	
6.	Shape future	5.87 (.95)	5.47 (1.08)	5.79 (.98)	5.36 (1.16)	16.20*	.04	G.A > S.B
7.	Enhance social equality	5.21 (1.23)	4.63 (1.23)	5.26 (1.30)	4.79 (1.31)	18.77*	.04	A.G > B.S
8.	Make social contribution	5.61 (1.07)	5.14 (1.11)	5.65 (1.06)	4.90 (1.21)	25.76*	.06	A.G > S.B
9.	Work with children/ adolescents	6.15 (.98)	5.80 (1.12)	5.98 (1.18)	5.49 (1.42)	18.95*	.05	G > S.A > B
10.	Prior teaching and learning experiences	4.85 (1.39)	4.53 (1.36)	4.78 (1.45)	4.35 (1.52)	4.92†	.01	
11.	Social influence	3.40 (1.73)	3.23 (1.57)	3.59 (1.56)	3.23 (1.48)	2.90†	.00	

* = $p < .01$ (significance level reached with adjustment of α according to Bonferroni correction; $p < .0009$); † = not significant; gender and teacher education program (P, S I, S II) were used as covariates in the analyses of covariance.
[a] = Sidak correction of the confidence interval ($p < .05$).

The situation is similar when examining the intrinsic motivations or the motivational factors relating to the social commitment involved in educating and working with children and young people. Students from pattern G rarely choose teaching as a career because of a lack of other alternatives or as a stopgap solution, however students in risk pattern B often cite this reason for their choice of profession (here the difference is more than one standard deviation and the effect is also of medium size (11%).

What stands out from the results of this first comparison is that the stated career-choice motivations of pattern G and risk pattern A are similar and, to an extent, they form homogenous subgroups, but at least at the level of the individual motivational factors they show the highest configurations in all cases except for the factor *fallback career*. The opposite is true for patterns S and B, which form homogenous subgroups for three factors and, furthermore, taken together tend to show lower career-choice-relevant motivational factors.

The teacher training students, as categorised by the patterns of work-related coping behaviour, differentiate themselves from one another significantly not just in relation to the motivational factors for choosing teaching as a career in the narrowest sense, but also when it comes to job-related beliefs, the negative influence of third parties on the career decision and satisfaction with the choice of career in four of the six recorded areas (Table 5.4).

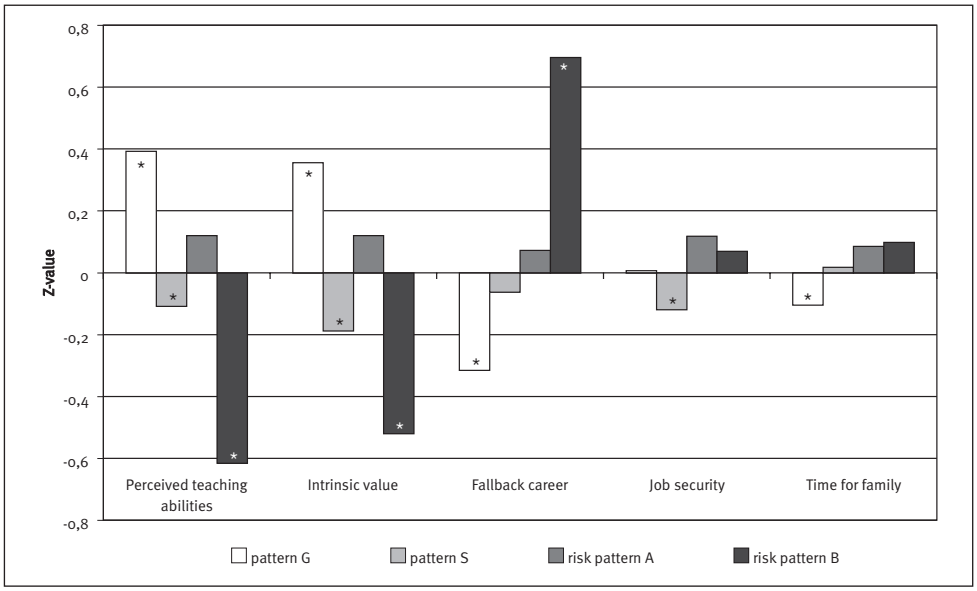
Table 5.4: Results of the covariance analysis (Perceptions about teaching)

		Work-related behaviour and experience pattern						
		G	S	A	B	ANCOVA		
Perceptions of teaching		*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	F	h^2	Pairwise comparison[a]
1.	Expert career	5.45 (1.08)	4.89 (1.05)	5.51 (1.18)	4.98 (1.19)	20.80*	.05	A.G > B.S
2.	High demand	5.79 (.73)	5.57 (.74)	6.00 (.76)	5.80 (.87)	9.98*	.02	A > B.G > S
3.	Social status	4.17 (1.10)	3.79 (1.03)	4.18 (1.30)	3.71 (1.26)	9.96*	.02	A.G > S.B
4.	Salary	4.43 (1.30)	4.39 (1.23)	4.49 (1.39)	4.28 (1.33)	.807†	.00	
5.	Social dissuasion	3.49 (1.52)	3.32 (1.37)	3.73 (1.41)	3.57 (1.40)	3.73†	.01	
6.	Satisfaction	4.86 (.96)	4.52 (.99)	4.76 (1.05)	4.21 (1.03)	18.48*	.04	G.A.S > B

* = $p < .01$ (significance level reached with adjustment of α according to Bonferroni correction; $p < .0009$);
† = not significant; gender and teacher education program (P, S I, S II) were taken as covariates in the analyses of covariance. [a] = Sidak correction of the confidence interval ($p < .05$).

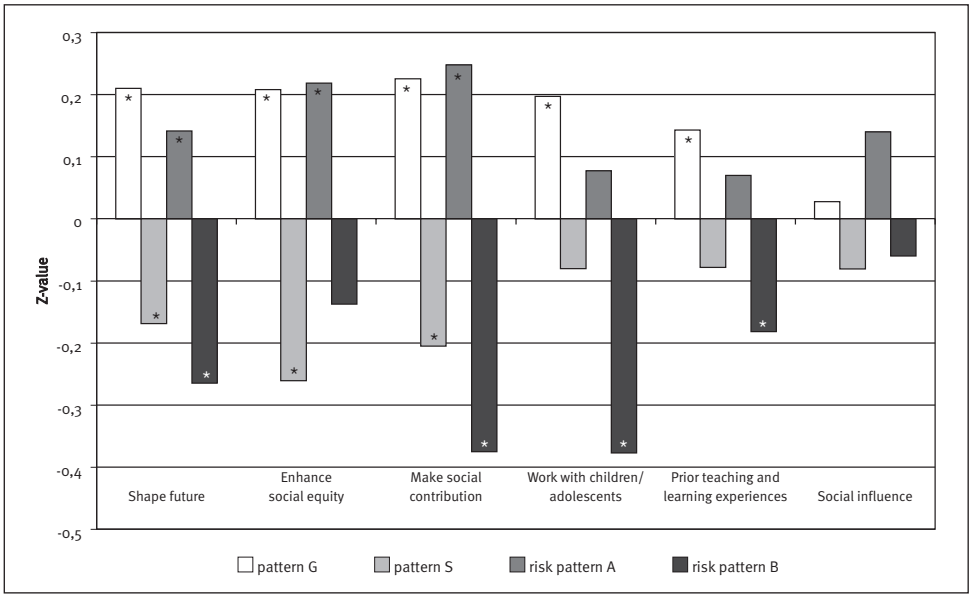
Thus the students from risk pattern A and pattern G rate the importance of technical expertise for teaching and the social status of the profession higher than their fellow students in patterns S and B. In the comparison, the challenges and demands of teaching are also rated by students in risk pattern A particularly highly. Moreover, in the overall assessment of career-choice-relevant beliefs, there are broad similarities between patterns G and A. When it comes to satisfaction with the choice of career, ultimately, only risk pattern B differs significantly from the other three: the students in this pattern are the least satisfied with their decision to undertake a university teacher training course.

If the stated motivational factors for choosing teaching as a career, differentiated according to the patterns of work-related coping behaviour, are presented in relation to the average of the overall sample (Z value), the differences, but also the similarities, between the patterns can be illustrated in respect of the stated career-choice motivations and beliefs, as they have already proved to be in the results of the *ANCOVA*s (Figures 5.2, 5.3 and 5.4).



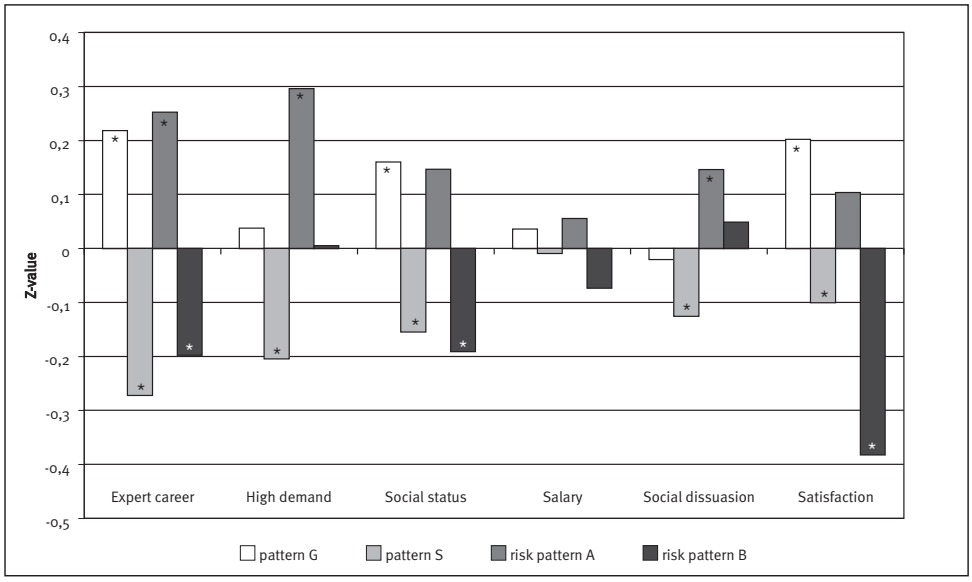
* = significant deviation from the mean ($p < .05$)

Figure 5.2: Motivational factors differentiated according to the patterns of work-related coping behaviour (Part 1)



* = significant deviation from the mean ($p < .05$)

Figure 5.3: Motivational factors differentiated according to the patterns of work-related coping behaviour (Part 2)



* = significant deviations from the mean ($p < .05$)

Figure 5.4: Job-related beliefs differentiated according to the patterns of work-related coping behaviour

In particular, the decision to undertake teacher training as a fallback career or in the absence of alternatives is markedly above average for the teacher training students in risk pattern B, while their motivations when it comes to assessing their own teaching skills, their intrinsic motivations, a desire to shape the future of children and young people, to make a social contribution and to work with children and young people generally are below the overall group average. Their satisfaction with their choice of career, as well as their evaluation of the importance of technical expertise are, amongst other aspects, also below average.

In contrast, in the majority of the motivational career-choice factors, as well as for the job-related beliefs, the students in pattern G and risk pattern A are below average particularly in the area of social orientation and social commitment, whereas the motivations and job-related beliefs involved in choosing teaching as a career are generally below average, similar to risk pattern B.

5.6 Summary and discussion

This study's examination of the career-choice motivations and career-choice-relevant beliefs of prospective teachers confirms the findings put forward by the Potsdam teacher study by Schaarschmidt and colleagues relating to motivational deficiencies, associated with the patterns of work-related coping behaviours of prospective teachers (pattern S and risk pattern B), which cannot be viewed as job-specific. In accordance with the general motivational deficits of pattern S and risk pattern B, the teacher training students that could be allocated to these two patterns, largely also show *job-specific* motivational deficits and therefore, in comparison with pattern G but also risk pattern A, also show an unfavourable motivational starting point both for the successful completion of a teacher training course, and for their teaching career in the long term. Taking into account the percentages for these two patterns within the sample, 48.5% of the surveyed teacher training students have motivational deficiencies.

In summary, for the students in pattern S (33%) the assessment of their own teaching skills, their intrinsic motivation, the aim of attaining a secure job and factors relating to societal usefulness (shaping young people's future, enhancing social equality, making a social contribution) are reported at similarly below-average levels as the job-related beliefs of the importance of technical expertise, the demands of teaching and the social status of teaching. The teacher training students from pattern S are also, on average, less satisfied with their choice of career.

The overall tendencies of students in risk category B are similar to the motivational deficits of pattern S. However individual motivational factors are far below average and in the case of a student having chosen teaching as a career as a way out of a difficult situation or as a stopgap they are above average. The significance of the *fallback career* factor is not the same for any of the other three patterns. The differences in the area of motivational career-choice factors between the two extreme poles, pattern G on the one hand and risk pattern B on the other, are particularly distinct, which,

using the controls of gender and teacher education program selected, amongst other things, sometimes show more than one standard deviation from the mean. The same is true for the desire to work with children and young people, i.e. the motivation factor that dominates the career-choice motivations of teachers internationally (cf. Brookhart & Freeman, 1992; Richardson & Watt, 2010; Rothland, 2011a; Watt & Richardson, 2007). Overall, the desire to make a social contribution (*shaping young people's future, making a social contribution*), positive prior teaching and learning experiences and satisfaction with the choice of career are lower than for teacher training students in patterns G and A. This confirms the assumptions formulated at the outset on the basis of the information from the present sample.

The research described here, together with the outlined findings, is, on the one hand, to be seen as a further indication of the importance of pattern differences in work-related coping behaviour also for teacher training students (cf. Rothland, 2011b). On the other hand, the results contribute to an improved understanding of the importance of career-choice motivations and job-related beliefs for the processes of "becoming a teacher" and "being a teacher", since the broad aim of research on choosing teaching as a career, beyond empirically recording the job-relevant motivations, interests and orientations, is to record the importance of these motivational factors for the course of study and ultimately for the careers of the prospective teachers. This makes it possible to identify, where necessary, favourable or unfavourable combinations of motivations, orientations or career-choice-relevant beliefs, amongst other things, as predictors of career suitability and possibly even of professional success (cf. Rothland, 2011a; Thomson, Turner & Nietfeld, 2012).

Research carried out to date has been able to demonstrate that the motivations for choosing teaching as a career and the related job-relevant beliefs affect (future) teaching practice, the commitment to teaching and the future professional identity of prospective teachers (cf. Cochran-Smith & Zeichner, 2005; Wilke & Losh, 2008). Additionally, the descriptive findings of the present study suggest connections between career-choice motivations, job-relevant beliefs and health-relevant, work-related behaviour and experiences. Therefore it seems possible, when it comes to broadening research in the field of choosing teaching as a career, to predict behaviour and experience styles that pose particular risks, such as risk pattern B, on the basis of specific stated career-choice motivations (e.g. *fallback career*) immediately at the beginning of a career or in the "becoming a teacher" phase. This means that the importance of prospective teachers' career choice motivations should not be reduced to the personal starting point for *taking up* a course of study in teacher training or to the beginning of the "becoming a teacher" process (cf. Sinclair, 2008). Instead, in the context of career choice motivations and job-relevant beliefs, professional development would be relevant up to the point when stress and strain in the workplace is experienced, which develop differently depending on the patterns of work-related coping behaviour and has an impact on health in the teaching profession (cf. Kieschke & Schaarschmidt, 2008; Schaarschmidt & Fischer, 2001).

Nevertheless, on the basis of the present descriptive evaluations and study results no statements can be made on the causal connections between the factors in choosing teaching as a career and the different patterns of work-related coping behaviour. Therefore, in relation to the above-mentioned potential prediction for risk pattern B, owing to a specific deficiency in career-choice motivation (fallback career), it is also feasible that an unfavourable personal starting situation in terms of risk pattern B, together with, amongst other things, a general dissatisfaction with life, leads to the choice of teaching as a career under difficult circumstances in the absence of alternatives. Whether and to what extent particular combinations of motivations in the context of the career decision are capable of predicting different patterns of work-related coping behaviour, above all in future teaching practice, can ultimately only be verified on the basis of genuine longitudinal studies. The differences presented in this study relating to the configurations of job-relevant factors in connection with the patterns of work-related coping behaviour provide the first indications, which should be validated in further studies.

In any case a particular emphasis should be placed on the career-choice motivations of prospective teachers when evaluating their suitability for the teaching profession (cf. Rothland & Terhart, 2011; Rothland & Tirre, 2011), since – as has been shown – even during a teacher training course, certain career-choice motivations are accompanied by behaviour and experiences that pose risks to future professional activity.

With regard to the motivations for teaching as a career, it seems significant that patterns S and B appear to be risk patterns, while pattern G, as well as risk pattern A, show no deficiencies linked to motivational aspects. This makes it clear that job-related coping behaviours which pose a risk to health, such as those found in risk pattern A, seem fundamentally desirable purely from a motivational perspective (high levels of commitment, etc.). Inversely, the group which is sparing in its personal investment in work, which shows no potential health risks, is problematic with regard to the motivation for choosing teaching as a career, as well as in relation to the quality of the work of practising teachers (Klusmann et al., 2008). In short, attitudes which seem unproblematic when looking at health in the teaching profession are not necessarily desirable with regard to the job-related motivation or to the quality of schools and teaching.

Finally, there is a need to mention further limits to the present study, alongside the aforementioned limitations with regard to the causalities and predictability of the work-related coping behaviours that pose risks on the basis of the combination of career-choice motivations. Firstly, no conclusions at all on the personal starting points of prospective teachers in general can be drawn from the distribution of the patterns in the current sample or from the distribution of the *AVEM* in the student sample from the Potsdam teacher study, since neither sample is representative. This remark seems necessary, since the respective findings from the Potsdam teacher study are openly presented as proof that the personal prerequisites of German teacher training students are of insufficient quality for undertaking teacher training and for teaching (cf. Pinn

& Rothland, 2011). Secondly, it is necessary to point out that the relative comparison of the configurations of career-choice factors was performed within the given samples. The evaluations (above or below average) are therefore only valid for the frame of reference determined, i.e. for the sample used, and should be checked in follow-up studies.

References

Bauer, J., Stamm, A., Virnich, K., Wissing, K., Müller, U., Wirsching, M. et al. (2006). Correlation between burnout syndrome and psychological and psychosomatic symptoms among teachers. *International Archives of Occupational & Environment Health, 79,* 199-204.

Brookhart, S.M., & Freeman, D.J. (1992). Characteristics of Entering Teacher Candidates. *Review of Educational Research, 62,* 37-60.

Bruinsma, M., & Jansen, P.W.A. (2010). Is the motivation to become a teacher related to preservice teachers' intentions to remain in the profession? *European Journal of Teacher Education, 33*, 185-200.

Cochran-Smith, M., & Zeichner, M. (2005). *Studying teacher education. The report of the AERA panel on research and teacher education.* American Educational Research Association: Lawrence Erlbaum Associates, Inc.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109-132.

Friedman, M., & Rosenman, R.F. (1974). *Type A behavior and your heart*. New York: Knopf.

Kieschke, U., & Schaarschmidt, U. (2008). Professional commitment and health among teachers in Germany: A typological approach. *Learning and Instruction, 18*, 429-437.

Klusmann, U., Kunter, M., Trautwein, U., Lüdtke, O., & Baumert, J. (2008). Teachers' Well-Being and the Quality of Instruction: The Important Role of Self-Regulatory Patterns. *Journal of Educational Psychology, 100*, 702-715.

König, J., & Rothland, M. (2012). Motivations for Choosing Teaching as a Career: Effects on General Pedagogical Knowledge during Initial Teacher Education. *Asia-Pacific Journal of Teacher Education, 40,* 291-317.

Maslach, C. (1999). Progress in understanding teacher burnout. In R. Vandenberghe, & M. A. Huberman (Eds.), *Understanding and preventing teacher burnout: a sourcebook of international research and practice* (pp. 211-222). Cambridge: Cambridge University Press.

Moran, A., Kilpatrick, R., Abbott, L., Dallatt, J., & McClune, B. (2001). Training to Teach: Motivating Factors and Implications for Recruitment. *Evaluation & Research in Education, 15*, 17-32.

Pinn, S., & Rothland, M. (2011). Die „Anti-Elite" – dumm, neurotisch und falsch motiviert? Das Bild angehender Lehrkräfte in den Printmedien. [The „anti-elite"– stupid, neurotic and wrong motivation? The image of preservice teachers in the print media]. *Seminar, 17* (4), 136-148.

Richardson, P. W., & Watt, H. M. G. (2005). ‚I've decided to become a teacher': Influence on career change. *Teaching and Teacher Education, 21,* 475-489.

Richardson, P. W., & Watt, H. M. G. (2006). Who choose teaching and why? Profiling characteristics and motivations across three Australian universities. *Asia-Pacific Journal of Teacher Education, 34,* 27-56.

Richardson, P. W., & Watt, H. M. G. (2010). Current and future directions in teacher motivation research. In T. C. Urdan & S. A. Karabenick (Eds.), *The decade ahead: Applications and contexts of motivation and achievement (Advances in Motivation and Achievement, Volume 16B)* (pp. 139-173). Bingley, U.K.: Emerald.

Rothland, M. (2011a). Warum entscheiden sich Studierende für den Lehrerberuf? Interessen, Orientierungen und Berufswahlmotivation angehender Lehrkräften im Spiegel der empirischen Forschung. [Why do students choose the teaching profession? Research on interests, orientations and career choice factors of preservice teachers]. In E. Terhart, H. Bennewitz, & M. Rothland (Hrsg.), *Handbuch der Forschung zum Lehrerberuf* [Handbook on Research into Teaching Profession] (pp. 268-310). Münster: Waxmann

Rothland, M. (2011b). Risikomerkmale von Lehramtsstudierenden. Empirische Befunde zu berufsbezogenen Eingangsvoraussetzungen angehender Lehrkräfte. [Risk characteristics of preservice teachers. Empirical findings on occupational entry requirements of preservice teachers]. *Zeitschrift für Bildungsforschung, 1*, 179-197

Rothland, M., & Terhart, E. (2011). Eignungsabklärung angehender Lehrerinnen und Lehrer. Einführung in den Thementeil. [Diagnosing the aptitude of perservice teachers. An Introduction]. *Zeitschrift für Pädagogik, 57*, 635-638

Rothland, M., & Tirre, S. (2011). Selbsterkundung für angehende Lehrkräfte: Was erfassen ausgewählte Verfahren der Eignungsabklärung? [Self-Exploration for preservice teachers: what do selected procedures of aptitude diagnostics record?]. *Zeitschrift für Pädagogik, 57*, 655-673

Rots, I., Aelterman, A., Devos, G., & Vlerick, P. (2010). Teacher education and the choice to enter the teaching profession: A prospective study. *Teaching and Teacher Education, 26,* 1619-1629.

Schaarschmidt, U. (2005a). Potsdamer Lehrerstudie – Anliegen und Konzept [Potsdam teacher study – concern and concept]. In Ders. (Eds.), *Halbtagsjobber? Psychische Gesundheit im Lehrerberuf – Analyse eines veränderungsbedürftigen Zustands* [Part Time Worker? Psychic Health in the Teacher Professione] (2nd ed. pp. 15-40). Weinheim: Beltz

Schaarschmidt, U. (2005b). Situationsanalyse [Analysis of the situation]. In Ders. (Eds.), *Halbtagsjobber? Psychische Gesundheit im Lehrerberuf – Analyse eines veränderungsbedürftigen Zustands* [Part Time Worker? Psychic Health in the Teacher Professione] (2nd ed., pp. 41-71). Weinheim: Beltz

Schaarschmidt, U. (2005c): Potsdamer Lehrerstudie – ein erstes Fazit [Potsdam teacher study – an initial conclusion]. In Ders. (Eds.), *Halbtagsjobber? Psychische Gesundheit im Lehrerberuf – Analyse eines veränderungsbedürftigen Zustands* [Part Time Worker? Psychic Health in the Teacher Professione] (2nd ed., pp. 141-160). Weinheim: Beltz

Schaarschmidt, U., & Kieschke, U. (2007). Einführung und Überblick [Introduction and overview]. In U. Schaarschmidt & U. Kieschke (Eds.), *Gerüstet für den Schulalltag. Psychologische Unterstützungsangebote für Lehrerinnen und Lehrer* [Equipped for Schools. Psychological Support for Teachers] (pp. 17-43). Weinheim/Basel: Beltz

Schaarschmidt, U., & Fischer, A.W. (2001). Coping with professional demands: a new diagnostic approach. In K.W. Kallus, N. Posthumus, & P. Jimenez (eds.), *Current psychological research in Austria* (pp. 145-149). Graz: Akademische Druck- und Verlagsanstalt.

Schaarschmidt, U., & Fischer, A.W. (2008). *Arbeitsbezogene Verhaltens- und Erlebensmuster. Manual* [Patterns of work-related coping behaviour]. (3rd ed.). London: Pearson

Sinclair, C. (2008). Initial and changing student teacher motivation and commitment to teaching. *Asia-Pacific Journal of Teacher Education, 36,* 79-104.

Thomson, M. M., Turner, J. E., & Nietfeld, J. L. (2012). A typological approach to investigate the teaching career decision: Motivations and beliefs about teaching of prospective teacher candidates. *Teaching and Teacher Education, 28,* 324-335.

Voltmer, E., Bochmann, A., Kieschke, U., & Spahn, C. (2007). Studienbezogenes Erleben und Verhalten, Selbstaufmerksamkeit und soziale Unterstützung zu Beginn des Medizinstudiums [Study-related experience and behavior, self-awareness and social support at the beginning of medical studies]. *Zeitschrift für Medizinische Psychologie, 16* (3), 127-134

Voltmer, E., Kieschke, U., & Spahn, C. (2007). Work-related behaviour and experience patterns of physicians compared to other professions. *Swiss Medical Weekly, 137* (31-32), 448-453.

Watt, H. M. G., & Richardson, P. W. (2007). Motivational factors influencing teaching as a career choice: Development and validation of the FIT- Choice Scale. *Journal of Experimental Education, 75,* 167- 202.

Watt, H. M. G., & Richardson, P. W. (2008). Motivations, perceptions, and aspirations concerning teaching as a career for different types of beginning teachers. *Learning and Instruction, 18,* 408-428.

Watt, H. M. G., Richardson, P. W., Klusmann, U., Kunter, M., Beyer, B., Trautwein, U., & Baumert, J. (2012). Motivations for choosing teaching as a career: An international comparison using the FIT-Choice scale. *Teaching and Teacher Education, 28*, 791-805.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25,* 68-81.

Wilke, R., & Losh, S. (2008). Beyond beliefs: preservice teachers' planned instructional strategies. *Action in Teacher Education, 30,* 64-73.

Chapter 6
Professionalism and the Role of Teacher Beliefs in Technology Teaching in German Primary Schools – An Area of Conflict

Ingelore Mammes, Niclas Schaper & Johannes Strobel

Abstract

The current lack of engineers and other technical specialists on the job market and the need for society to be informed about technology and its human, environmental and social dimensions in order to make socially responsible decisions have triggered a discussion about the early introduction of technology classes in schools. The political aim of this discussion is to increase primary school pupils' learning of technology early so that they develop an interest in the subject which can be then maintained and developed throughout their schooling. However, primary school teachers are often not trained to teach technology. They lack the competencies and a belief in the importance of the subject, which are both necessary to teach the subject. This creates a conflict with the intentions of the policy makers. Teacher training can resolve this situation. Developing teachers' competencies, self-efficacy and beliefs in this sphere can lead to more and better technology teaching in primary schools. To this end, it is necessary to gather information about the effectiveness of teacher training in this field. An assessment instrument needs to be developed and verified to gain more information about the professional skills of teaching staff.

Keywords:
Technology education (engineering), teacher education focus k-7

6.1 Introduction

Following the most recent international comparative test results on school quality and the related discussion on teaching quality, public focus has once again shifted to the teaching profession. Teachers' skills, beliefs and competencies are critical elements of teaching quality. In order to plan and structure their lessons and reflect on pupils' learning progress, teachers must possess the professional and problem-solving skills relevant to their profession (Terhart, 2000; Pfadenhauer, 2003). Professionalisation takes place during teacher training when expertise and subject-related didactical and pedagogical knowledge is transferred.

Professional behaviour is always influenced by normative postulates and realistic possibilities (Terhart, 2000). External circumstances influence teachers' professionalism

and can create an area of conflict between the professional expectations and their performance. The reality of everyday school life (the quality of classrooms, the resources available and so on, Mammes, 2008a) often causes a rift between a teacher's own pedagogical standards and the feasibility of their implementation. Furthermore, a lack of teacher expertise also has an influence on teaching quality and creates a gap between educational policy aims and reality. Inadequate teacher training can lead to knowledge gaps, which prevent the implementation of learning standards. When this happens professionalism becomes an area of conflict in itself.

This is particularly the case amongst primary school teachers in Germany. Primary school teacher training in this country covers two or three subjects, yet teachers go on to teach a broad spectrum of subject areas in schools. As a result, their expertise becomes part of an area of conflict between concepts of pedagogical professionalism, educational standards and the feasibility of their daily implementation.

This article deals with this area of conflict in primary schools taking the example of technology education. Here, a lack of expertise often hinders high-quality teaching. In order to analyse the lack of expertise an instrument is presented, which can be used to measure teacher competencies and their development.

6.2 The need for technical education in primary schools

In international comparative tests on school quality German pupils attain average results in natural sciences and technology. These tests also show that German pupils are not very interested in these subjects (OECD, 2008). National studies support these results, especially in the area of "technik" education (Deutsche Akademie der Technikwissenschaften, 2009).

Not only do such deficits affect an individual's ability to participate fully in debates about society in later life, they also limit the choice of university courses and vocational training available to pupils (cf. Mammes 2009; 2011). This results in both a lack of skilled workers in certain fields and limits the variety of educational and training options open to young people (Deutsche Akademie der Technikwissenschaften, 2009; Mammes, 2001).

In response, education policy requires that early learning initiatives for "technik" be included in curricula. At pre-school and primary school, boys and girls should be challenged and encouraged so that they develop the competencies they will need in future life. Primary school children should acquire knowledge and skills to help them grasp important concepts, gain self-confidence and, most of all, an interest in topics related to natural sciences and technology (GDSU, 2002; Mammes, 2001; 2008b; Rohaan, 2009). The institutionalised, formal promotion of "technik" is also important since it can help compensate for the fact that some pupils lack "technik" learning experiences outside school. (Deutsche Akademie der Technikwissenschaften, 2009, p. 9). Studies show that structured "technik" education in schools generates pupil interest in natural sciences and technology, fosters knowledge and skills and reduces the shortfall

in the recruitment of women into technology-related professions (Conrads, 1992; Mammes, 2001; cf. Hartinger, 1997; cf. Deutsche Akademie der Technikwissenschaften, 2009). Thus, an institutionalised promotion of "technik" not only supports active participation in society's debates on important issues, but it further prevents technical illiteracy and has a major role to play in the development of equal opportunities.

Early "technik" education can spark interest in technology as early as primary school which, as the common entrance level into the educational system, can answer the calls made by education policy makers for early education in natural sciences and technology (Mammes, 2001). Educational plans and curricula set the course for these developments.

6.3 The institutionalisation of technology education on the basis of curricula, professional conduct and expertise

In German primary schools technical education is generally taught in the subject *Sachunterricht* (personal and social education). In different *federal states* technical topics appear under different section headings of the state curricula, for example under Humankind/Nature/Culture in Baden-Württemberg, Sculptural Composition in Lower Saxony and Aesthetic Education in Western Pomerania. Although technology is incorporated into the primary school curricula of almost all federal states. But technical topics are still underrepresented (Biester, s.a.; Mammes, 2008b; cf. Blaseio, 2002). Existing school curricula do not provide a satisfactory framework for teaching technology. According to the TeBiS-study, simply institutionalising technology teaching will not along improve results in this subject. Teachers' expertise in teaching technology is also crucial (see Möller et al., 1996; Helmke, 2009). In other words, teachers' technical competency and the quality of technology teaching in schools are connected. In Germany generally teachers decide themselves which curriculum topics they will teach in their classes and which topics are to be given priority. More than half of all primary school teachers never choose technology topics for their lessons. They explain this choice saying they lack the necessary competencies in this field (cf. Möller et al., 1996). Teachers state that during their training they have either never or only rarely been exposed to technology-related topics (cf. Möller et al., 1996, p. 69; cf. Bolte & Streller, 2007). In her research in the Netherlands, Rohaan (2009) also identifies teachers' lack of technical competency as the reason for the weak implementation of technology education in Dutch primary schools.

The aforementioned studies point to a contradiction between the demands of education policy and actual teacher professionalism connected with their expertise. They identify a rift in schools between aspired professional standards and the reality which is linked to teachers' limited skills and competences.

A solution, which could reconcile policy demands for the early promotion of technology education with the rift between a teacher's personality and their professional standards, may lie in staff development.

6.4 The competency structure model for the identification of expertise and the development of competencies

Research into teacher training focuses on the competencies and orientation of teachers as dominant variables and supports the results of the studies mentioned above (see Helmke, 2009). As a consequence, progress in developing technology education can only be achieved by increasing teacher competency and/or changing existing approaches to teaching the subject.

It seems that one way of overcoming the rift between professional requirements for a competent approach towards technology education and the teacher's own personality is to be found in the development of primary school teachers' technical competency. Such an approach requires an analysis of an average trainee teacher's personal disposition. In order to do this a sufficiently sensitive measurement instrument must be developed. As a first step, the current state of primary school teachers' technical competency must be assessed. Thereafter, further assessments of the teachers' competency can be compared with the initial assessment to monitor the development of competency in this subject area (cf. Rohaan 2009). Such a competency assessment can only be carried out on the basis of a suitable competency model.

In the following, we will present how such a measuring instrument can be developed and the criteria that can be used as a basis for its development. Furthermore, we will use examples to demonstrate survey methods, which can be used to assess teachers' technical and teaching competence.

6.5 Basis for the modeling process

The concept of competency is most commonly used when identifying educational aims and lesson content for pupils, but it is also used in connection with the education and training of teachers. Teacher competency has become a vital element in the debate on professionalism, especially with regard to academic development, for which the focus is mostly on the education and training of teachers by developing and increasing their knowledge. While the concept of competency is differently perceived in different contexts, its definition and reference standard are important for the development of a model and the respective measurements (cf. Schaper, 2009). The competency model broadly describes which competencies a teacher needs to do his/her job effectively. Seifert, Hilligus and Schaper (2009) have described and organised teacher competencies into professional competencies and professional approaches or beliefs.

Back in 1986, Shulman defined the term professional competence. His definition and the classification of content areas in the context of teacher training are still valid today and constitute a key element of research in this field. Most surveys of teachers' professional competence use Shulman's model (see König & Blömeke, 2009; Mammes 2008a; Riese & Reinhold, 2009), as does this article.

Shulman (1986; also see Bromme, 1997) organised professional competence into three knowledge areas: content knowledge also called subject matter knowledge (Grossmann, 1990), pedagogical content knowledge and pedagogical knowledge. In the current debate about professional competence these cognitive aspects or dimensions of competence are supplemented by beliefs or attitudes (cf. Baumert & Kunter, 2006; Bromme, 1997; Mammes, 2008a; Riese & Reinhold, 2009; Rohann, 2009; Weinert, 2001).

Definition of technology

The modeling of competencies for technology teaching calls for the subject to be defined. Ropohl's definition (2009) provides a good basis.

According to Ropohl, technology is:

a) the sum of user-oriented, artificial and representational objects,
b) the sum of human activity and institutions which produce technical objects and
c) the sum of human activity which makes use of technical objects.

Technology is a broad subject, which covers different aspects of the interaction between nature, the individual and society.

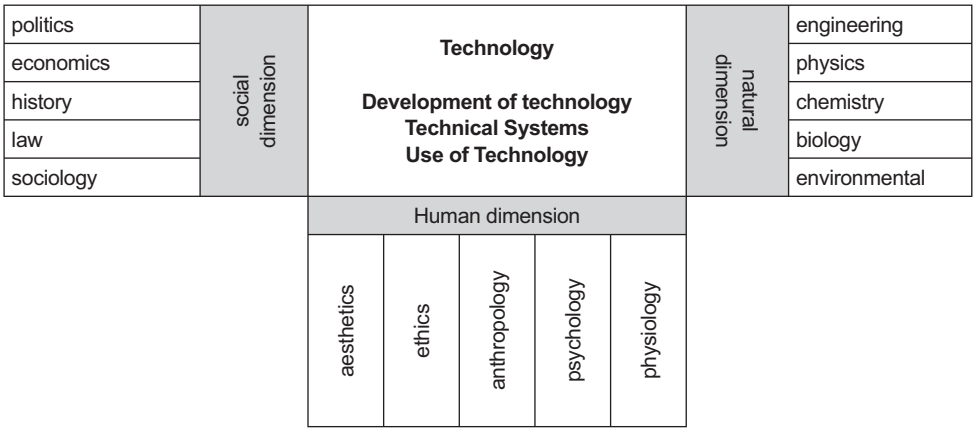


Figure 6.1: The different dimensions of technology as a school subject (Ropohl, 2009, p. 32)

The *natural dimension* of technology covers the basic elements and fundamental laws of nature, which form the basis for technical objects like machines or bridges. The environmental perspective focuses on the interaction between organisms and their surroundings, while the engineering perspective aims at predicting effects of technical objects (Ropohl, 2009).

The *human dimension* looks at the relationship between human beings and technology. All human-made objects have been made by someone and were intended for someone's use (see Ropohl, 2009, p. 35). The subdivisions of the human dimension provide a structure for looking at this relationship more closely. Physiology, for instance, examines the way in which technology can be used to enhance or help the

human body, while in ethics the moral consequences of technical activity are considered.

The *social dimension* presents the close links between technology and society. Specific laws are promulgated, for example, to regulate technical activity. In political life technology is an instrument of influence and a means of supporting the state (cf. Ropohl, 1999, p. 38). At the same time, sociology highlights the societal changes, which have been triggered by technical developments.

The process of defining the subject area shows just how complex technology education is. Apart from basic knowledge in natural sciences and technical knowledge (the knowledge perspective) pupils and teachers need technical skills and knowledge (the activity perspective) in order to construct and produce objects, as well as skills and knowledge which allow an understanding of the importance of technology (importance and assessment perspective) (Sachs, 1987). The definition, therefore, points to cognitive knowledge dimensions which need to be differentiated. So as to create an instrument to assess competence in technology it is necessary to take the respective dimensions of the subject into account. The following fields of action can be used to identify technology content areas for schools:

Technical fields of action
- work and production
- building and housing
- transport and traffic
- supply and disposal
- information and communication
- home and leisure (VDI, 2007; cf. GDSU, 2002).

Although the suitability of these fields of action is currently being discussed, this structure provides a good basis for a closer look at technology teaching (cf. VDI, 2007).

Taking the proposed definition and structure into account, different teaching methods can be identified, which should be used alongside usual technology teaching methods.

Technology teaching methods
- experiments,
- construction assignments,
- production assignments,
- repair assignments,
- technical analysis.

The principle of problem orientation is of particular importance in technology teaching bearing in mind the purpose-oriented nature of technology aiming to address social and/or individual needs. Problem-solving approaches applied in technology

classes involve creative processes. This notion of thinking and acting as engineers is a key element of technical development. Technology education has to adopt these elements of engineering behaviour, and for this reason technology teachers should focus on contextualised problem-solving learning.

6.6 Theoretical concept

The political debate about school achievement has only led to the development of measuring instruments for the assessment of teacher competencies in a few subjects (see COACTIV; FALKO). In German-speaking countries standards have not yet been set for technology teaching; so far targets only exist for learners (VDI, 2007). Rohaan's survey (2009) includes a measuring instrument for assessing the competencies of primary school teachers in the field of technology in the Netherlands. However, this approach lacks a systematic model as it does not include a definition of technology and the subject is not sufficiently systemized in the Netherlands. This article will present a theoretical concept of primary school teacher competencies for technology classes, which takes the aforementioned aspects into account. The basis for this approach is the concept of competence in the field of teacher training, as discussed above, including the dimensions of content knowledge, pedagogical content knowledge, pedagogical knowledge, as well as professional beliefs or attitudes. In addition, in order to determine which competencies are necessary in technology teaching it is crucial to assess the six technical fields. Furthermore, the concept needs to take into account the prospects for technical education or the relevant dimensions of cognitive knowledge, such as the competent use of technology or the capacity to evaluate and assess it. From this it is possible to establish a general competency model for the subject, which systematically combines the aforementioned requirements and descriptive dimensions of professional competencies (see Table 6.1).

We assume that it is not only possible to differentiate the competency acquisition of trainee primary school teachers with regard to the aforementioned content dimensions but that it also reflects different levels. Since it has not been possible to formulate assumptions on the basis of existing theoretical approaches when it comes to the formation of these levels, our aim is to define these levels in reference to existing empirical analyses (see for example Schaper et al. 2008 or Schaper 2009).

The competency structure matrix for primary school teachers in the field of technology education used in Table 6.1 (below) is still hypothetical and must be assessed and further developed using advanced empirical analyses (e.g. expert knowledge).

Table 6.1: Competency structure matrix for primary school teachers in the field of technology education

Competency structure matrix				
Dimensions **Fields of action (Perspectives)**	**Content knowledge**	**Pedagogical content knowledge**	**Pedagogical knowledge**	**Beliefs**
Work & Production Knowledge perspective Activity perspective Assessment perspective	Level 1 2. 3. ...	Level 1. 2. 3. ...	Level 1 2 3 ...	Level 1 2 3 ...
Transport & Traffic Knowledge perspective Activity perspective Assessment perspective	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...
Building & Housing Knowledge perspective Activity perspective Assessment perspective	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...
Supply & Disposal Knowledge perspective Activity perspective Assessment perspective	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...
Information & Communication Knowledge perspective Activity perspective Assessment perspective	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...
Home & Leisure Knowledge perspective Activity perspective Assessment perspective	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...	Level 1. 2. 3. ...

6.7 Modeling on the basis of sampling

The competency model described above will be further differentiated and validated through additional empirical examination. This will be used as a basis for developing an instrument for the assessment of primary school teacher competencies in technology. The competency model still requires that teachers are exposed to technology education during their training. The amount of technology education offered by German universities as part of their primary school teacher training programmes varies from institution to institution. In the most extreme case it is possible to finish

a teacher training programme, which has included the subject *Sachunterricht* (personal and social education), without having encountered technology or similar topics from the field of natural sciences. An additional area of concern relates to the fact that teachers in primary schools are almost exclusively women (Kühn, 2010) who have often had little exposure to technology (Möller et al., 1996). Nevertheless these teachers still have to teach *Sachunterricht*, which combines topics from the natural sciences, technology and social sciences in one subject.

In teacher training programmes, an interdisciplinary approach is often encouraged for the teaching of *Sachunterricht*, which involves replacing subject content with key topic areas. Most of the time, this merely prevents the systematic teaching of the necessary subject content. There are significant differences between the key topic areas of the *Sachunterricht* curricula of the 16 federal states. For example, the Rhineland-Palatinate curriculum includes the topic "exploration and the design of the environment" (Ministerium für Bildung, Frauen und Jugend, 2010). In the Saarland, the curriculum includes "inanimate nature, technology or space and time" (MB-FFK, 2009). Taking into account the diverse and confusing structure of the primary school curricula in the different federal states, it is important to identify one topic area, which – independently of *Sachunterricht* – allows for the teaching of technology, and which includes technology as an interdisciplinary scientific subject.

"Bicycles and traffic" is such a topic. It appears on the curricula of all 16 federal states. The topic involves technology and, as such, is appropriate for our study. Various aspects of technology education are covered by "Bicycles and traffic": the bicycle as a means of transport (transport and traffic), the bicycle as a manufactured product (work and production), electrical appliances which can be found on a bicycle (supply and disposal), bicycle frames and statics (building and housing) and traffic lights as a means of controlling and regulating traffic (information and communication).

This topic, therefore, provides a good starting point for our examination of teaching technical competencies. It can be used as a model for teaching its relevant subject competencies, subject-related didactics and pedagogical competencies. It is possible to avoid overloading the assessment instrument with content and methods by using this approach and we must refrain from individually assessing each field of action. At the same time this approach covers a very important and relevant content area within of primary education.

6.8 Data collection method

In order to collect data and gain comprehensive knowledge of teachers' professional competencies with regard to technology it is necessary to use standardised and quantified methods to gather relevant competencies. Other approaches, such as explorative methods using interviews or observations, have been discarded. It was decided to use paper-and-pencil questionnaires to measure the competencies, although this format may not provide a full assessment of the activities involved in technology

education. In order to fulfill the requirements of an activity-oriented competency assessment, only tasks, which explicitly contain an activity perspective are used. For the most part, so-called situational judgement items are used, which are based on initial situations (using hypothetical but genuine requirement scenarios of an activity area). These are described either in writing or using audiovisual material. On the basis of these judgement items the survey participants share their analysis and evaluation of situations, as well as identifying various possibilities for action by answering open or closed questions (cf. Weekly & Ployhart, 2006). The participants' answers on how they would act when presented with certain scenarios may be viewed as indicators for their real-life behaviour.

Situational judgment tests can be based on items which use open as well as closed question formats. Open question formats, to which participants can respond in their own words, are often more sophisticated. At the same time, such tests are more difficult to evaluate and sometimes give rise to problems relating to the objectivity and reliability of the assessment.

This is why competence-oriented situational judgement tests normally combine open and closed question formats (by using multiple-choice questions, for example) in order to guarantee a reliable assessment while keeping the effort involved in measuring and evaluating to a reasonable level. The example items described below provide an overview of the options available for a primary school teacher competency test for technology education.

Task: Mark the distribution of forces when the bicycle is in use

Figure 6.2: Example item for measuring content knowledge

You would like to build bird houses with a fourth grade class to illustrate production processes. How do you approach this task?

a) I bring a model into class and ask the pupils to rebuild it

b) I select a model from the text book with instructions and ask the pupils to build it

c) I develop a model together with the pupils

Figure 6.3: Example item for measuring pedagogical content knowledge

Fourth grade pupils build an electric circuit using a lamp, a socket, conductivity wire, a battery and crocodile clips. One of the pupils is not able to light up the lamp because s/he has not properly stripped the conductivity wire at the battery. S/he loses motivation. Even though I want to give him/her the opportunity to work independently I intervene.

a) I explain the mistake and let him/her solve the problem afterwards

b) I initiate a systematic joint search for the mistake

c) I tell him/her to have another close look at the battery and the conductivity wire. S/he will then find the mistake him/herself.

Figure 6.4: Example item for measuring pedagogical content knowledge (cf. Rohaan, 2009)

In order for a diagnostic assessment to be fair and exact, which of the three quality criteria have to be met?

a) Neutrality, reliability, veridicality

b) Objectivity, reliability, validity

c) Objectivity, reliability, veridicality

d) Neutrality, reliability, validity

Figure 6.5: Example item for measuring pedagogical knowledge (König & Blömeke, 2009)

A teacher's main task in the classroom is to spread knowledge.

0	0	0	0	0	0
1	2	3	4	5	6

Totally agree Totally disagree

Figure 6.6: Example item for measuring professional beliefs (cf. Mammes, 2008a)

6.9 Summary and outlook

The current political debate about early learning initiatives in natural sciences and technology is becoming an increasingly important one. Children enter the education system at primary school and, therefore, primary school teachers are responsible for establishing fundamental knowledge and fostering interest in learning. Despite this, technology is still not broadly taught in German primary schools or in similar schools of other countries either (cf. Biester, s.a.; Rohaan, 2009). Although technology education is part of regional and national primary school curricula, teachers rarely teach the technology-related topics in their lessons because of a lack of expertise, thereby creating a rift between required educational standards and what is actually taught. A lack of training and low personal interest in technology mean that teachers do not teach as much technology as they should, thus failing to meet educational standards (cf. Möller et al., 1996). There is, therefore, a risk that the aims of education policy for early learning initiatives in natural sciences and technology may not be fulfilled.

In order to deal with this complex problem, teachers must be trained in the natural sciences and technology so as to increase their professionalism. Such competency-oriented staff development should be based on a differentiated competency model for technology teaching in primary schools and on instruments for diagnosing and evaluating competency levels and the processes for acquiring these competencies. These kinds of measuring instruments for competency levels have not yet been developed to a sufficient level for technology teaching (cf. Rohaan, 2009). However, the development of such a competency model and the respective measurement instrument is essential.

These development processes are based on a theoretical foundation for technology and the competency structure required of teachers so as to provide a systematic structure. This theoretical and deductive approach is complemented by empirical and inductive expert surveys (in line with the critical incident approach). On this basis, content areas are further differentiated.

In order to validate the competency model developed in the steps described above, the model has to be operationalised transformed by developing a particular measurement instrument. Furthermore it has to be examined using empirical studies and modified if necessary.

A measurement instrument validated in this way means that conclusions can be drawn about the quality of teacher training, as well as about the measures needed for assuring good-quality teaching. In the long run, these results can support early learning initiatives in natural sciences and technology and can serve to bridge the gap between educational standards and the feasibility of their implementation.

References

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keywords: Professional competence of teachers]. *Zeitschrift für Erziehungswissenschaft, 9*, 469-520.

Biester, W. (s.a.). *Praktisches Lernen und technische Bildung in der Grundschule. Bestandsaufnahme und Ausstattungsempfehlungen* [hands-on learning and technology education in primary schools: an inventory and equipment recommendations]. Düsseldorf: VDI-Verlag.

Blaseio, B. (2002). Inhaltsstrukturen und Tendenzen der Inhalte im Sachunterricht. Eine empirische Bestandsaufnahme der Inhalte des Sachunterrichts in den 70er, 80er und 90er Jahren anhand von Unterrichtswerken [Structures of content and tendencies of contents in general science. An empirical study of the contents in general science in the 1970s, 1980s and 1990s on the basis of teaching materials]. In Spreckelsen, K., Möller, K., & Hartinger, A. (Eds.), *Ansätze und Methoden empirischer Forschung zum Sachunterricht. Forschung zur Didaktik des Sachunterrichts* [Appraches and methods of empirical research in general science. Research in didactics of general science] (vol. 5, pp. 205-222). Bad Heilbrunn: Klinkhardt.

Bolte, C., & Streller, S. (2007). „Unverhofft kommt oft" – Wenn Grundschullehrerinnen und – lehrer Naturwissenschaften für ihre Unterrichtspraxis entdecken (müssen) [„Without any prior warning" –when primary school teachers (have to) discover natural science for their teaching]. In R. Lauterbach, A. Hartinger, B. Feige, & D. Cech, (Eds.), *Kompetenzerwerb im Sachunterricht fördern und erfassen* [Advancement and assessment of the aquisition of competencies in general science] (pp. 139-151). Bad Heilbrunn: Klinkhardt.

Bromme, R. (1997). Kompetenzen, Funktionen und unterrichtliches Handeln des Lehrers [Skills, functions and curricular activities of the teacher] . In F. E. Weinert (Ed.), *Enzyklopädie der Psychologie: Psychologie des Unterrichts und der Schule* [Encyclopedia of psychology: Psychology of teaching and the school] (Vol. 3, pp. 177-212). Göttingen: Hogrefe.

Conrads, H. (Ed.) (1992). *Mädchen in Naturwissenschaften und Technik. Grundlagen und Ergebnisse* [Girls in Natural Sciences and Technology. Basics and results]. Frankfurt a.M., Bern, New York & Paris: Peter Lang.

Deutsche Akademie der Technikwissenschaften & Verein deutscher Ingenieure (Ed.) (2009). Nachwuchsbarometer Technikwissenschaften [Indicator for Recruitment in the Technical Sciences]. Wuppertal: VDI-Verlag.

GDSU (Eds.) (2002). *Perspektivrahmen Sachunterricht* [Framework of perspectives in general science]. Bad Heilbrunn: Klinkhardt.

Grossmann, P. (1990). *The making of a teacher: Teacher knowledge and teacher education.* New York NY: Teachers College Press, Columbia University.

Hartinger, A. (1997). *Interessenförderung. Eine Studie zum Sachunterricht* [Promoting interest. A study in general science]. Bad Heilbrunn: Kinkhardt.

Helmke, A. (2009). *Unterrichtsqualität und Lehrerprofessionalität. Diagnose, Evaluation und Verbesserung des Unterrichts* [Teaching quality and teacher professionalism. Diagnosis, evaluation, and improvement of teaching]. Seelze: Kallmeyer.

König, J., & Blömeke, S. (2009). Disziplin- oder Berufsorientierung? Zur Struktur des pädagogischen Wissens angehender Lehrkräfte [Discipline oriented or profession oriented? The structure of pedagogic knowledge of prospective school teachers] *Lehrerbildung auf dem Prüfstand, 2(1),*126-148.

Kühn, A. (2010). Frauen in Bildungsberufen [Women in Educational Profession]. *Statistisches Monatsheft Baden-Württemberg,* 25-28.

Mammes, I. (2001). *Förderung des Interesses an Technik. Eine Untersuchung zum Einfluss technischen Sachunterrichts auf die Verringerung von Geschlechterdifferenzen im technischen Interesse* [Promoting interest in technology. A Research study on the influence of technology education on the decrease of gender differences in technology interest]. Frankfurt a. M., Berlin, Bern, Bruxelles, New York, Oxford & Wien: Peter Lang.

Mammes, I. (2008a). *Denkmuster von Lehrkräften als Herausforderung für Unterrichtsentwicklung* [Teachers beliefs as a challenge for the development of classroom activities]. Bad Heilbrunn: Klinkhardt.

Mammes, I. (2008b). Zur Bedeutung der Professionalisierung von Lehrkräften im naturwissenschaftlich-technischen Unterricht (The meaning of professionalisation of teachers in natural and technology sciences. In K. Henseler, K.-H. Hoffmann, R. Meiners, & G. Reich, (Eds.): *Technische Bildung – Quo vadis?* [Technology education – Quo vadis?] (pp. 147-161). Hamburg: Verlag Dr. Kovac.

Mammes, I. (2008c). Technische Bildung schon in der Grundschule? – Kleine Ingenieure [Technology education in primary schools? – Kids engineers]. *Grundschulmagazin 1/2008*, 8-10.

Mammes, I. (2009). Jungen als Verlierer und Mädchen als Gewinnerinnen des Bildungssystems – Zur Problematik eines Perspektivwechsels in einer polarisierten Diskussion [Boys as losers and girls as winners of the German school system – the problematic of a changeover in perspectives in a polarized discussion]. In T. Schweiger, & T. Hascher (Eds.), *Geschlecht, Bildung und Kunst. Chancengleichheit in Unterricht und Schule* [Gender, Education and arts. Equal opportunities in education and school] (pp. 155-167). Wiesbaden: VS Verlag.

Mammes, I. (2011). Technische Bildung und Sozialerziehung [Technology education and social learning] ?! In M. Limbourg, & G. Steins (Eds.), *Sozialerziehung in der Schule* [social learning in school] (pp. 263-281). Wiesbaden: VS Verlag.

Ministerium für Bildung, Familie, Frauen und Kultur (Eds.) (2009). Kernlehrplan Sachunterricht curriculum general science]. Grundschule. Entwurf. O.A.

Ministerium für Bildung, Frauen und Jugend (Eds.) (2010). *Rahmenplan Grundschule* [curriculum for primary schools]. Mainz: Sommer Druck und Verlag.

Möller, K., Tenberge, C., & Ziemann, U. (1996). *Technische Bildung im Sachunterricht* [Technology education in general science]. Münster: Selbstverlag.

OECD (2008). *PISA 2006 – Schulleistungen im internationalen Vergleich – Naturwissenschaftliche Kompetenzen für die Welt von morgen* [PISA 2006 – school performances in international comparison – science competencies for the world of tomorrow]. Bielefeld: Bertelsmann Verlag.

Pfadenhauer, M. (2003). *Professionalität* [Professionality]. Opladen: Leske & Budrich.

Riese, J. & Reinhold, P. (2009). Fachbezogene Kompetenzen und Kompetenzentwicklung bei Lehramtsstudierenden der Physik im Vergleich verschiedener Studiengänge [Competencies related to specific fields and development of competencies of teacher training students with the subject physics in comparison to different degree programs]. *Lehrerbildung auf dem Prüfstand, 2*(1), 104-126.

Rohaan, E. (2009). *Testing Teacher Knowledge for Technology Teaching in Primary Schools.* Eindhoven: Printservice TU/e.

Ropohl, G. (2009). *Allgemeine Technologie. Eine Systemtheorie der Technik* [General technology. A system theory of technology]. Karlsruhe: Universitätsverlag.

Sachs, B. (1987). Frauen und Technik – Mädchen im Technikunterricht [Women and Technology – Girls in Technology Education]. *TU 46. November*, 5-14.

Schaper, N. (2009). Aufgabenfelder und Perspektiven bei der Kompetenzmodellierung und -messung in der Lehrerbildung [Fields of responsibility and perspectives in modeling and assessment of competencies in teacher education]. *Lehrerbildung auf dem Prüfstand*, *2*(1), 166-200.

Schaper, N., Ulbricht, T., & Hochholdinger, S. (2008). Zusammenhang von Anforderungsmerkmalen und Schwierigkeitsparametern der MT21-Testitems [The coherence between the characteristics of requirment and the parameter of difficulties of the MT21-test items]. In S. Blömeke, G. Kaiser, & R. Lehmann (Eds.), *Kompetenzmessung bei angehenden Lehrerinnen und Lehrern – Ergebnisse einer empirischen Studie zum professionellen Wissen, zu den Überzeugungen und zu den Lerngelegenheiten von Mathematik-Studierenden und -Referendaren* [Assessment of competencies of prospective teachers – results of an emprirical study about professional knowledge, about beliefs and about opportunities to learn for students and prospective teachers in mathematics] (pp. 453-480). Münster, New York, München & Berlin: Waxmann.

Seifert, A., Hilligus, A.H., & Schaper, N. (2009). Entwicklung und psychometrische Überprüfung eines Messinstruments zur Erfassung pädagogischer Kompetenzen in der universitären Lehrerausbildung [Development and psychometirc testing of an assessment instrument to capture pedagogical competencies in the teacher training programs of Universities]. *Lehrerbildung auf dem Prüfstand*, *2*(1), 82-104.

Shulman, L.S. (1986). Those Who Understand: Knowledge Growth in Teaching. *Educational Researcher, Vol. 15*(2), 4-14.

Terhart, E. (2000). *Perspektiven der Lehrerbildung in Deutschland* [Perspectives of teacher education in Germany]. Weinheim & Basel: Belz.

Verein deutscher Ingenieure e.V. (2007). *Bildungsstandards Technik für den Mittleren Schulabschluss* [educational standards of technology education for middleschools]. Düsseldorf: VDI Verlag.

Weekley, J.A., & Ployhart, R.E. (2006). *Situational judgement tests. Theory, measurement and application.* Mahwah, N.J.: Lawrence Erlbaum.

Weinert, F. E. (2001). Concept of competence: A conceptual clarification. In D.C. Rychen, & L.H. Salganik (Eds.), *Defining and Selecting key competencies* (pp. 445-66). Hogrefe: Göttingen.

II
IN-SERVICE TEACHERS

Chapter 7
Teachers' Pedagogical Beliefs: Findings from the first OECD Teaching and Learning International Survey

Lorraine Gilleece

Abstract

The first Teaching and Learning International Survey (TALIS; OECD, 2009), conducted in 2007–2008 in 24 countries, surveyed lower secondary education teachers and school principals. Teacher pedagogical beliefs were an important focus of the survey. Findings indicated that in almost all participating countries, teachers endorsed constructivist beliefs to a greater extent than direct transmission beliefs. Contrary to expectations, in most countries there was a positive correlation between direct transmission and constructivist beliefs (OECD, 2009).

This chapter summarises findings from some previously published TALIS reports and extends earlier work by considering the association between teacher pedagogical beliefs and student achievement. Detailed student achievement data were available for Ireland only. Findings point towards a negative association between direct transmission beliefs and student achievement. One criticism of TALIS which may be advanced is that teacher beliefs are measured at an abstract level rather than in the context of a specific subject or classroom activity. This may reduce the likelihood of uncovering associations between teacher beliefs and instructional practices.

Keywords:
TALIS, teacher pedagogical beliefs, student achievement, Ireland

Concerns with the definition of teacher beliefs have been widely expressed in the literature (see e.g. Pajares, 1992; Tatto & Coupland, 2003) although there is general support for two broad categories of pedagogical belief: direct transmission beliefs and constructivist beliefs (Bereiter, 1994; Staub & Stern, 2002). Direct transmission beliefs are informed by associationist theories which emphasise contiguity and reinforcement as key to learning while constructivist approaches focus "on the role of the subject's prior knowledge, which provides the means to relate stimuli in ways that go well beyond registering their temporal contiguity" (Staub & Stern, 2002, p. 345).

Owing in part to the "messy" nature of teacher beliefs (Pajares, 1992), researchers have struggled to find consistent links between teacher beliefs and the use of particular instructional practices (e.g. Raymond, 1997; van der Schaaf, Stokking & Verloop, 2008). One hypothesis put forward to account for this is that not all beliefs are expected to influence behaviour; only the most salient are likely to influence a particular

task (van der Schaaf et al., 2008). Furthermore, teachers' content knowledge (Wilkins, 2008) and epistemological beliefs (Kang & Wallace, 2005) may be relevant, whereby beliefs about teaching may mediate the relationship between content knowledge or epistemological beliefs and instructional practice.

In spite of these complexities, some general findings have emerged which suggest that teachers' pedagogical beliefs have a significant influence on their instructional strategies (Aguirre & Speer, 2000; Peterson, Fennema, Carpenter & Loef, 1989; Hermans, Tondeur, van Braak & Valcke, 2008; Richardson, Anders, Tidwell & Lloyd, 1991; Wilkins, 2008) and there is some limited evidence pointing towards positive associations between teacher constructivist beliefs and student achievement (Peterson et al., 1989; Staub & Stern, 2002). Research into teacher beliefs has been identified as a key area of educational research (Pajares, 1992; Tatto & Coupland, 2003) and teacher beliefs, attitudes, and practices represented a major theme of the recent Teaching and Learning International Survey (TALIS; OECD, 2009). In the analysis framework for teaching practices and beliefs in TALIS, it was proposed that teacher beliefs about the nature of teaching and learning, together with content knowledge and pedagogical content knowledge, influence both classroom practice and professional activities such as co-operation among staff. Teacher background, including professional experience, is hypothesized to be associated with pedagogical beliefs. Of course, this is an analytic model, not all aspects of which were examined empirically in TALIS, but it usefully places teacher beliefs within the broader context of teaching and learning.

This chapter summarises TALIS findings in the area of teacher pedagogical beliefs (Jensen, Sandoval-Hernández, Knoll, & Gonzalez, 2012; OECD, 2009) and extends earlier Irish national analyses of the TALIS data (Gilleece, 2010; Gilleece, Shiel, Perkins & Proctor, 2009). The chapter begins with a brief overview of TALIS. Secondly, the approach taken in the survey to measuring teacher pedagogical beliefs and some relevant methodological issues are discussed. Thirdly, TALIS findings related to teacher beliefs are presented, referring to the initial TALIS report (OECD, 2009), later secondary analysis (Jensen et al., 2012), and some limited new analyses. New analyses focus on a subset of six countries; the rationale for selection will be explained later. The fourth section provides an overview of a regression analysis which examines links between a number of TALIS variables (including teacher pedagogical beliefs) and student achievement in Ireland (Gilleece, 2010). In the fifth section, a proxy measure of student achievement in five other TALIS countries (Austria, Denmark, Poland, Lithuania, and Italy) is presented and consideration is given to the association between this variable and teacher pedagogical beliefs. The concluding section highlights some limitations of TALIS and provides suggestions for future research.

7.1 What is TALIS?

The Teaching and Learning International Survey is a project of the Organisation for Economic Co-operation and Development (OECD, 2009). It was developed as part of

the OECD's work in the area of *Indicators of Education Systems* (INES) and arose, following a recommendation of an earlier OECD report (OECD, 2005) that there was a need for better national and international information on teachers (OECD, 2010a). The first cycle of TALIS, conducted in 2007–2008, focused on the teaching conditions and learning environments in lower secondary education (ISCED 2) and examined aspects of teacher professional development; teachers' beliefs, attitudes, and practices; teacher appraisal and feedback; school evaluation; and school leadership styles. A total of 24 countries (or education systems) participated: Australia, Austria, Belgium (Flemish community), Bulgaria, Brazil, Denmark, Estonia, Hungary, Iceland, Ireland, Italy, Korea, Lithuania, Malaysia, Malta, Mexico, Netherlands[1], Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, and Turkey. In each of the 24 participating countries, about 200 schools and about 20 teachers in each school were sampled. Sampling and weighting were conducted by Statistics Canada. A field trial took place in 2007 and data collection for the main study took place in southern hemisphere countries towards the end of 2007 and in early 2008 in northern hemisphere countries (OECD, 2010a).

Each sampled teacher was invited to complete a questionnaire which was either paper-based or online, depending on decisions taken by National Study Centres and, in some countries, on teachers' own preference. School principals were also invited to complete a questionnaire. Both teachers and principals were advised that the questionnaires would take about 45 minutes to complete (OECD, 2010a).

A second cycle of TALIS will take place in 2012–2013 in which the population of interest will be extended to ISCED 1 and ISCED 3 and links with PISA (Programme for International Student Assessment; see e.g. OECD, 2010b) will be facilitated. This paper draws on data from the first cycle of TALIS only.

7.2 Measuring teachers' pedagogical beliefs in TALIS

TALIS distinguishes between direct transmission beliefs and constructivist beliefs. Teachers who give a high level of endorsement to direct transmission beliefs view their role as being to "communicate knowledge in a clear and structured way, to explain correct solutions, to give students clear and resolvable problems and to ensure calm and concentration in the classroom" (OECD, 2009, p. 92).

In contrast, teachers with strong constructivist beliefs focus "on students not as passive recipients but as active participants in the process of acquiring knowledge. Teachers holding this view emphasise facilitating inquiry, prefer to give students the chance to develop solutions to problems on their own, and allow students to play active [*sic*] role in instructional activities. Here, the development of thinking and reasoning processes is stressed more than the acquisition of specific knowledge" (Staub & Stern, 2002, cited in OECD, 2009, p. 92).

1 Sampling standards were not achieved in the Netherlands; thus data are not included in international comparisons.

The scales measuring the two types of teacher beliefs each comprised four statements (see Figure 7.1). Teachers were asked to indicate their level of agreement with each of the statements on a four-point Likert scale ranging from "strongly disagree" to "strongly agree". Principal teachers' constructivist beliefs about teaching were also measured with the same statements but these are not discussed here.

OECD (2010a) describes using confirmatory factor analysis (CFA) to combine the individual statements and to confirm that a two factor structure was appropriate. This approach treats the two constructs (direct transmission and constructivist) as latent variables which cannot be directly observed but which are inferred from the variables which were directly measured (OECD, 2010a).

Direct transmission beliefs

- Effective/good teachers demonstrate the correct way to solve a problem
- Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly
- How much students learn depends on how much background knowledge they have – that is why teaching facts is so necessary
- A quiet classroom is generally needed for effective learning

Constructivist beliefs

- My role as a teacher is to facilitate students' own enquiry
- Students learn best by finding solutions to problems on their own
- Students should be allowed to think of solutions to practical problems themselves before the teacher shows them how they are solved
- Thinking and reasoning processes are more important than specific curriculum content

Figure 7.1: Questionnaire items measuring teachers' pedagogical beliefs

In order to determine whether or not it was valid to compare mean scores on the teacher belief indices across countries, the cross-cultural comparability or "invariance" of the scales was examined (OECD, 2009; OECD, 2010a). This involved testing whether or not three levels of invariance (configural, metric and scalar invariance) were achieved. Further detail on the various levels of invariance is given in OECD (2009) and OECD (2010a). As scalar invariance was not achieved on the indices of teacher beliefs (although configural and metric invariance were), country mean scores are not directly comparable. Therefore, OECD (2009) recommends that analyses focus on the extent to which teachers within a country endorse one set of beliefs over the other and on the pattern of cross-cultural differences.

The emphasis on teachers' relative endorsement of the two types of beliefs was achieved through the use of ipsative mean scores (OECD, 2009). Using this approach, an individual's response represents a preference between two or more options and this helps to reduce response bias (OECD, 2009). These scores were computed by subtracting the individual mean across all of the eight items measuring teachers' beliefs from the individual mean across the four items belonging to the direct transmission

index and also from the four items measuring constructivist beliefs (see OECD, 2009, pp. 93-94).

7.3 Findings on teacher beliefs across TALIS countries

Looking at the pattern of results across all TALIS countries, findings from the first OECD TALIS report (OECD, 2009) show that in 22 of 23 TALIS countries, teachers showed greater support for constructivist beliefs than for direct transmission beliefs. The gap was largest in Iceland, followed by Austria, Australia, Denmark and Estonia; i.e., in these countries, teachers endorsed constructivist beliefs to a much greater extent than direct transmission beliefs (OECD, 2009). A much smaller gap between the two was found in Mexico, Ireland, Lithuania, Brazil, and Portugal, while in Bulgaria and Malaysia, teachers endorsed direct transmission beliefs almost as strongly as constructivist beliefs. Only in Italy did teachers show stronger support for direct transmission beliefs than constructivist beliefs.

For the current chapter, six countries were selected for more detailed analyses and for each of these, the percentages of teachers who agreed or strongly agreed with each of the statements about teacher beliefs were computed (Table 7.1). The six countries are as follows: Austria (AUT), Denmark (DNK), Italy (ITA), Lithuania (LTU), Poland (POL), and Ireland (IRL). Austria and Denmark were selected as in these countries, teachers on average demonstrated much greater support for constructivist beliefs than direct transmission beliefs.[2] Poland was selected as it has seen recent educational reform and there was somewhat greater support for direct transmission beliefs than in Austria and Denmark. Ireland and Lithuania were selected as examples of countries with comparatively smaller gaps between the levels of endorsement given to the two types of teacher belief; i.e., although teachers in these countries reported higher levels of endorsement for constructivist beliefs than direct transmission beliefs, their preference was weaker than in Austria, Denmark and Poland. (Interestingly, Ireland is somewhat unusual in terms of the teaching practices used by teachers. Relative to all other TALIS countries, structuring teaching practices received a much higher level of endorsement in Ireland than other teaching practices; OECD, 2009); Italy was selected as it was the only TALIS country where teachers supported direct transmission beliefs to a greater extent than constructivist beliefs.

Table 7.1 shows that a large majority of teachers across the six countries agreed or strongly agreed that 'effective/good teachers demonstrate the correct way to solve a problem'. Greater variation in the levels of agreement was associated with the statement 'Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly'; e.g., just one-third of teachers in Denmark agreed or strongly agreed with this statement compared to three-quarters in Italy, Lithuania and Ireland. A similar pattern was evident with the statement

2 Although the largest gap was found in Iceland between support for the two types of belief, Icelandic data are not provided in the international database precluding further analyses.

'How much students learn depends on how much background knowledge they have – that is why teaching facts is so necessary'. Again on this statement, the lowest levels of agreement were found in Austria and Denmark; these are the two countries (of the six) where support for direct transmission beliefs overall was lowest relative to support for constructivist beliefs. The highest levels of agreement with this statement were in Italy, the only TALIS country where teachers endorsed direct transmission beliefs to a greater extent than constructivist beliefs. Perhaps surprisingly, given the overall weak endorsement of direct transmission beliefs in Austria and Denmark, high percentages of teachers in these countries agreed or strongly agreed that 'a quiet classroom is generally needed for effective learning'.

Table 7.1: Percentages (SE) of teachers who agreed or strongly agreed with statements regarding teacher beliefs

	AUT	DNK	ITA	LTU	POL	IRL
DIRECT TRANSMISSION BELIEFS						
Effective/good teachers demonstrate the correct way to solve a problem	79.9 (0.64)	86.9 (1.37)	83.2 (0.64)	72.3 (1.16)	91.0 (0.73)	89.1 (0.78)
Instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly	51.4 (0.98)	34.5 (1.72)	76.3 (0.82)	75.9 (0.97)	63.2 (1.22)	75.2 (1.01)
How much students learn depends on how much background knowledge they have – that is why teaching facts is so necessary	49.4 (0.96)	43.5 (1.50)	93.3 (0.47)	68.1 (0.97)	71.6 (0.84)	59.0 (1.05)
A quiet classroom is generally needed for effective learning	90.6 (0.50)	81.3 (1.00)	84.9 (0.70)	63.9 (1.13)	70.0 (1.02)	48.7 (1.49)
CONSTRUCTIVIST BELIEFS						
My role as a teacher is to facilitate students' own enquiry	95.3 (0.39)	88.8 (0.80)	93.7 (0.41)	96.0 (0.44)	94.6 (0.23)	82.8 (0.97)
Students learn best by finding solutions to problems on their own	93.3 (0.43)	92.8 (0.69)	64.8 (1.04)	65.4 (1.01)	90.4 (0.72)	80.8 (1.07)
Students should be allowed to think of solutions to practical problems themselves before the teacher shows them how they are solved	91.8 (0.48)	96.7 (0.49)	77.0 (0.76)	85.9 (0.69)	95.7 (0.38)	94.3 (0.57)
Thinking and reasoning processes are more important than specific curriculum content	91.4 (0.49)	84.6 (1.02)	92.0 (0.51)	89.5 (0.56)	92.0 (0.56)	76.8 (1.11)

Turning to constructivist beliefs, in general high percentages of teachers (ranging between about 75% and 97%) in each of the six countries agreed or strongly agreed with each of the statements comprising the constructivist beliefs scale (Table 7.1). On one of the statements, 'Students learn best by finding solutions to problems on their own' the percentages of teachers who agreed or strongly agreed in Italy and Lithuania were somewhat lower (65% in each).

Returning to previously published analyses, OECD (2009) demonstrates that constructivist beliefs and direct transmission beliefs are not mutually exclusive. In many countries, teachers who endorse constructivist beliefs also show support for direct

transmission beliefs. A significant positive correlation between the two was found in 19 of 23 TALIS countries. The strongest correlations were found in Malaysia, Turkey, Mexico, Korea, Bulgaria, and Brazil. However, in a small number of countries, teachers who showed support for constructivist beliefs tended not to support direct transmission beliefs: statistically significant negative correlations were found in Australia (r = -.08), Austria (r = -.24) and Iceland (r = -.18) (OECD, 2009).

An examination of variance components indicates that a quarter of the variation in teacher constructivist beliefs and over half the variation in direct transmission beliefs was accounted for by differences between countries (OECD, 2009). A very small amount of variance in teacher beliefs was accounted for by differences between schools and about 40% in the case of direct transmission beliefs and over 70% in the case of constructivist beliefs was accounted for by differences between teachers within schools (OECD, 2009).

OECD (2009) examined the association between teacher beliefs and some teacher background characteristics such as gender, subject area, experience, and level of education (a Master's degree or higher versus a lower level qualification). After controlling for subject area, experience and level of education, female teachers in more than half of participating countries showed less support for direct transmission beliefs than male teachers. The authors concluded that interventions aimed at promoting modern beliefs about instruction might best explicitly target male teachers (OECD, 2009). Regarding differences among teachers in their levels of support for constructivist beliefs, in more than half of TALIS countries, teachers of mathematics and science were found to endorse these beliefs to a greater extent than teachers of other subjects, after controlling for other background variables (OECD, 2009).

The initial TALIS report (OECD, 2009, Table 4.3) did not provide parameter estimates for the associations between background variables and teacher beliefs. Rather, median values and the range across countries are available online.[3] For the current paper, multiple regression analyses were run separately for each of the six selected countries in order to get parameter estimates for these countries. For Italy only, data are not provided in the TALIS database on main subject area so the current regression used teacher gender, years of experience and highest level of qualification (Masters or higher compared with lower-level qualification) as predictor variables. For the other five countries, data were provided on main subject area; thus, this was included as a predictor variable alongside gender, years of experience and highest level of qualification. Within each country, the dependent variables were standardised to have a mean of zero and a standard deviation of one to facilitate interpretation.

Results of the regression analyses carried out for this paper for the six countries indicate that female teachers in Denmark and Ireland were significantly less likely to endorse direct transmission beliefs than male teachers. Gender differences in the other four countries were not statistically significant (Appendix Table A7.1).

The initial TALIS report indicated that the remaining predictor variables, i.e. subject area, teacher experience, and level of education, were not significantly associated

3 See http://dx.doi.org/10.1787/607814256732, last verified February 23rd, 2012.

with direct transmission beliefs in the majority of TALIS countries (OECD, 2009), although some significant associations are seen in the six countries examined here. For example, findings of the current regression analyses indicate that teachers of mathematics and science were significantly less likely than teachers of other subjects (i.e. technology, arts, physical education and practical subjects) to endorse direct transmission beliefs in Austria and Lithuania. Also, teachers of humanities subjects were significantly less likely to endorse direct transmission beliefs than teachers of other subjects in three of the countries examined here. There is evidence of a negative association between higher level qualifications (Masters or above) and direct transmission beliefs in three of the six countries considered; and, finally, teaching experience had a weak positive association with direct transmission beliefs in five of the six countries (Appendix Table A7.1).

Turning to constructivist beliefs and teacher background characteristics, the initial TALIS report (OECD, 2009) found that only one predictor variable (subject taught) was significantly associated with constructivist beliefs in more than half of TALIS countries, whereby teachers of mathematics or science were significantly more likely to endorse constructivist beliefs than teachers of other subjects. Looking specifically at the regression results for the subset of countries examined in this chapter, some additional background variables are associated with constructivist beliefs. Female teachers reported significantly greater endorsement of constructivist beliefs than male teachers in Austria and Poland (Appendix Table A7.2). In Lithuania and Poland, teachers of mathematics or science were significantly more likely to endorse constructivist beliefs than teachers of other subjects. Whether teaching experience is positively or negatively associated with constructivist beliefs appears to vary across countries, as the association is negative and statistically significant in two of the six countries examined here but positive and statistically significant in another two countries (Appendix Table A7.2).

Returning to the initial TALIS report (OECD, 2009), there is some evidence of an association between teacher beliefs and professional development activities. After controlling for various background characteristics (i.e., gender, years of experience, level of education and subject taught), a negative association was found in eight countries between teacher support for direct transmission beliefs and the number of days of professional development taken (OECD, 2009). Conversely, a positive association was found in the same number of countries between days of professional development and endorsement of constructivist beliefs. Looking at specific types of professional development, teachers were asked a yes-no question on whether or not in the 18 months prior to TALIS, they had participated in various specific activities including courses and workshops; networks; and mentoring or peer observation. In nine TALIS countries, a negative association was found between direct transmission beliefs and participation in workshops or courses while positive associations between participation in courses or workshops and constructivist beliefs were found in seven TALIS countries. Significant associations between teacher beliefs and participation in networks or participation in mentoring activities were found in a small number

of TALIS countries. In general, associations were positive between participation in networks or mentoring activities and constructivist beliefs, while associations varied across countries for direct transmission beliefs. Of course, given the binary nature of the questions on participation in specific types of professional development activity, no information is available from TALIS on the amount of time teachers may have spent engaged in mentoring activities or the extent of their involvement in a teacher network.

Further to the initial reporting on TALIS, a thematic report was published focusing on the experiences of new teachers (i.e. those within their first two years of teaching; Jensen et al., 2012). It was noted earlier that across teachers of all levels of experience, in all but one TALIS country (Italy), there were higher levels of endorsement of constructivist beliefs compared to direct transmission beliefs. *New* teachers in all countries except Italy also endorsed constructivist beliefs to a greater extent than direct transmission beliefs (Jensen et al., 2012). In four TALIS countries (Austria, Belgium (Fl.), Ireland, and Turkey), new teachers demonstrated significantly stronger support for constructivist beliefs (relative to direct transmission beliefs) than more experienced teachers. In Poland only, new teachers endorsed constructivist beliefs to a significantly lesser extent than more experienced teachers. Few differences were found between new and experienced teachers in the correlations between direct transmission and constructivist beliefs, leading the authors to conclude that both new and experienced teachers appear to combine the two to a similar degree in their teaching practices (Jensen et al., 2012).

7.4 Linking achievement with teacher characteristics in Ireland

This section provides an overview of a multiple regression of the association between school-average student achievement and various teacher characteristics in Ireland, including teacher beliefs (Gilleece, 2010). Most of the variables were drawn from TALIS although data on student achievement were provided by the State Examinations Commission and some additional nationally available variables (e.g., school participation in a programme for schools serving large numbers of students from disadvantaged backgrounds) were included. School-average achievement is the average achievement of students in the school on the 2008 Junior Certificate examinations. (This year was selected as TALIS was conducted in Spring 2008 in Ireland.)

The Junior Certificate examinations are taken by almost all students at the end of Grade 9. Students typically take examinations in between 9 and 12 subjects, including English, Irish and mathematics.[4] Most examinations are available at two levels – higher and ordinary level – but there is also a more basic level in English, Irish, and

4 The Junior Certificate is currently undergoing substantial revision whereby it is envisaged that students will take a reduced number of examinations (see http://ncca.ie/framework/doc/NCCA-Junior-Cycle.pdf, last verified January 19th, 2012).

mathematics. In Civic, Social, and Political education, there is a single common level examination paper.

For each Junior Certificate examination undertaken, students receive a result in the form of a grade which can be transformed into a corresponding Junior Certificate Performance Score, based on the grade and the level of the examination (i.e. higher, ordinary or foundation) (see Appendix Table A7.3). This method of transforming students' grades into scale scores has been used in a number of previous studies (see e.g., Eivers, Shiel & Cunningham, 2008; Kellaghan & Dwan, 1995; Martin & Hickey, 1993). A student's overall performance can be described by computing an overall performance scale score (OPS). OPS scores are based on a student's best seven grades, excluding grades awarded in common level subjects (currently only Civic, Social and Political Education). For the current study, student-level scores were aggregated to the level of the school as it was not possible to link individual teachers to their students.

7.4.1 Method

As achievement data were aggregated to school-level, a single level regression was run, rather than a multi-level model. School-average achievement was the dependent variable (scores ranged from 49.71 points to 77.75, with a mean of 65.70 and standard deviation of 5.82).

Predictor variables were also aggregated to school level. Analyses were conducted in WesVar v5.1.16, with data weighted based on the TALIS school-weight. One school which had participated in TALIS in Ireland was omitted from the current analyses as it did not have Junior Certificate examination students in 2008. Predictor variables were grouped into the following five conceptually-related blocks:

Characteristics of teachers in the school
Percentage of teachers that were female; percentage working full-time; percentage of teachers with a Master's degree; percentage of teachers with a permanent job; percentage of teachers in their first or second year; percentage of teachers who reported that they had never received an appraisal; average number of years teachers had been teaching; average age of teachers; average number of professional development days in the eighteen months prior to TALIS; and average teacher self-efficacy.

Teacher beliefs and practices
Average use of student-oriented practices in the school; average use of structuring practices; average use of enhanced activities; average teacher endorsement of direct transmission beliefs; average teacher endorsement of constructivist beliefs; average teacher collaboration.

School structural features
Average class size in the school; proportion of parents with a third-level degree; proportion of students speaking languages other than Irish or English at home; whether or not the school serves a large proportion of socioeconomically-disadvantaged students, i.e., the school is in the School Support Programme (SSP) under DEIS (Delivering Equality of Opportunity in Schools; Department of Education and Science, 2005); school gender composition; school location; school enrolment size; school type (vocational, secondary, or community/comprehensive); whether or not the school had carried out a self-evaluation in the 5 years prior to TALIS; and whether or not the school had been the subject of an external evaluation in the 5 years prior to TALIS.

School atmosphere
Average classroom disciplinary climate in the school; student delinquency in the school (based on principals' reports); quality of teacher-student relations (averaged from teacher reports).

Principal characteristics
Use of an administrative leadership style; use of an instructional leadership style; number of professional development days.

Each variable was tested separately in a linear regression model using school average Junior Certificate OPS as the dependent variable. If a variable was significant ($p < .1$), it was retained in the block (see Table A7.4 for parameter estimates and significance tests for variables added individually to the null model). Once each block was finalised, blocks were entered in the regression model together. Variables which were not significant (i.e., $p > .05$) were dropped one by one. Curvilinear terms associated with continuous variables were examined. Interactions between variables in the final model were also considered.

7.4.2 Results of linear regression of school-average achievement in Ireland

The final model of school average achievement is presented in Table 7.2. The model is presented without interactions or squared terms as the primary interest in this paper is the association between achievement and teacher beliefs and the teacher beliefs variable is not involved in an interaction. For the model with significant squared terms (for percent female enrolment) and interactions (between school participation in SSP and average percent of parents with degrees), see Appendix Table A7.5.

There is a statistically significant negative association between the average endorsement of direct transmission beliefs and school average achievement, after controlling for the other variables in the model (Table 7.2). Substantively, this is a small effect given that a one-standard deviation increase in endorsement of direct transmission beliefs corresponds to a decrease in average achievement of about one-tenth of a

standard deviation. The percentage of parents with a third-level degree and whether or not the school is part of the SSP have comparatively larger associations with achievement. A one standard deviation increase in the percentage of parents with degrees is associated with a two-fifths of a standard deviation increase in achievement while on average, the difference in achievement between schools in the SSP and those not in the SSP is about half a standard deviation.

Schools with higher percentages of girls enrolled typically have higher scores, all else being equal. Of course, this may relate to the better average performance of girls than boys; without a multilevel model, it is not possible to know if differences are at the individual or the group level and whether or not there is a contextual effect over and above the individual effect. Schools with better average classroom disciplinary climate typically have higher scores than those with poorer disciplinary climate. A one standard deviation increase in average disciplinary climate corresponds to about one-third of a standard deviation increase in average achievement.

Table 7.2: Parameter estimates of variables in final model without interactions

	PE	SE	t	p
Intercept	66.77			
Avg teacher endorsement – direct transmission beliefs (z-score)	-0.52	0.225	-2.298	0.024
Average percentage of parents with Third-Level degree (z-score)	2.57	0.307	8.382	<.001
School is in the School Support Programme under DEIS (1=yes)	-3.23	0.633	-5.098	<.001
Percent Female enrolment (z-score)	0.65	0.220	2.960	0.004
Average classroom disciplinary climate (z-score)	1.80	0.255	7.050	<0.001

The total R-squared for this model is 0.796. Very little of the variance in school-average achievement is uniquely explained by teacher beliefs (examined by comparing the R-squared of the full model with the R-squared for the model without teacher beliefs); the difference in the R-squared values for the full and partial models is just .008 so less than 1% of variance in average achievement is uniquely accounted for by average teacher endorsement of direct transmission beliefs. A greater proportion of variance (29.4%) is uniquely explained by school structural features, i.e. the percentage of parents with a Third-level degree, school participation in the SSP, and the percentage of student enrolment that is female. About 6% of variance in average achievement is explained by average classroom disciplinary climate.

As previously noted, the significance of curvilinear terms and interaction terms was also considered and the model with curvilinear and interaction terms is provided in Appendix Table A7.5. A curvilinear term for percent female enrolment is statistically significant which indicates that at higher levels of the predictor variable (i.e. when percent female enrolment is greater), the association between percent female

enrolment and average achievement is weaker than at lower levels. However, the parameter estimate for the curvilinear term is very small (-.001) and therefore adds little to the model outlined above. An interaction between participation in the SSP and the percentage of parents with Third-level degrees is also statistically significant. This means that when the percentage of parents with Third-level degrees is higher, schools in the SSP do not experience the same drop in average achievement as when the percentage of parents with degrees is lower. The total R-squared for the model with the squared term and interaction term was 0.823.

7.5 Linking achievement and teacher beliefs in other countries

For the other TALIS countries, no direct measure of student achievement was available. However, in Ireland variables such as the percentage of parents with a Third-level degree strongly correlate with achievement. It therefore seems appropriate to consider whether there are variables which could be used as a proxy for achievement in countries where no direct measure was available. This section relates to exploratory work and can give rise at most to tentative conclusions.

In order to consider whether it would be possible to derive a proxy measure of achievement for countries where no achievement score was available, it was necessary to begin with the Irish data as these would allow a comparison of the proxy measure and the actual achievement measure. Exploratory factor analysis was used to examine whether or not a number of explanatory variables (teacher reports of student ability in a particular class, teacher reports of the education levels of students' parents, and teacher reports of the percentage of students whose first language was different from the language of instruction) loaded on a single factor in Ireland. Two variables, i.e. teacher reports of student ability and the percentage of students whose parents had a third-level degree, loaded on a single factor. The percentage of students who spoke a language other than English or Irish at home had a very low loading on this factor and was therefore excluded.

Confirmatory factor analysis was then carried out using teacher reports of student ability and the percentage of students whose parents had a third-level degree (for factor loadings, see Appendix Table A7.6). The resulting scores were generated using the Anderson-Rubin method to have a mean of zero and a standard deviation of one. The factor explained 70.6% of variance in the variables. The Kaiser-Meyer-Olkin measure of sampling adequacy was a little low (.50) but Bartlett's test of sphericity was significant ($p < .01$).

The proxy measure of student achievement in Ireland was aggregated from teacher- to school-level and standardised to have a mean of zero and a standard deviation of one. This measure correlated positively and strongly ($r = .84$, $p < .01$) with school-average Junior Certificate performance. Thus, in Ireland at least, this appears to be a reasonable substitute as a measure of student achievement.

Moving onto countries where no direct measure of achievement was available, confirmatory factor analysis was carried out separately for the five other countries in order to derive a single factor score from teacher reports of student ability and the percentage of parents with a Third-level degree. Within each country, the 'achievement measure' (i.e. factor score) was standardised so that the mean across schools was zero with a standard deviation of one. Similarly, within each country, direct transmission beliefs and constructivist beliefs were standardised to have a mean of zero and a standard deviation of one across schools.

In Austria and Italy, there were statistically significant negative correlations between the factor score estimating achievement and teacher endorsement of direct transmission beliefs (Austria, $r = -.30$, $p < .01$; Italy, $r = -.27$, $p = .03$). In Austria, there was also a statistically significant positive correlation between the factor score estimating achievement and teacher endorsement of constructivist beliefs ($r = .17$, $p = .03$). Other correlations were not statistically significant but were generally positive for constructivist beliefs and negative for direct transmission (see Appendix Table A7.7). Of course, analyses presented in this section are of a preliminary nature but it is interesting that there appears to be some tentative evidence of a negative association between direct transmission beliefs and achievement while there appears to be some evidence of a positive association between constructivist beliefs and achievement.

7.6 Conclusion

OECD (2009, p.18) reports that TALIS was "the first international survey to focus on the working conditions of teachers and the learning environment in schools". Teacher pedagogical beliefs formed one aspect of the survey. In almost all TALIS countries, teachers endorsed constructivist beliefs to a greater extent than direct transmission beliefs, although differences in the strength of endorsement between the two varied considerably across countries. It is, of course, necessary to acknowledge that these are teachers' "professed" beliefs and may not necessarily represent their "attributed" beliefs (i.e. beliefs which an observer would attribute to the teacher; Aguirre & Speer, 2000).

TALIS asks teachers about their pedagogical beliefs in a very general sense although previous research has shown that teacher beliefs are closely linked to subject matter (Wilkins, 2008). The first international report on TALIS acknowledges that there are important differences between concrete and abstract beliefs, notably that concrete beliefs may be more strongly associated with action (OECD, 2009), yet abstract beliefs are measured in the survey. While later in the TALIS questionnaire, teachers are asked about the instructional approaches used in a *particular* class in which they teach one of their main subjects, the items on beliefs are more general in nature and teachers are not asked to respond to the question on beliefs in the context of a particular subject. Attempting to measure teacher beliefs in a very general

sense, without accounting for subject-matter content has been criticised in the literature where it has been noted that "unfortunately, research on teachers' beliefs has not been concerned with subject-matter content; rather, it has focused on teachers' general conceptions of their roles (…) Thus, these studies are limited because they report findings on teachers' beliefs across a wide range of curriculum areas and grade levels" (Peterson et al., 1989, p. 3).

Given that the TALIS questionnaire includes a section which refers to a specific class (i.e., the first <ISCED Level 2>[5] <class> that you (typically) teach in this school in one of these subjects[6] after 11am on Tuesdays), the validity of the teacher belief items might be improved by inclusion in the section dealing with a specific class.

The initial TALIS report (OECD, 2009) notes that direct transmission beliefs and constructivist beliefs had been expected to correlate negatively or not at all, yet this was not borne out in the TALIS data. Aguirre and Speer (2000, p. 333) discuss the concept of belief bundles which they define as "a particular manifestation of certain beliefs at a particular time". They argue that a bundle contains beliefs from across the teacher's entire belief system, including beliefs about learning and beliefs about teaching. Component beliefs may belong to different bundles so although a teacher holds a particular belief, it may not be active at a particular time if the bundle to which it belongs is not active. Jensen et al. (2012) suggest that teachers move between direct transmission and constructivist beliefs depending on the particular instructional context and the objectives of the current lesson. This suggestion appears compatible with the idea of a belief bundle according to which not all beliefs are active at a particular time.

A more complex understanding of teacher pedagogical beliefs, such as that posited by Aguirre and Speer (2000), would accommodate positive correlations between direct transmission and constructivist beliefs. In a general context, a teacher may hold various incompatible beliefs but only some of these will be activated in a specific context. It is likely that the beliefs activated in a specific context will be compatible with each other, although not necessarily compatible with all of a teacher's other beliefs (i.e. those outside the currently activated belief bundle).

Findings from TALIS indicate a high degree of variation in teacher beliefs within schools; i.e. socialisation processes within a school appear to have a very limited effect on teacher pedagogical beliefs (OECD, 2009). Between-school variance in teacher beliefs is lower than between-school variance in, for example, teaching practices, co-operation among staff, classroom climate and teacher-student relations (OECD, 2009). If subject matter taught is indeed relevant to teacher beliefs (e.g. Peterson et al., 1989), greater concordance of beliefs might be expected among teachers of similar subjects compared to teachers of disparate subjects. Thus, the sampling approach in TALIS, which involved selecting teachers from across subject areas, might partly account for the low between-school variance in teacher beliefs.

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5 <Item> is adapted with an appropriate term in each country.

6 The reference to *these subjects* relates to one of the main subjects identified in an earlier question.

The stability of teacher beliefs, at least some of which have been shown to be quite resistant to change in pre-service education (e.g. Kagan, 1992), could also account for high within-school variation in teacher beliefs. Pajares (1992, p. 324) notes that "beliefs are formed early and tend to self-perpetuate, persevering even against contradictions caused by reason, time, schooling, or experience". (As noted earlier, TALIS provides some evidence that teacher beliefs may be modifiable by professional development activities as in a small number of countries, there was a negative association between days of professional development and endorsement of direct transmission beliefs and a positive association with constructivist beliefs. TALIS does not however allow any inference to be drawn about causality.)

It is interesting to note that a comparatively large proportion of the variance in teacher beliefs is accounted for by between-country variance, particularly in the case of direct transmission beliefs (OECD, 2009). This indicates that teachers within countries tend to show greater similarity in pedagogical beliefs than teachers across countries and suggests that national school systems, culture and pedagogical traditions are an important influence on teacher beliefs (OECD, 2009). The influence of teachers' own schooling experience on the formation of beliefs has been described in the literature (e.g. Anderson, White & Sullivan, 2005; Nespor, 1987). The relatively higher homogeneity of schooling experience within countries compared to across countries (as well as the stability of teacher beliefs over time) is likely to contribute to the comparatively high between-country variance.

Based on secondary analyses of the TALIS data conducted by the author of this chapter, there is some tentative evidence of a negative association between average student achievement and teacher endorsement of direct transmission beliefs. Of course, between-school variance in teacher beliefs is very low (i.e., most of the variance in teacher beliefs is between teachers within schools); therefore, aggregating teacher beliefs to school level is not the optimal way to examine associations between beliefs and achievement. Furthermore, although TALIS provides a wealth of data on teaching and learning at lower second level, it is not designed to examine specific links with student achievement. Future research would benefit from using an approach which allows individual student measures of achievement to be matched to individual teachers but of course, student achievement is associated with the contribution of multiple teachers over many years and a cross-sectional study will not capture the effects of different teachers. It is likely that the forthcoming cycle of TALIS, which will allow matching of TALIS and PISA data, may encounter similar difficulties as the analyses in the current paper.

References

Aguirre, J., & Speer, N. M. (2000). Examining the relationship between beliefs and goals in teacher practice. *Journal of Mathematical Behaviour*, *18*, 327-35.

Anderson, J., White, P., & Sullivan, P. (2005). Using a schematic model to represent influences on, and relationships between, teachers' problem-solving beliefs and practices. *Mathematics Education Research Journal*, *17*, 9-38.

Bereiter, C. (1994). Constructivism, socioculturalism, and Popper's World 3. *Educational Researcher*, *23*, 21-23.

Department of Education and Science. (2005). *DEIS (Delivering Equality of Opportunity in Schools): An action plan for educational inclusion.* Dublin, Ireland: Author.

Eivers, E., Shiel, G., & Cunningham, R. (2008). *Ready for tomorrow's world? The competencies of Ireland's 15-year-olds in PISA 2006.* Dublin, Ireland: Educational Research Centre.

Gilleece, L. (2010, August). *Linking outcomes of the OECD's teaching and learning international survey (TALIS) to student achievement.* Paper presented at the second biennial meeting of the European Association for Research on Learning and Instruction (EARLI) Special Interest Group 18, Leuven, Belgium.

Gilleece, L., Shiel, G., Perkins, R., & Proctor, M. (2009). Teaching and learning international survey (2008): National report for Ireland. Dublin: Educational Research Centre. Retrieved January 18, 2012, from http://www.erc.ie/documents/talis_national_report_2009.pdf

Hermans, R., Tondeur, J., van Braak, J., & Valcke, M. (2008). The impact of primary school teachers' educational beliefs on the classroom use of computers. *Computers & Education*, *51*, 1499-1509.

Jensen, B., Sandoval-Hernández, A., Knoll, S., & Gonzalez, E. J. (2012). *The experience of new teachers: Results from TALIS 2008.* Paris: OECD. Retrieved from http://dx.doi.org/10.1787/9789264120952-en.

Kagan, D. M. (1992). Professional growth among preservice and beginning teachers. *Review of Educational Research, 62*, 129-169.

Kang, N., & Wallace, C. S. (2005). Secondary science teachers' use of laboratory activities: Linking epistemological beliefs, goals, and practices. *Science Education*, *89*, 140-165.

Kellaghan, T., & Dwan, B. (1995). *The 1994 Junior Certificate examination: A review of results*. Dublin: National Council for Curriculum and Assessment.

Martin, M. O., & Hickey, B. L. (1993). *The 1992 Junior Certificate examination: A review of results.* Dublin, Ireland: National Council for Curriculum and Assessment.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, *19*, 317–328.

OECD (Organisation for Economic Co-operation and Development). (2005). *Teachers matter: Attracting, developing and retaining effective teachers*. Paris: Author.

OECD. (2009). *Creating effective teaching and learning environments: First results from TALIS*. Paris: Author.

OECD. (2010a). *TALIS 2008: Technical report*. Paris: Author.

OECD. (2010b). *PISA 2009 results: What students know and can do – Student performance in reading, mathematics and science (Volume I)*. Retrieved from http://dx.doi.org/10.1787/9789264091450-en.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, *62*, 307–332.

Peterson, P. L., Fennema, E., Carpenter, T. P., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. *Cognition and Instruction*, *6*, 1-40.

Raymond, A. M. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice. *Journal for Research in Mathematics Education*, *28*, 550–576.

Richardson, V., Anders, P., Tidwell, D., & Lloyd, C. (1991). The relationship between teachers' beliefs and practices in reading comprehension instruction. *American Educational Research Journal*, *28*, 559-586.

Staub, F. C., & Stern, E. (2002). The nature of teachers' pedagogical content beliefs matters for students' achievement gains: Quasi-experimental evidence from elementary mathematics. *Journal of Educational Psychology*, *94*, 344–355.

Tatto, M. T., & Coupland, D. B. (2003). Teaching and measuring attitudes in teacher education. In J. Raths, & A. McAninch (Eds.), *Teacher beliefs and classroom performance – the impact of teacher education: Advances in teacher education* (Vol 6, pp. 123-181). Greenwich, CT: Information Age Publishing.

van der Schaaf, M. F., Stokking, K. M., & Verloop, N. (2008). Teacher beliefs and teacher behavior in portfolio assessment. *Teaching and Teacher Education*, *24*, 1691-1704.

Wilkins, J. L. M. (2008). The relationship among elementary teachers' content knowledge, attitudes, beliefs, and practices. *Journal of Mathematics Teacher Education*, *11*, 139-164.

Appendix

Table A7.1: Multiple regression of teacher background characteristics and teacher direct transmission beliefs, six countries

	R_sq	Intercept	Gender (female – male)	Subject taught (Maths/ Science – other)	Subject taught (Humanities – other)	Years of teaching experience	Teacher qualifications (Masters or above – Bachelors or below)
Austria	.01	-.03 (.049)	.00 (.039)	**-.09 (.044)**	**-.087 (.043)**	**.01 (.002)**	**-.16 (.041)**
Denmark	.02	.10 (.093)	**-.21 (.064)**	-.04 (.104)	-.090 (.089)	**.00 (.003)**	.10 (.107)
Lithuania	.02	.07 (.062)	-.03 (.052)	**-.10 (.060)**	**-.282 (.056)**	**.01 (.003)**	**-.11 (.052)**
Poland	.00	.23 (.103)	-.03 (.057)	-.04 (.050)	**-.106 (.045)**	.00 (.002)	**-.17 (.091)**
Ireland	.01	.04 (.071)	**-.16 (.048)**	-.02 (.068)	-.064 (.066)	**.01 (.002)**	-.06 (.051)
Italy[1]	.02	-.17 (.058)	-.06 (.036)	–	–	**.01 (.001)**	-.030 (.040)

Values in **bold** are statistically significant ($p \leq .05$).
Outcome variable was z-standardised within each country
[1]No data for Italy on subjects taught so gender, years of experience and teacher education used as predictor variables.

Table A7.2: Multiple regression of teacher background characteristics and teacher constructivist beliefs, six countries

	R_sq	Intercept	Gender (female – male)	Subject taught (Maths/ Science – other)	Subject taught (Humanities – other)	Years of teaching experience	Teacher qualifications (Masters or above – Bachelors or below)
Austria	.02	-.03 (.066)	**.25 (.037)**	.01 (.044)	.01 (.044)	**-.01 (.002)**	-.01 (.043)
Denmark	.01	.16 (.106)	.04 (.062)	.04 (.125)	-.10 (.104)	**-.01 (.003)**	-.07 (.101)
Lithuania	.02	-.25 (.059)	-.02 (.062)	**.24 (.063)**	.05 (.044)	**.01 (.002)**	.06 (.052)
Poland	.03	-.33 (.105)	**.24 (.053)**	**.24 (.076)**	**.12 (.058)**	**.00 (.002)**	-.04 (.092)
Ireland	.01	-.03 (.071)	.10 (.057)	.10 (.066)	-.02 (.056)	.00 (.002)	.12 (.071)
Italy[1]	.01	-.21 (.060)	.08 (.043)	–	–	.00 (.002)	**.17 (.038)**

Values in bold are statistically significant (p≤.05).
Outcome variable was z-standardised within each country
[1]No data for Italy on subjects taught so gender, years of experience and teacher education used as predictor variables.

Table A7.3: Matching Junior Certificate grades to a performance scale score

Higher Level	Ordinary Level	Foundation Level	Junior Certificate Performance Scale Score
A			12
B			11
C			10
D	A		9
E	B		8
F	C		7
	D	A	6
	E	B	5
	F	C	4
		D	3
		E	2
		F	1

Table A7.4: Variables tested separately by addition to the null model of Junior Certificate OPS 2008

		PE	SE	Test statistic	p
Block 1. Teacher characteristics	Percentage of teaching staff which is female	0.03	0.026	t=1.334	0.185
	Percentage of teaching staff which works full-time	-0.09	0.041	t=-2.313	0.023
	Percentage of teaching staff with a Masters degree or higher	0.07	0.043	t=1.501	0.137
	Percentage in permanent employment	0.03	0.046	t=0.756	0.451
	Percentage in first or second year of teaching	0.02	0.070	t=0.331	0.741
	Percentage never evaluated	0.04	0.044	t=0.824	0.412
	Average number of years experience	0.15	0.141	t=1.048	0.297
	Average teacher age	0.12	0.131	t=0.915	0.362
	Average number of days of professional development	-0.13	0.240	t=-0.544	0.588
	Average teacher self-efficacy[1]	2.47	0.458	t=5.393	<0.001
Block 2. Teacher beliefs and practices	Average use of structuring practices[1]	-1.14	0.471	t=-2.416	0.018
	Average use of student-oriented practices[1]	-0.95	0.566	t=-1.672	0.098
	Average use of enhanced activities[1]	-0.27	0.480	t=-0.560	0.576
	Average endorsement of direct transmission beliefs[1]	-1.01	0.533	t=-1.898	0.061
	Average endorsement of constructivist beliefs[1]	0.94	0.604	t=1.557	0.123
	Average teacher exchange and co-operation[1]	0.28	0.544	t=0.516	0.607
Block 3. School structural features	Average class size	0.64	0.186	t=3.425	0.001
	Average percentage of parents with a third-level degree[1]	4.64	0.359	t=12.927	<0.001
	Average percentage of students who speak languages other than English or Irish at home	0.07	0.070	t=1.060	0.292
	School participates in School Support Programme under DEIS (measure of disadvantage, 1=yes, 0=no)	-8.67	0.901	t=-9.620	<0.001
	School location (rural – town)	-0.37	1.709	F=0.224	0.800
	School location (city – town)	-0.82	1.535		
	School size (small – medium)	-3.11	1.77	F=2.744	0.069
	School size (large – medium)	-1.64	0.908		
	School has had self-evaluation	0.05	1.201	t=0.042	0.967
	School has had external evaluation	-0.23	1.110	t=-0.207	0.837
	Percentage of school's enrolment that is female[1]	1.71	0.421	t=4.059	<0.001
Block 4. School climate	Average classroom climate[1]	4.06	0.358	t=11.350	<0.001
	Delinquency in the school (principal's report)[1]	-1.91	0.607	F=6.023	0.003
	Missing indicator for delinquency	1.06	1.252		
	Average teacher-student relations[1]	1.78	0.560	t=3.179	0.002
Block 5. Principal characteristics	Principal's use of an instructional leadership style	-0.68	0.704	t=-0.964	0.338
	Principal's use of an administrative leadership style	0.53	0.849	t=0.628	0.531

[1]Variable is z-standardised in Ireland

Table A7.5. Parameter estimates of variables in final model of Junior Certificate OPS 2008 with interactions

	PE	SE	t	p
Intercept	67.70			
Average teacher endorsement of direct transmission beliefs (z-score)	-0.49	0.221	-2.202	0.030
Average percentage of parents with a Third-Level degree (z-score)	2.53	0.282	[a]	[a]
School is in the School Support Programme under DEIS (1=yes)	-1.40	1.015	[a]	[a]
Percent Female enrolment (z-score)	0.80	0.232	3.451	0.001
Percent Female enrolment squared	-0.73	0.239	-3.037	0.003
Average classroom disciplinary climate (z-score)	1.65	0.244	6.749	<.001
SSP * average percent of parents with Third-Level degree	2.79	1.223	2.280	0.025

[a]Significance tests are not provided for variables with significant interactions or curvilinear terms. This model explains 82% of the variance in average achievement (R^2=0.823)

Table A7.6. Components of the proxy measure of student achievement, Ireland

	Factor Loading
Ability of students in the target class compared to students in the same grade/ year level more generally	.840
Estimate of the percentage of students who have at least one parent/guardian who had completed Third level education to at least undergraduate degree level	.840

Extraction method: Principal Component Analysis

Table A7.7: Correlation between proxy measure of achievement and teacher pedagogical beliefs (constructivist and direct transmission) – Austria, Denmark, Ireland, Italy, Lithuania, Poland

	Constructivist		Direct Transmission	
	r	p	r	p
Austria	**0.17**	0.03	**-0.30**	<.01
Denmark	-0.03	0.89	-0.01	0.95
Ireland	**0.21**	0.05	-0.12	0.17
Italy	0.04	0.66	**-0.27**	0.03
Lithuania	0.01	0.85	0.10	0.15
Poland	0.15	0.09	-0.10	0.20

Bold indicates p ≤ .05

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Chapter 8
The Role of Teachers' Pedagogical Beliefs – An Analysis from the Perspective of Vocational Education and Training

Jürgen Seifried

Abstract

There is a general consensus that not only content or pedagogical content knowledge but also basic orientations shaped by personal experience (beliefs, world views, or subjective, naive or implicit theories) play an important role in the professional activities of teachers. This is especially the case when it comes to the organisation of teaching and learning processes in the classroom. A great deal of research has been done looking at these basic orientations (Schoenfeld, 2002), however, despite the general academic interest in these issues, the directions of the research vary significantly. This chapter will first of all sketch out the main areas of research and discuss how the different pieces of research relate to one another. The second section will outline empirical findings in the field of Vocational Education and Training (VET). Bearing in mind the learning venues in VET – in-house training at the workplace on the one hand and vocational schools on the other – some results for company trainers (workplace learning) will be compiled. This will be followed by the findings of a study, which deals with teachers at business schools in the field of accountancy.

Keywords:
Teachers' pedagogical beliefs, domain specific beliefs, conceptions of teaching and learning, vocational education training

8.1 Research on Teachers' Beliefs

Due to the focus on teaching and learning, we shall begin by outlining research approaches to (1) teachers' beliefs, (2) conceptions of teaching and learning, and (3) teachers' subjective theories (especially in the German tradition of Research Program Subjective Theories). Any possible connections to research regarding implicit personal theories or teacher's attitudes, although conceivable, are not referenced here.

8.1.1 Beliefs

Beliefs in general are personally founded basic orientations (Calderhead, 1996; Op't Eynde, De Corte, & Verschaffel, 2002; Pajares, 1992). Epistemological beliefs

in particular refer to the nature of one's knowledge and learning (Hofer & Pintrich, 1997). Differences between non domain-specific and domain-specific epistemological beliefs have been drawn and discussed, illustrating the extent to which these are distinctly learning content-specific. In this context there have been contradictory results, which, nevertheless, mostly demonstrate domain dependency (Buehl & Alexander, 2001; Hofer, 2000; Schommer & Walker, 1995; Stahl & Bromme, 2007).

Research has shown that beliefs do have an effect on teaching and learning, and that a teacher's constructivist orientation can positively impact learning success. Peterson, Fennema, Carpenter, and Loef (1989), for example, found a significant positive relationship between a constructivist basic orientation of primary school mathematics teachers and the ability of their students to solve problems. Referencing the data from the SCHOLASTIK Project in a longitudinal study, Staub and Stern (2002) confirmed that a constructivist orientation with a selection of comprehension-oriented exercises in primary school mathematics lessons went hand in hand with and had a positive effect on learning progress. As a part of the COACTIV Study (Baumert et al., 2010), questions were asked as to what influence teachers' knowledge and beliefs have on the planning of mathematics lessons. The "transmission view", which is negatively linked to the cognitive activation of students, was invalidated. In the same way, Hartinger, Kleickmann, and Hawelka (2006) show that lessons given by teachers with constructivist beliefs offer more scope for development than lessons from teachers who have instructional ideas. The results of other studies do not, however, always support these findings. In the video study "Pythagoras" (Hugener et al., 2009; Lipowsky et al., 2009), for example, Staub and Stern's results are not replicated. Lederman and Zeidler (1987) were also unable to find a relationship between teachers' epistemological beliefs and their teaching methods.

8.1.2 Conceptions of Teaching and Learning

The different views on teaching and learning processes have been analysed in international literature in the context of 'conceptions of teaching and learning.' In the literature, teaching-oriented and learning-oriented basic approaches are regularly distinguished, and are understood as end-points of a continuum (Kember, 1997). The conceptions of teaching and learning represented in Figure 8.1 can be expanded into the following five dimensions: (1) The role of the teacher (presenter vs. change agent), (2) the concept of teaching (transfer of information vs. development of person and conception), (3) the role of the learner (passive recipient vs. developer), (4) the nature of the learning content (defined by curriculum vs. constructed by students), and (5) the ownership of knowledge (knowledge possessed by the lecturer vs. socially constructed knowledge). Empirical evidence for the existence of these different viewpoints can be found in interview studies conducted by Prawat (1992), Prosser, Trigwell, and Taylor (1994) or Trigwell, Prosser, and Waterhouse (1999). For accountancy education see Leveson, 2004, and Lucas, 2002.

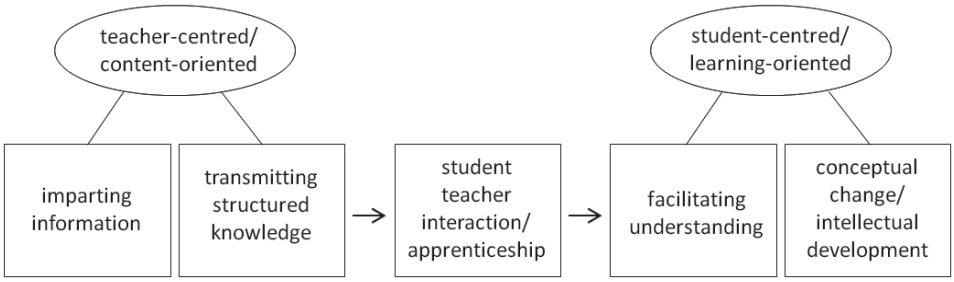

Figure 8.1: Teaching Conceptions (Kember, 1997, p. 264)

8.1.3 Subjective Theories

In Germany the discussion surrounding subjective theories has been particularly marked by the work of Groeben (Research Programme on Subjective Theories, see Groeben et al., 1988; Groeben & Scheele, 2000). It has been empirically shown that subjective theories correspond to a guiding function, and that they differentiate between successful and less successful teachers with respect to the level of consistency between subjective theories and teaching strategies (e.g. Dann, Diegritz, & Rosenbusch, 1999; Müller, 2004). However, pertinent studies in VET, which are explicitly related to this programme, are rare. In her literature review Ziegler (2006) identifies only two works on VET, namely a German study by Girke (1999) and a Swiss study by Flüglister et al. (1985).

8.1.4 Similarities and Differences

A range of similarities can be found in the approaches outlined above, although they derive from various research traditions and are not clearly differentiated in literature. Research carried out thus far has been carried out independently and makes no reference to other research in the same field. Generally speaking, the outlined concepts are only vaguely defined – apart from the relatively precise definitions by Groeben et al. (1988). Researchers work with a selection of similar terms or use synonyms when they describe specific phenomena (Baumert & Kunter, 2006). This approach cannot be entirely dismissed, since there is certainly a shared academic interest. The discussion about the psychical make-up of teachers and the influence this has on the organisation of teaching-learning situations is of general interest. The approaches share more or less explicitly presented suppositions concerning the function of perspectives. As general, basic orientations and clusters of conceptions, they pre-structure cognition and enable quick access to strategies in action situations (see also the remarks concerning the relationship of scripts, didactic routines and subjective theories in Blömeke, Eichler, and Müller, 2003). To sum up: beliefs control mental processes, work like a filter, are active with respect to information intake and the acquisition of knowledge,

and can therefore have an noticeable impact (Hofer, 2002; Marton, 1990; Pratt, 1992). In the author's opinion, possible starting points for the differentiation of the various concepts lie not in the specific meanings but rather in different research traditions and the preferred research methods (surveys, interview techniques, structural techniques, forms of action validation).

8.2 Findings on beliefs in VET

8.2.1 Perspective 1: Trainers in the Workplace

The discussion surrounding the role of pedagogical beliefs is an important one in current research into the professional competencies of teachers. The addition of other legal aspects and factors relating to the work and teaching activities of training personnel in companies, compared to school teachers, means that the results of teacher training research are not directly transferable to this group without limitations. Before examining the findings from the field of workplace learning and instruction, a concise outline of the particularities of educational training facilities will be given.

Workplace learning is of great importance for the development of apprentices' professional competence (Billett, 2001; Fuller & Unwin, 2003; Tynjäla, 2008). In recent decades, apprentices have not always had the opportunity to learn directly in the workplace. Due to the complexity of industrial production processes and the tendency to strive towards an efficient and error-free workflow, trainers have exercised their role of instructor in accordance with the principle of demonstration and imitation in workshops which were often separate from the workplace. This traditional view has today – as in teacher training research, in which constructivist arrangements have also spread – been replaced by a new role for teaching personnel (for a European perspective see Evans, Dovaston, & Holland, 1990; Cedefop, 2010). The re-emergence of workplace training venues has led to the increased prevalence of project orientation, teamwork, decentralised decision-making and qualification processes and other trends. These have altered the demands placed upon employees. The trainer's function is increasingly described as an advisor (with regard to in-company socialisation) or as a learning process supervisor, fulfilling multiple requirements and a variety of roles (Billett, 2003; Cedefop, 2010).

Company-based training can be broken down into three models and forms of learning (Dehnbostel & Dybowski, 2001). Workplace-oriented learning does not have any direct link to the workplace itself and is organised, for example, in the form of corporate seminars or training groups. Workplace-linked learning (learning interlinked with work) also divides work and learning venues, but is characterised by the physical proximity to the workplace and the way work is organised around the trainees (for example, the relevant simulated learning processes). Finally, workplace and learning site may be the same (learning tied to work). Learning situations (which are deliberately initiated in order to achieve lasting change in students' behaviour: learning-goal

orientation) and work situations (performance-target orientation as part of production processes: incidental learning) can be defined using these categories.

Who becomes a trainer and the qualifications they should have are issues which need to be considered. It is important to establish whether and to what extent the regulations included in the German "Vocational Training Act" (*Berufsbildungsgesetz*), in combination with the "Ordinance of Trainer Aptitude" (*Ausbilder-Eignungsverordnung*) provide the necessary guidance. Broadly speaking, there are two methods of competence acquisition open to trainers: (1) pedagogical qualification through activity as a trainer (award) and (2) pedagogical qualification through an institutionalised educational programme (aptitude test). Both qualifications are essential. Given the lack of pedagogic skills taught in the qualification attained through work experience, there is concern that a tendency to revert to a naive concept of good vocational training may develop. If this happens individual experiences may become the point of reference for the arrangement of teaching-learning processes.

In contrast, a pedagogical qualification within the framework of an educational programme aims to teach vocational education skills in addition to a professional qualification. However, this path alone cannot guarantee a comprehensive pedagogical qualification either. The "Ordinance of Trainer Aptitude" provides no distinct differentiation between industry- and company-specific requirements. Moreover, the definition of a company-trainer – someone who is entitled to carry out training measures and therefore needs vocational education skills – is not legally defined. It is common practice to only consider those registered by the Chamber of Industry and Commerce as actual trainers. Skilled workers responsible for providing training on the job, however, are seldom pedagogically trained. As a result, trainers (skilled workers) who are directly responsible for training in the workplace do not need a pedagogical certificate and an acknowledged full-time trainer does not train at all – at least not in the workplace.

In conclusion, it seems that "the trainer" in company-based training cannot be defined. The development of roles and self-conceptions, the qualifications required for pedagogical training duties as well as pedagogical regulatory frameworks are far less clear than for the trainers' school-based counterparts. Furthermore, the academic community has dedicated far less attention to the duties of workplace trainers than to school teachers, even though these duties are no less challenging. Figure 8.2 summarises the observations made above.

<table>
<tr><td colspan="3">Role of the trainer</td></tr>
<tr><td colspan="2">Traditional model</td><td>Modern interpretation</td></tr>
<tr><td colspan="2">Instruction/knowledge transfer
Training principle: Demonstration/Imitation
Role of the trainer: To impart knowledge, guide trainees</td><td>Design/moderation of learning processes
Training principle: Project-oriented procedures, self-regulated learning, self-contained activities
Role of the trainer: Learning advisor</td></tr>
<tr><td colspan="3">Groups of trainers</td></tr>
<tr><td>Full-time trainer</td><td>Part-time trainer</td><td>Skilled worker</td></tr>
<tr><td colspan="2">Formal qualification according to the “Ordinance of Trainer Aptitude”</td><td>No formal qualification</td></tr>
<tr><td>Main duty: training</td><td colspan="2">Training alongside actual workplace duties (part-time trainer)</td></tr>
<tr><td colspan="3">Learning venue</td></tr>
<tr><td>Workplace-oriented</td><td>Workplace-linked</td><td>Workplace-tied</td></tr>
<tr><td>Learning-goal oriented</td><td></td><td>Performance-goal oriented</td></tr>
</table>

Figure 8.2: Overview of the learning venue workplace (Vogg, 2010)

Empirical findings

An overview of the results for the German-speaking area, with its dual training system (with close collaboration between the learning venue workplace and vocational schools, Deißinger, 2010), initially shows that empirical studies can be categorised under different theoretical approaches. These are, research into (1) conceptions, (2) subjective theories, (3) teaching-learning conceptions, and (4) self-perceptions (Vogg, 2010).

Regarding the methodological approach to the studies, it should be noted that interview methods (expert discussions, narrative interviews etc.) were the most common approach taken, and there were very few survey studies. Correspondingly, small samples (between six and fiftytwo trainers) were used. It remains unclear to what extent obstacles in gaining access to this field led to this preference for smaller interview studies. There is also a distinct lack of studies in this field showing a connection between the belief system of trainers, the arrangement of educational situations and educational success.

A summary of the research results is as follows: workplace trainers attach a great deal of value to everyday/experiential knowledge (Arnold, 1983; Keck, 1995; Leidner, 2002; Leu & Otto, 1981; Noss, 2000). Curriculum guidelines hardly play a role – trainers seem rather to orientate themselves towards daily duties and their own experiences (Noss, 2000). Many trainers consider their own professional competence and their inherent “natural pedagogical talent” as the basis for their training success, and sometimes take on a “paternal role” in relation to their trainees (Pätzold &

Drees, 1989). The respondents consider the transfer of work tasks as a considerably influential factor needed to support trainees (Keck, 1995; Noss, 2000).

In a written survey by Müller, Rebmann, and Liebsch (2008), on the epistemological beliefs of n = 52 trainers in the business sector (recorded with the Epistemic Belief Inventory of Schraw, Bendixen, and Dunkle, 2002), values were shown to be in the intermediate range between naive and well-developed. It is striking that the epistemological beliefs clearly (at least in the cross-sectional analysis) appeared to degenerate and drift towards "naive" in the course of professional life. The self-conceptions of trainers vary between the roles of expert and teacher (Michelesen, 1979) – the respondents mainly see themselves as more of an expert than as a trainer (Jutzi, 1997; Koch et al., 2009). The double-burden of part-time trainers (pedagogical duties and their role in the business' performance) is highlighted by, for example, Selinger, 2007.

The analysis of trainer conceptions in the field of industrial technical training by Baeriswyl, Wandeler, and Oswald (2006) differs to the studies referenced above. Here, a written survey of n = 259 trainers (86 of which were polled twice) analysed the relationship between trainer conceptions and training quality (situation: Job Diagnostic Survey; Hackman & Oldham, 1975; training success: self-reported competency development and evaluation). A cluster analysis defined three trainer conceptions – instructional, constructivist, social-constructivist. Overall, as expected, it seemed to be advantageous for trainers to have a constructivist conception of their role. It should be noted, however, that the study was based on an almost exclusively male sample from industrial technical training in Switzerland – with respect to the trainees as well as the trainers – and therefore cannot be used to make generalised statements.

8.2.2 Focus: Teachers in Commercial Schools (accountancy education)

The focus of one of our studies is an investigation into the views of teachers on accountancy lessons on the basis of a written survey and subsequent in-depth interviews (Seifried, 2009; Seifried, 2012). Why is this field of particular interest? Firstly, fewer investigations have been carried out into this area than into other fields of business. Secondly, accountancy lessons have been the subject of particularly severe criticism for some time now (Adler, Milne, & Stringer, 2000; Beattie, Collins, & McInnes, 1997; May, Windal, & Sylvestre, 1995; Mladenovic, 2000). Thirdly, empirical findings indicate that learning difficulties in this field are not uncommon (Wuttke & Seifried, 2012).

Method

Sampling: The data was obtained with the help of a standardised written survey (n = 225 teachers, average teaching experience = 15 years, average age = 46). Following the written survey, 21 teachers were selected and questioned in in-depth interviews, in order to gain a greater understanding of the issues involved. The respondents, chosen

according to various criteria, are not distinctive in any way from the overall random sample.

Questionnaire: In order to survey the basic orientations of teaching and learning in the field of accountancy, an adaptation of a questionnaire by Fennema, Carpenter, and Loef (1990) was used. Using factor analyses, three subscales were formed. It should be noted that, in the above case, alongside the "classical" difference between a constructivist view (constructivist ideas of teaching and learning; 9 items; Cronbach's $\alpha = .78$; example item: "In accounting lessons, students should discuss their own ideas of problem solving") and an instructional approach (instructional ideas of teaching and learning; 9 items; Cronbach's $\alpha = .77$; example item: "In accounting lessons, students have to be shown how to solve problems"), a factor which leads back to the requirements of the learning subject can be identified. This, we will call the "systematic transmitting of basic concepts and practice" (3 items; Cronbach's $\alpha = .66$; example item: "In accounting lessons, one should proceed systematically").

In order to put the domain specific beliefs into operation, an instrument developed by Grigutsch, Raatz and Törner (1998), which focused on mathematics, was modified for accountancy. A factor analysis resulted in Grigutsch's four subscales, namely (1) process-aspect (6 items; Cronbach's $\alpha = .79$; example item: "Contents, ideas and thinking processes are in the foreground of accounting"); (2) application-aspect (4 items; Cronbach's $\alpha = .74$; example item: "Knowledge of accounting is important for the later life of the students"); (3) formalist-aspect (4 items; Cronbach's $\alpha = .68$; example item: "Accounting thought is characterised by abstraction and logic"), and (4) schema-aspect (3 items; Cronbach's $\alpha = .61$; example item: "Accounting lessons consist of rules which determine exactly how exercises have to be solved"). Finally, the teachers were asked to judge how often (on average) various teaching methods were used in the classroom (class work, group work, individual work on tasks and peer interaction, case studies).

Findings

Findings from the survey (n = 225). In order to identify homogeneous groups of teachers using basic orientations, a grouping was made on the basis of a cluster analysis. The 55 pooled teachers in the first cluster were characterised by a more constructivist approach and a comparatively low instruction orientation (25% of respondents). Therefore, the teachers in this cluster are referred to as "constructivist-oriented teachers". The biggest group, with 102 teachers, was in the second segment (46% of the random sampling). This cluster represented a stronger instructional perception, and could thus be called the "instructional-oriented teachers" group. The third group of 66 teachers (30% of respondents) demonstrated both constructivist and instructional approaches. They could be characterised by the fact that they emphasised the systematic aspect far more than both other groups. In view of this data array, cluster 3 can be called the "systematic-oriented mixed type". The cluster combines theoretically incompatible orientations. These findings are similar to those of Hartinger, Kleickmann, and Hawelka (2006) who, in addition to an instructional and a constructivist oriented

cluster, found two groups with inconsistent conceptions (the first group: highly valuing both dimensions; the second group: low characteristics of either dimension). Similarly, Patry and Gastager (2002) as well as Müller (2004) came to the conclusion that constructivist and instructional approaches can coexist. Furthermore, it can be shown that both groupings conform to the theory (constructivist approach, instructional approach) exist, but they are not reproduced in pure form. When looking at teachers with a more pronounced constructivist or instructional orientation, these too were found to make reference to the other perspective. These clusters must, strictly speaking, be considered as either more constructivist-oriented or more instructional-oriented.

Correlation analyses were used to examine the relationships between domain specific and pedagogical beliefs on the one hand and teaching methods on the other. A normal distribution does not occur in all cases, and therefore Spearman's rank correlation coefficient (r_s) was used to calculate the relationship. Table 8.1 shows some correlations between the different constructs in line with expectations. The constructivist view is negatively related to the instructional view with regard to pedagogical beliefs (r_s = -.30**). The systematic approach and the instructional idea are positively linked (r_s = .21**). By analysing domain specific beliefs, it is possible to identify a relationship between formalism-aspects and scheme-aspects (r_s = .42**). Furthermore, there is an evident negative relationship between classwork and student-centred teaching methods (e.g. groupwork: r_s =. -.42**; case studies: r_s = -.50**). For a more detailed report of the findings see Seifried, 2009, and Seifried, 2012.

To sum up: the findings of this study more or less replicate a number of existing studies (especially in mathematics, Hartinger, Kleickmann, and Hawelka, 2006; Staub & Stern, 2002; Stipek et al., 2001). However, as expected, the distribution of the respondents across different pedagogical belief systems differs between the studies. Whereas about one quarter of teachers report constructivist ideas (such as our teachers do) in Hartinger, Kleickmann and Hawelka (2006), the majority of teachers in the reports of Staub and Stern (2002) and Stipek et al. (2001) tend toward a constructivist orientation.

Table 8.1: Results of the Correlation Analysis (Spearman's Rho)

	1	2	3	4	5	6	7	8	9	10
1 Constructivist	---									
2 Instructional	-.30**	---								
3 Systematics	-.03	.21**	---							
4 Process	.62**	-.43**	-.05	---						
5 Formalism	-.03	.29**	.38**	-.05	---					
6 Scheme	-.02	.38**	.38**	-.15*	.42**	---				
7 Application	.14*	-.19**	.10	.25**	.07	.24**	---			
8 Class work	-.30**	.40**	.19**	-.28**	.16*	.14*	-.09	--		
9 Group work	.28**	-.26**	-.30**	.24**	-.21**	-.14*	.10	-.42**	---	
10 Ind. & peer work	.04	-.17*	-.01	.01	.10	.02	.11	-.53**	-.09	---
11 Case studies	.09	-.21**	-.09	.16*	-.13	-.09	.05	-.50**	.03	-.05

n = 225, **: significant on the 1%-level, *: significant on the 5%-level

Findings from the interviews (subsample, n = 21). An analysis of the survey data provides initial clues as to the representative basic orientations of respondents' attitudes towards teaching and learning and also points to significant differences. In view of the limitations of the reach and flexibility of standardised surveys, in-depth interviews will be referred to in the following section. The aim here is to develop additional conclusions, in order to obtain further information about the basic orientations of the identified teacher types. The 21 interviewees were distributed to the different clusters as follows: cluster 1 (constructivist-oriented teachers): eight teachers, cluster 2 (instructional-oriented teachers): eight teachers, and cluster 3 (systematic-oriented mixed type): five teachers. The constructivist-oriented teachers are, however, over-represented in the subsample.

The teacher's position as a role model, which will be examined in the following section, stands in direct relation to the referenced basic orientations. In this regard, the teacher's role in transmitting knowledge on the one hand and as a learning advisor on the other are usually differentiated. Teachers demonstrate a more instructional-oriented point of view as a knowledge mediator and a more constructivist-oriented view as learning advisor or coach. Furthermore, Pratt (1992) defines a third position where teachers consider themselves to be a model for ways of thinking and working methods – the learning model. Based on the interviews in the above-mentioned case, an additional fourth position can be identified – namely, the educator as a role model. Here, in lessons teachers attempt to train the students in different areas, for example, in punctuality, cleanliness and also in a readiness to help and work as a team. The values and norms taught are shared by the teacher (role model function). Multiple responses are possible here, which means that the interviewees could address various roles.

In total, the role of transmitter of knowledge was found to be dominant (in total 38 mentions by 17 teachers). This is especially true for both cluster 2 (instructional

oriented teachers: 18 mentions by seven teachers) and cluster 3 (systematic oriented mixed type: 12 mentions by five teachers). In particular, instructional-oriented teachers mostly speak of structuring factual knowledge, working step by step and, when necessary, taking it back to basics. They try, for example, to keep essential information in key sentences or to point students to important content. Below are statements made by two teachers from the instructional-oriented cluster, which can be seen as representative of these positions:

> I believe that it makes sense in accountancy to learn the rules, and then to use them. That is easier than letting [the students] find out how things might work.
>
> I then try to get across this new, important aspect in simple steps. I always refer to the "salami technique" – everything in nice, small slices.

In contrast, in the constructivist-oriented cluster, the role of learning advisor (in total nine mentions by seven teachers) is the dominant approach. The teachers regarded themselves mostly as a "coach" or a "moderator" and described the effect this has on their role in lessons. They expressed a desire to support students on an individual basis and to try to give them free rein. The following quote illustrates this position:

> As a coach. Exactly. My goal is to make myself redundant in the lesson.
>
> The lesson proceeds like a team meeting. The moderator or arbiter should be the teacher.

Beside this, the answers given by ten respondents suggest they feel they are (also) an educator or a role model. They point out that their school aims to increase educational activities, such as training on punctuality and order. And finally, six teachers, evenly divided between clusters 1 and 2, considered themselves a model to the students (and thus as possessing the "correct strategies" that students acquire through learning from models). Here, the goal was to give them, "their own understanding of the logic," or to encourage the students to work things out themselves based on structures learnt in the lesson.

To sum up: the role of learning advisor is more strongly represented amongst constructivists than by instructional-oriented teachers and the mixed types. As expected, the instructional-oriented teachers also see themselves first and foremost as knowledge transmitters and refer to themselves as such more than twice as often as their constructivist-oriented colleagues. Measured by the number of mentions, the role of knowledge mediator, together with that of learning advisor, also takes a leading position. In contrast to the teachers from clusters 2 and 3, the constructivist-oriented teachers report a significantly better balanced role model approach. However, even if they see themselves more as learning advisors than as instructional-oriented teachers, they do not unequivocally lean towards this position. For a more detailed report of the findings from the interviews see Seifried, 2009, and Seifried, 2012.

8.3 Summary and Outlook

The discussion of the perspectives of company trainers and teachers in VET seems important for various reasons. There is a lack of research into VET in general and business education in particular – only a few (older) studies exist. Due to diverse changes to the working conditions of teachers in vocational schools as well as trainers in companies providing traineeships it remains unclear whether it will be possible to adapt the existing findings. For one thing, instructors (teachers in schools and trainers in companies) are today under more pressure, both on their time and as a result of a changing professional environment, than ever before. For another, the demography of students and trainees is changing considerably. In addition, (vocational) schools face increasing pressure from external sources to perform efficiently, which is reflected in the growing emphasis on external evaluations. Furthermore, studies have been carried out which have broadly comparable designs but lead to differing results. While some make references to the connections between beliefs and teaching strategies, others find no, or only a few, non-systematic relationships (section 8.1). Finally, it can be assumed that teaching-learning-processes are worth examining from a subject-didactic perspective. Teachers and company trainers generally report on the specifics of learning content in different ways, so that studies from the field of general education can be considered as a reference, but can under no circumstances be considered a substitute for studies based in vocational education and training.

It seems essential to determine when and how (pedagogical) beliefs are acquired. When and over what period of time prospective teachers and company-based trainers' perspectives develop and manifest themselves is still not understood. However, it is not clear how these perspectives come about. Some studies identify memories from a teacher's own school days as a source and others the teacher's training (Flüglister et al., 1985). Future research efforts should, for example, investigate in more detail the beliefs with which trainee teachers enter their studies, and to what extent experiences at school influenced the development of these perspectives.

Finally, it is also important to analyse the effectiveness of trainer and teacher training programmes, which up until now in Germany has not been the subject of sufficient empirical evaluation. Until now, there have only been a few selective studies with inconsistent results, which in some instances suggest teacher training is essentially ineffective. (Blömeke et al., 2008). Here, international comparisons shed some light on the issues at stake (see Blömeke, Suhl, & Kaiser, 2011, and the chapters by Blömeke and Gilleece in this edition).

References

Adler, R. W., Milne, M. J., & Stringer, C. P. (2000). Identifying and overcoming obstacles to learner-centred approaches in tertiary accounting education: A field study and survey of accounting educators' perceptions. *Accounting Education*, *9*(2), 113-134.

Arnold, R. (1983). *Pädagogische Professionalisierung betrieblicher Bildungsarbeit: Explorative Studie zur Ermittlung weiterbildungsrelevanter Deutungsmuster des betrieblichen Bildungspersonals* [Pedagogical professionalisation of company training: An explorative study into the establishment of educationally relevant patterns of interpretation for company training personnel]. Frankfurt a.M.: Lang.

Baeriswyl, F., Wandeler, C., & Oswald, K. (2006). *Die Ausbildungskonzeptionen von betrieblichen Ausbildenden: Schlussbericht des Teilprojektes Freiburg. Qualitätsmerkmale und ihre Wirkung in der betrieblichen Bildung (QUWIBB)* [The training conceptions of company trainers: Final report of the Freiburg subproject. Quality attributes and their effect on company training]. Freiburg/Schweiz.

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften. [Keyword: Professional competencies of teachers] *Zeitschrift für Erziehungswissenschaft*, *9*(4), 469-520.

Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., Klusmann, U., Krauss, S., Neubrand, M., & Yi-Miau, T. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress. *American Educational Research Journal*, *47*(1), 133-180.

Beattie, V., Collins B., & McInnes B. (1997). Deep and surface learning: A simple or simplistic dichotomy? *Accounting Education*, *6*(1), 1-12.

Billett, S. (2001). *Learning in the workplace: Strategies for effective practice*. Sydney: Allen & Unwin.

Billett, S. (2003). Workplace mentors: Demands and benefits. *Journal of Workplace Learning*, *15*(3), 105-113.

Blömeke, S., Eichler, D., & Müller, C. (2003). Rekonstruktion kognitiver Strukturen von Lehrpersonen als Herausforderung für die empirische Unterrichtsforschung: Theoretische und methodologische Überlegungen zu Chancen und Grenzen von Videostudien [Reconstruction of teachers' cognitive structures as a challenge for educational research: Theoretical and methodological considerations concerning the possibilities and limits for video studies]. *Unterrichtswissenschaft*, *31*(2), 103-121.

Blömeke, S., Felbrich, A., Müller, C., Kaiser, G., & Lehmann, R. (2008). Effectiveness of teacher education: State of research, measurement issues and consequences for future studies. *ZDM – The International Journal on Mathematics Education*, *40*(5), 719-734.

Blömeke, S., Suhl, U., & Kaiser, G. (2011). Teacher education effectiveness: Quality and equity of future primary teachers' mathematics and mathematics pedagogical content knowledge. *Journal of Teacher Education*, *62*(2), 154-171.

Buehl, M. M., & Alexander, P. A. (2001). Beliefs about academic knowledge. *Educational Psychology Review*, *13*(4), 385-418.

Calderhead, J. (1996). Teachers: beliefs and knowledge. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of Educational Psychology* (pp. 709-725). New York: Macmillan.

Cedefop (2010). *Professional development opportunities for in-company trainers: A compilation of good practices*. Luxembourg: Publications Office of the European Union. Retrieved from http://www.cedefop. europa.eu/EN/Files/6106_en.pdf

Dann, H.-D., Diegritz, T., & Rosenbusch, H. S. (Eds.). (1999). *Gruppenunterricht im Schulalltag: Realität und Chancen* [Group lessons in everyday school life: Realities and possibilities]. Erlangen: Universitätsverbund Erlangen-Nürnberg e.V.

Dehnbostel, P., & Dybowski G. (2001). Company-based learning in the context of new forms of learning and differentiated training path. In P. Descy, & M. Tessaring (Eds.), *Cedefop Reference series*. *Training in Europe. Second report on vocational training research in Europe 2000: backround report, volume 1* (pp. 391-429). Luxembourg: Office for Official Publications of the European Communities.

Deißinger, T. (2010). Dual System. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education*, 3rd edition, (Vol. 8, pp. 448-454). Oxford: Elsevier.

Evans, K., Dovaston, V., & Holland, D. (1990). The changing role of the in-company trainer: An analysis of British Trainers in the European Community Context. *Comparative Education*, *26*(1), 45–59.

Fennema, E., Carpenter, T. P., & Loef, M. (1990). *Teacher belief scale: Cognitively guided instruction project*. Madison: University of Wisconsin.

Flüglister, P., Born, R., Flückinger, V., & Kuster, H. (1985). *Alltagstheorien von Berufschullehrern über ihr unterrichtliches Handeln: Wissenschaftlicher Schlussbericht. Nationales Forschungsprogramm „Bildung und das Wirken in Gesellschaft und Beruf" (NFP).* [Everyday theories of vocational teachers concerning their teaching: Final scientific report of the National Research Program "Education and its effects on society and the workplace"] *Project number 4.319.0.79.10 / 4.664.0.83.10*. Bern.

Fuller, A., & Unwin, L. (2003). Fostering workplace learning: Looking through the lens of apprenticeship. *European Educational Research Journal*, *2*(1), 41-55.

Girke, U. (1999). *Subjektive Theorien zu Unterrichtsstörungen in der Berufsschule: Ein Vergleich von Lehrern als Lehramtsstudenten und Referendaren sowie Lehrern im ersten Berufsjahr* [Subjective theories of classroom disruptions. A comparison of teachers as students in teacher training and as teachers during their first year of employment]. Frankfurt a.M.: Lang.

Grigutsch, S., Raatz, U., & Törner, G. (1998). Einstellungen gegenüber Mathematik bei Mathematiklehrern. [Mathematics Teachers Attitudes towards Mathematics] *Journal für Mathematik-Didaktik*, *19*(1), 3-45.

Groeben, N., & Scheele, B. (2000). Dialogue-Hermeneutic Method and the "Research Program Subjective Theories". *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *1*(2). Retrieved from http://nbn-resolving.de/urn:nbn:de:0114-fqs0002105

Groeben, N., Wahl, D., Schlee, J., & Scheele, B. (1988). *Das Forschungsprogramm Subjektive Theorien: Eine Einführung in die Psychologie des reflexiven Subjekts* [The Research Programme Subjective Theories. An Introduction into the Psychology of the Reflexive Subject]. Tübingen: Francke.

Hackman, J. R., & Oldham, G. R. (1975). Development of the job diagnostic survey. *Journal of Applied Psychology*, *60*(2), 159-170.

Hartinger, A., Kleickmann, T., & Hawelka, B. (2006). Der Einfluss von Lehrervorstellungen zum Lernen und Lehren auf die Gestaltung des Unterrichts und auf motivationale Schülervariablen [The influence of teachers' conceptions of teaching and learning on the design of lessons and on motivational pupil variables]. *Zeitschrift für Erziehungswissenschaft*, *9*(1), 110-126.

Hofer, B. K. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational Psychology*, *25*(4), 378-405.

Hofer, B. K. (2002). Personal epistemology as a psychological and educational construct: An introduction. In B. K. Hofer, & Pintrich P. R. (Eds.), *Personal epistemology. The psychology of beliefs about knowledge and knowing* (pp. 3-14). Mahwah, NJ: Erlbaum.

Hofer, B. K., & Pintrich P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research*, *67*(1), 88-140.

Hugener, I., Pauli, C., Reusser, K., Lipowsky, F., Rakoczy, K., & Klieme, E. (2009). Teaching patterns and learning quality in Swiss and German mathematics lessons. *Learning and Instruction*, *19*(1), 66-78.

Jutzi, K. (1997). *Schlüsselqualifikationen und betriebliches Ausbildungspersonal: Eine Erkundungsstudie zu subjektiven Konzeptionen von Schlüsselqualifikationen bei hauptamtlichen Ausbildern im gewerblichen Bereich der elektro- und metallverarbeitenden Industrie in Schleswig-Holstein* [Key qualifications and company training personnel: An explorative study into subjective conceptions of key qualifications for full-time trainers in the electric and metal manufacturing industries of Schleswig-Holstein]. Kiel: IPN.

Keck, A. (1995). *Zum Lernpotential kaufmännischer Arbeitssituationen: Theoretische Überlegungen und empirische Ergebnisse zu Lernprozessen von angehenden Industriekaufleuten an kaufmännischen Arbeitsplätzen* [The learning potential of work situations in business: Theoretical considerations and empirical results for learning processes of prospective industrial clerks]. Göttingen: Georg-August-Universität.

Kember, D. (1997). A reconceptualisation of the research into university academics' conceptions of teaching. *Learning and Instruction*, *7*(3), 255-275.

Koch, R., Jahn, R. W., Schumann, J., & Schiller, S. (2009). Aufgaben- und Rollenpluralität des beruflichen Bildungspersonals: Ergebnisse einer empirischen Untersuchung [Task and role pluralities of vocational training personnel: Results of an empirical study]. *bwp@ Berufs- und Wirtschaftspädagogik – online, Profil2*. Retrieved from www.bwpat.de/profil2/koch_etal_profil2.pdf

Lederman, N. G., & Zeidler, D. L. (1987). Science teachers' conceptions of the nature of science: Do they really influence teaching behaviour. *Science Education*, *71*(5), 721-734.

Leidner, M. (2002). Subjektive Interessenstheorie nebenberuflicher Ausbilder im Handwerk [Subjective interests theory of part-time trainers in trade]. *Zeitschrift für Berufs- und Wirtschaftspädagogik*, *98*(2), 268-277.

Leu, H. R., & Otto, E.-M. (1981). Ausbildung und Auszubildende in der Sicht von Berufsschullehrern und Ausbildern [Training and trainees from the perspective of vocational teachers and trainers]. *Zeitschrift für Pädagogik*, *27*(5), 711-722.

Leveson, L. (2004). Encouraging better learning through better teaching: A study of approaches to teaching in accounting. *Accounting Education*, *13*(4), 529-548.

Lipowsky, F., Rakoczy, K., Pauli, C., Drollinger-Vetter, B., Klieme, E., & Reusser, K. (2009). Quality of geometry instruction and its short-term impact on students' understanding of the Pythagorean theorem. *Learning and Instruction*, *19*(6), 527-537.

Lucas, U. (2002). Contradictions and uncertainties: Lecturers' conceptions of teaching introductory accounting. *British Accounting Review*, *34*(3), 183-203.

Marton, F. (1990). The phenomenography of learning: A qualitative approach to educational research and some of its implications for didactics. In H. Mandl, E. de Corte, N. Bennett, & H. F. Friedrich (Eds.), *Learning and instruction* (pp. 601-616). Oxford: Pergamon.

May, G. S., Windal, F. W., & Sylvestre, J. (1995). The need for change in accounting education: An educator survey. *Journal of Accounting Education*, *13*(1), 21-43.

Michelsen, U. A. (1979). *Der Ausbilder in der Industrielehrwerkstatt: Tätigkeit, Berufseinstellung, Ausbildung* [The trainer in the industry training workshop: Duties, work habits, training]. Trier: Spee.

Mladenovic, R. (2000). An investigation into ways of challenging introductory accounting students' negative perceptions of accounting. *Accounting Education*, *9*(2), 135-155.

Müller, C. T. (2004). Subjektive Theorien und handlungsleitende Kognitionen von Lehrern als Determinanten schulischer Lehr-Lern-Prozesse im Physikunterricht [Subjective Theories and Guiding Cognitions as Determinants of School-based Teaching and Learning Processes in Physics Lessons] *Studien zum Physikunterricht.* Vol. 33. Berlin: Logos.

Müller, S., Rebmann, K., & Liebsch, E. (2008). Überzeugungen zu Wissen und Lernen von Ausbilder(inne)n: Eine Pilotstudie [Trainers' conceptions of knowledge and learning: A pilot study]. *Europäische Zeitschrift für Berufsbildung*, *45*(3), 99-118.

Noss, M. (2000). *Selbstgesteuertes Lernen am Arbeitsplatz* [Self-controlled learning in the workplace]. Wiesbaden: Gabler.

Op't Eynde, P., De Corte, E., & Verschaffel, L. (2002). Framing students' mathematics-related beliefs: A quest for conceptual clarity and a comprehensive categorization. In G. C. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs. A hidden variable in mathematics education?* (pp. 13-37). Dordrecht: Kluwer.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, *62*(3), 307-332.

Patry, J.-L., & Gastager, A. (2002). Subjektive Theorien von Lehrerinnen und Lehrern: Der Übergang von der Idiographie zur Nomothetik [Subjective Theories of teachers: The Transition from Idiographic to Nomothetic]. In W. Mutzeck, D. Wahl, & J. Schlee (Eds.), *Psychologie der Veränderung. Subjektive Theorien als Zentrum nachhaltiger Modifikationsprozesse* [Psychology of change: Subjective theories as central to sustainable modification processes] (pp. 53-78). Weinheim: Beltz.

Pätzold, G., & Drees, G. (1989). *Betriebliche Realität und pädagogische Notwendigkeit: Tätigkeitsstrukturen, Arbeitssituationen und Berufsbewußtsein von Ausbildungspersonal im Metallbereich* [Operational reality and pedagogical necessity: Task structures, work situations and the professional awareness of training personnel in the metal industry]. Köln: Böhlau.

Peterson, P. L., Fennema, E., Carpenter, T. P., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. *Cognition and Instruction*, *6*(1), 1-40.

Pratt, D. D. (1992). Conceptions of teaching. *Adult Education Quarterly*, *42*(4), 203-220.

Prawat, R. S. (1992). Teachers' beliefs about teaching and learning: A constructivist perspective. *American Journal of Education*, *100*(3), 354-395.

Prosser, M., Trigwell, K., & Taylor, P. (1994). A phenomenographic study of academics' conceptions of science learning and teaching. *Learning and Instruction*, *4*(3), 217-231.

Schoenfeld, A. H. (2002). How can we examine the connections between teachers' world views and their educational practices? *Issues in Education*, *8*(2), 217-227.

Schommer, M., & Walker, K. (1995). Are epistemological beliefs similar across domains? *Journal of Educational Psychology*, *87*(3), 424-432.

Schraw, G., Bendixen, L. D., & Dunkle, M. E. (2002). Development and validation of the epistemic belief inventory (EBI). In B. K. Hofer & Pintrich P. R. (Eds.), *Personal epistemology. The psychology of beliefs about knowledge and knowing* (pp. 261-275). Mahwah, NJ: Erlbaum.

Seifried, J. (2009). *Unterricht aus der Sicht von* Handelslehrern [Instruction from the Point of View of Commercial School Teachers]. Frankfurt a.M.: Lang.

Seifried, J. (2012). Teachers' beliefs at vocational schools – an empirical study in Germany. *Accounting Education: An international Journal*. iFirst (online), DOI:10.1080/09639284.2012.661606.

Selinger, Y. (2007). Berufliches Selbstverständnis und Sichtweisen von Praxisleitern zu formalen und inhaltlichen Aspekten der Altenpflegeausbildung [Professional Self-Comprehension and Perspectives of Practical Leaders on Formal and Content-Related

Aspects of Training of Carers]. *PrinterNet. Die Zeitschrift für Pflegewissenschaft*, *9*(10), 608-621.

Stahl, E., & Bromme R. (2007). The CAEB: An instrument for measuring connotative aspects of epistomological beliefs. *Learning and Instruction*, *17*(6), 773-785.

Staub, F. C., & Stern, E. (2002). The nature of teachers' pedagogical content beliefs matters for students' achievement gains: Quasi-experimental evidence from elementary mathematics. *Journal of Educational Psychology*, *94*(2), 344-355.

Stipek, D. J., Givvin, K. B., Salmon J. M., & MacGyvers V. L. (2001). Teachers' beliefs and practices related to mathematics instruction. *Teaching and Teacher Education*, *17*(2), 213-226.

Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education*, *37*(1), 57-70.

Tynjälä, P. (2008). Perspectives into learning at the workplace. *Educational Research Review*, *3*(2), 130-154.

Vogg, A. (2010). *Sichtweisen betrieblicher Ausbilder auf Fehler im Arbeitsprozess: Eine empirische Untersuchung* [Perspectives of company trainers on mistakes during work processes: An empirical study]. Unveröffentliche Diplomarbeit, Universität Konstanz.

Wuttke, E., & Seifried, J. (2012). Ansätze der Identifikation typischer Schülerfehler: Ergebnisse aus Studien in kaufmännischen Schulen [Approaches to the identification of typical student errors: Results from studies in a vocational school]. *Unterrichtswissenschaft, 40*(2), 174-192.

Ziegler, B. (2006). „Subjektive Theorien" und didaktisches Handeln: Forschungsaktivitäten und Befunde zu Lehrenden in der beruflichen Bildung ["Subjective theories" and didactic acting in class: Research activities and findings of teachers in vocational education]. *Zeitschrift für Berufs- und Wirtschaftspädagogik*, *102*(4), 525-551.

Chapter 9
Teacher Beliefs and Technology Integration Practices: Examining the Alignment between Espoused and Enacted Beliefs

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Abstract

This multiple case-study research addressed the question, "How do the pedagogical beliefs and classroom technology practices of teachers, recognized for their technology uses, align?" Twelve K-12 teachers were purposefully selected based on their award-winning technology practices, supported by evidence from their websites. One-on-one interviews were conducted to examine the correspondence between teachers' classroom practices and their pedagogical beliefs. Results suggest close alignment; that is student-centered beliefs undergirded student-centered practices. Teachers' beliefs and attitudes about the relevance of technology to students' learning were perceived as having the biggest impact on their success. Most teachers indicated that internal factors (e.g., passion for technology) and support from others (e.g., personal learning networks) played key roles in shaping their practices. Recommendations are made for refocusing professional development efforts on strategies for facilitating changes in teachers' attitudes and beliefs.

Keywords:
Teacher beliefs, student-centered instruction, technology integration, teacher professional development

9.1 Introduction

For over three decades, researchers (Kagan, 1992; Nespor, 1987) have argued that teacher beliefs, the "internal constructs that help teachers interpret experiences and that guide specific teaching practices" (Park & Ertmer, 2007-2008, p. 248), are key to understanding teachers' classroom practices including their instructional approaches (Nespor, 1987), classroom management techniques (Bryan & Atwater, 2002), as well as the technology resources used to enable students to understand specific subject matter (Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010). According to Richardson (1996), "In most current conceptions, the perceived relationship between teachers' beliefs and actions is interactive" (p. 104). That is, while beliefs are generally thought to drive action, experiences can also drive changes in beliefs.

Early work by Hadley and Sheingold (1993) and Becker (1994) demonstrated a common pattern in the relationship between teachers' pedagogical beliefs and their technology integration practices: teachers with constructivist beliefs tended to use technology to support student-centered curricula while those with traditional beliefs used computers to support more teacher-directed curricula. This pattern has been replicated by more current work (Andrew, 2007; Hermans, Tondeur, van Braak, & Valcke, 2008), and appears to hold true despite teachers' differing levels of resources, training, and support (Ertmer, Gopalakrishnan, & Ross, 2001; Ertmer & Hruskocy, 1999).

Given this relationship between pedagogical beliefs and technology integration practices, researchers initially assumed that teachers with student-centered beliefs would readily translate those beliefs into constructivist technology practices (Sandholtz, Ringstaff, & Dwyer, 1997). However, early studies (Berg, Benz, Lasley, & Raisch, 1998; Ertmer et al., 2001) indicated that teachers' *enacted* beliefs, as represented by classroom technology practices, often did not align with *espoused* beliefs. That is, teachers with constructivist beliefs were observed, at least in some instances, to use technology in fairly traditional ways – asking students to complete drill and practice exercises or to fill in computer-generated worksheets (Ertmer et al., 2001). Reasons for the disparity between practices and beliefs were attributed to the external constraints placed on teachers by pre-determined curricular or assessment practices. Other researchers reported that teachers' abilities to implement constructivist beliefs were often limited by difficulties associated with meeting individual student needs, balancing multiple objectives (Ravitz, Becker, & Wong, 2000), and responding to external forces such as limited time and access (Berg et al., 1998).

Although external factors may explain some of the disparity between beliefs and practices, internal factors cannot be ruled out (Ertmer, 1999). That is, second-order barriers (internal to the teacher) may exert more influence over teachers' practices than first-order barriers (external to the teacher). As such, teachers' knowledge, attitudes, and beliefs may play a more critical role in the enactment of student-centered practices than specific classroom resources (Ertmer, 2005). However, it is currently unknown whether a minimal threshold exists, below which resources must not fall, in order for teachers to successfully align their student-centered beliefs with meaningful technology use.

Munby (1982) suggested that when teachers' beliefs and practices appear misaligned, closer scrutiny often reveals "different and weightier" beliefs at work (p. 216). Rokeach (1968) proposed that beliefs vary in strength and that those more central to a person's identify have more connections to other beliefs and actions. While it is possible that a teacher's core belief (e.g., teachers are responsible for helping their students learn skills) might overrule a less-central belief (e.g., technology should be used to support higher-level thinking), a strong core belief (e.g., the importance of engaging students in authentic work) might also enable a teacher to overcome or circumvent external constraints that normally prevent the enactment of student-centered beliefs.

9.1.1 Research Purpose and Question

Recent improvements in teachers' access to technology resources (U. S. DOE, 2010) provide the opportunity to re-examine the relationship between teachers' beliefs and practices. If resource barriers are no longer operational in teachers' classrooms today, or are operating below a minimal threshold, we may be in a better position to observe how teachers enact their beliefs through purposefully selected practices. This study was designed to address the overarching question: *How do the pedagogical beliefs and classroom technology practices of teachers, recognized for their technology uses, align?*

9.2 Methods

We used a multiple case-study research design to examine the similarities and differences among the pedagogical beliefs and technology practices of 12 K-12 classroom teachers. Data were collected via in-depth analyses of teachers' websites, followed by one-on-one interviews. Websites provided evidence of teachers' classroom technology practices while interviews provided insights into the extent to which beliefs supported those practices. Interview data were analyzed to identify patterns among teachers' espoused beliefs. Websites were analyzed using the criteria of student-centeredness (Bellanca & Brandt, 2010; see Table 9.1).

9.2.1 Role of the Researcher

This study was designed and conducted by a team of five researchers. A secure online spreadsheet was used to track information about potential participants during the selection process. Interviews were conducted by two faculty researchers and transcribed by three graduate student researchers. The first round of data analysis was completed by the two interviewers then discussed among all team members to reach consensus regarding overall themes.

9.2.2 Selection of Participants

Participants were selected using a purposeful sampling strategy (Patton, 2002). We began with an online search for technology award winners over the past few years (e.g., International Society for Technology in Education, Apple, Edublog), initially identifying 78 potential participants. Using a three-step selection process (described in more detail in Data Collection), we identified 20 teachers whose websites presented the most apparent student-centered practices.

Table 9.1: Categories of Classroom Practices – Teacher Centered to Student Centered

CATEGORIES OF CLASSROOM PRACTICE	TEACHER-CENTERED Teacher-directed Primarily Didactic	STUDENT-CENTERED Student-directed Primarily Interactive
TEACHER ROLE	▪ Present information ▪ Manage classroom	▪ Guide discovery ▪ Model active learning ▪ Collaborator (sometimes learner)
STUDENT ROLE	▪ Store, remember information ▪ Complete tasks individually	▪ Create knowledge ▪ Collaborator (sometimes expert)
CURRICULAR CHARACTERISTICS	▪ Breadth – focused on externally mandated curriculum ▪ Focus on standards ▪ Fact retention ▪ Fragmented knowledge and disciplinary separation	▪ Depth – focused on student interests ▪ Focus on understanding of complex ideas ▪ Application of knowledge to authentic problems ▪ Integrated multidisciplinary themes
CLASSROOM SOCIAL ORGANIZATION	▪ Independent learning ▪ Individual responsibility for entire task	▪ Collaborative learning ▪ Social distribution of thinking
ASSESSMENT PRACTICES	▪ Fact retention ▪ Product oriented ▪ Traditional tests ▪ Norm referenced ▪ Teacher-led assessment	▪ Applied knowledge ▪ Process oriented ▪ Alternative measures ▪ Criterion referenced ▪ Self-assessment and reflection
TECHNOLOGY ROLE	▪ Drill and practice ▪ Direct instruction ▪ Programming	▪ Exploration and knowledge construction ▪ Communication ▪ Collaboration, information access, expression) ▪ Tool for writing, data analysis, problem-solving
TECHNOLOGY CONTENT	▪ Basic computer literacy ▪ Skills taught in isolation	▪ Emphasis on thinking skills ▪ Skills taught and learned in context and application

Adapted from Ertmer et al. (2001)

9.2.3 Description of Participants

Participants included seven females and five males who had been teaching an average of 14.8 years. Nine participants taught at the elementary level, two at the middle school level, and one at both the middle and high school level. Of the 12 interviewees, 11 were classroom teachers; one was a computer teacher. Classroom resources varied greatly among the teachers. Some teachers enjoyed one-to-one laptop access, while others used old computers, brought in their own personal devices, or scheduled computer lab time (see Table 9.2 for more details).

9.2.4 Data Collection and Analysis

Data were collected from two primary sources: teacher websites and individual interviews. After identifying our initial pool of 78 teachers, we revisited teachers' websites to determine if there were enough information to make a fair assessment of teachers' classroom practices related to student-centered technology use. Forty-one of the 78 teachers were dropped from the sample due to a lack of information or lack of evidence related to student-centered practices.

A preliminary analysis was completed on the websites of the remaining 37 teachers, using the criteria of student-centeredness. Specifically, we looked at 1) at the extent to which students, rather than teachers, used the technology, 2) the level of interactivity (with content, teacher, and peers) and collaboration evident, 3) the types of homework assignments students were asked to complete, 4) the resources and web links teachers provided for their students, and 5) the types of assessments used. Based on the results of this preliminary analysis, we identified 25 teachers who "showed promise" and began a more extensive analysis of their websites, rating each, on a scale from 1-5 (with 5 being most student-centered), on the seven categories listed in Table 9.1 (Ertmer et al., 2001). Following this analysis, we invited 20 teachers to participate in follow-up interviews; 12 agreed.

Interviews were conducted over a month's time in Spring 2011, lasted 35 to 60 minutes, were audio-taped, and transcribed. The majority of teachers were interviewed via Skype; four were interviewed by telephone. A semi-structured interview protocol was used, which allowed for additional questions to be added as needed. Interviews began by securing teachers' consent to participate. Demographic data, not available on teachers' websites, were gathered, and then participants were asked to describe their journeys in becoming technology-using teachers. Additional questions prompted teachers to share examples of successful lessons or projects in which technology was used, to describe factors that prevented them from implementing technology according to their beliefs, and to name the factor(s) that had the biggest impact on their ability to use technology. Teachers also were asked to rate, on a scale from 1 to 5 (5 being the most and 1 being the least), the level of impact different factors had on their practices and the technology practices of other teachers.

Table 9.2: Demographic Information for Selected Participants

NAME	GENDER	YEARS OF EXP.	ADVANCED DEGREE	GRADE LEVEL	CONTENT AREA	CLASS-ROOM SIZE	RESOURCES
Abernethy	Female	14	Master's Degree (Instructional media)	5th grade	Classroom teacher	26	2 flip videos, smart board, teacher lap top and projector, airliner, karaoke machine, 4-5 desktop computers, iPad, digital camera, u-star, green screen, 4 computer labs
Barnes	Male	19	Master's Degree (Teaching and Learning)	7th, 8th, 10th and 12th grades	Language	16-26	2 computer labs, 5 classroom computers, smart board
Buller	Female	31		4th grade	All subjects	24	2 classroom computers, a teacher laptop, 1 computer lab, smart board
Cassidy	Female	17		1st grade	Classroom teacher	18	2 desktops and 3 laptops in classroom, netbooks, and iPads
Coley	Male	15	Master's Degree (Curriculum and Instruction)	5th grade	Language, Social Studies, Math, Science	30	Student iPods, camera, computers, LCD projector
Crosby	Male	30	Master's equivalency	4th, 5th and 6th grades	Classroom teacher	23	Student laptops, 4 digital cameras, sound system, active board, teacher desktop computer, printer
Cross	Female	2	Master's Degree (Mild/ Moderate Disabilities)	1st grade	Classroom teacher	19	4 computers, personal equipment (iPhone, iPod touch, and iPod)
deHaan	Male	6	Master's Degree (Communi-cation and Digital Media)	Middle School	Technology	12-22	A computer lab
Garcia	Male	10	Master's Degree (Science Education)	6th, 7th, 8th grades	Science	19-26	One to one laptops
Goneau	Female	14	Master's Degree (Curriculum and Instruction)	2nd grade	Classroom teacher	16-18	5 regular computers, iPod, projector, 6 netbooks, 3 iPod touch
Hillman	Female	10	Master's Degree (Curriculum and Instructional Technology)	4th grade	Classroom teacher	20-25	3 computer labs, mobile laptop cart, 3 student computers, teacher computer, interactive whiteboard
Travis	Female	9	Working on Master's Degree (Elementary Education)	4th grade	Reading, Math, Science	16-22	A computer lab, 3 wireless laptop carts, docu-ment cameras, teacher computer, 3 classroom computers, and Interwrite (smart board)

Interviews were analyzed using a constant comparison method (Strauss & Corbin, 1998). Analysis efforts began deductively, looking for evidence of student-centered practices or beliefs, using the categories in Table 9.1. Each interview transcript was read multiple times to identify patterns. A case record was created for each participant; interview quotes were added to support espoused beliefs and evidence from teachers' websites was linked to enacted beliefs.

9.2.5 Issues of Validity and Reliability

In this study, *credibility* was enhanced through triangulation of multiple data sources (e.g., interviews, teacher websites). The use of multiple researchers and the use of member checks led to *confirmability* of the data (Lincoln & Guba; 1985). In the early stages of the study, regularly scheduled team meetings were held to establish and clarify our research questions, identify our criteria for participant selection, and develop our interview protocol. After data were collected, the two lead researchers examined the data individually and then collaboratively to reach consensus regarding the patterns of alignment among beliefs and practices. Subsequently, alignment patterns were presented to the rest of the team for comment and verification. Finally, after tentative results were drafted, member checks were completed with the participants and suggested revisions were made.

9.3 Results

In this study we examined the beliefs and practices of 12 award-winning technology-using teachers to determine the alignment between their beliefs, as expressed in one-on-one interviews, and their practices, as evidenced on their websites and described during their interviews. We also explored teachers' perceptions of the factors that most impacted their technology integration practices.

9.3.1 Alignment Among Beliefs and Practices

For 11 of the 12 teachers in this study, espoused and enacted beliefs appeared well aligned. For example, when asked to describe her beliefs about the best ways to use technology in the classroom, Cassidy indicated that technology enables students to collaborate: "*Ideally technology allows the classroom to be open to the world. It's a portal for kids who can show their work and get feedback. It allows for collaboration between classes via Skype, blogs, and Google docs and wikis*." Her practices closely aligned with these beliefs. For example, students in her first-grade classroom kept individual blogs on which they posted their thoughts about various classroom activities including "Why we use video" and "My adding strategy," and on which others could

comment. When asked to describe a successful technology project, Cassidy described her breakfast project, which used Google Docs, blogs, Twitter, and Wordle to help students meet specific social studies' standards:

> *One of the objectives in social studies is that you understand that people in different places eat different things ... We decided we wanted to know what other people around the world would have [for breakfast]. I set up a Google doc and each of my kids typed in what they had for breakfast and where they lived. And then I just put a little link to it on my blog and I put a link on Twitter and said, "Can you help some grade one students? Tell us what you have for breakfast."*

When asked why she thought this was a successful project, Cassidy referenced her belief about the importance of using technology for collaboration: *"Kids were learning the value of collaboration, learning from other people. I think it was successful because the students learned from each other. And then they were able to learn from the other people and they were able to learn something that they didn't expect to learn."*

In another example, Barnes indicated that one of his most fundamental beliefs was the need to provide students with choices. According to Barnes, teachers should serve as facilitators in the learning process, answering questions along the way and providing just-in-time learning:

> *We really have to create choice for the kids. [I am] trying to create menus of learning outcomes to say, "Here is what we want to learn, this is the end result. I'd like you to show me how you learned. You can use a blog, podcast, video, slide show program." And they apply and practice, discuss and share and create. And the teacher just goes around and facilitates.*

On his website, Barnes provided a wide range of ideas for potential student projects (e.g., collages, comic strips, newspapers, commercials, posters). He encouraged students to think "outside the box" and to propose new ideas to him. This example, like the previous one, showcases a strong alignment between beliefs and practices (see Table 9.3 for more brief examples).

Table 9.3: Teachers who Demonstrated Close Alignment among Beliefs and Practices

TEACHER	BELIEFS	PRACTICES	ROLE OF TECHNOLOGY
Cross	Technology to deliver content; reinforce skills	Math stations; use technology to keep other students busy interacting with the content	Supplement to Reinforce Skills
Coley	Technology as a motivator; as a leverage for education; as a supplement; reinforces writing and speaking skills	Uses technology to present information learned and to allow students to study for exams (podcasts)	Supplement to Reinforce Skills
DeHaan	For motivation; appropriate tool for learning specific skills in context (e.g., writing)	Teaching procedural thinking (e.g., programming); digital identity website	Enrich
Goneau	Complements the curriculum; provides student choice; collaborative work; engages students	Mimeo presentation on animals; teacher as facilitator	Enrich
Hillman	Student-centered; authentic applications; peer teaching and student choices	iMovies; digital storytelling	Enrich
Abernethy	Technology as an educational tool; learn skills in context; student choice and excitement	Literature circles; present what they've learned; teach each other; excitement about reading	Enrich
Cassidy	Technology for collaboration; share work with others; higher order thinking; student learning	Breakfast project using Google docs and Wordle; student blogs; videos capturing student thinking	Enrich
Travis	For higher order thinking and collaboration (make connections to real world); student excitement and engagement	Teacher-created WebQuest; created video sharing the importance of math in real world. Student learning and excitement	Enrich
Barnes	Teachers as facilitators; student choice; applied to learning	Results Only Learning Environment (ROLE); Students choose their own books; choose ways to demonstrate learning; engaged learning	Transform
Crosby	Tool for learning; as needed to complete certain tasks (transparent); student collaboration; higher-order thinking	Energizing energy project – cross-school collaboration; kids teaching each other; higher order thinking (e.g., students anticipating where others might struggle)	Transform
Garcia	Help students become 21st century literate; technology to solve problems; motivates students	Challenge-based Learning; claymation movies for learning microbiology; students teach each other; engaged learning	Transform

9.3.2 Factors Influencing Technology Integration

Teachers were asked to rate, on a scale from 1 (not at all) to 5 (very much), the extent to which various factors impacted their students' uses of technology (see Table 9.4). Average ratings indicate that although barriers were present, none were considered particularly impactful (all averaging less than 3 out of 5). Teachers' ratings suggest that external barriers were more impactful than internal barriers. The most impactful barriers, with a ranking greater than 2.5, were all external. Attitudes and beliefs of *other* teachers were perceived to be the most impactful barrier on students' uses of technology (M=3.17).

In contrast, among the top three *least-impactful* barriers, two were internal. That is, teachers' own attitudes and beliefs received an average score of 1; all 12 teachers believed that their own attitudes and beliefs were *not* a barrier to their students' uses of technology. Similarly, as the third lowest-rated barrier, teachers indicated that their own knowledge and skills (M=1.42) were not a barrier to their students' uses of technology.

Table 9.4: Perceptions of the Impact of Different Factors on Technology Integration

FACTORS INFLUENCING TECHNOLOGY INTEGRATION (from most to least impactful)	AVERAGE RATING OF IMPACT (1 = not at all a factor 5 = very much a factor)
Attitudes and Beliefs (Other teachers)	3.17
Technology Support	3.00
State Standards	2.83
Money	2.83
Technology Access	2.67
Time	2.58
Assessments (Standardized, State)	2.50
Technology Problems	2.33
Institution (Administration)	2.09
Subject Culture	1.91
Knowledge and Skills (Students)	1.83
Institution (Community)	1.42
Knowledge and Skills (Their own)	1.42
Institution (Parents)	1.33
Attitudes and Beliefs (Their own)	1.00

Internal factors are highlighted.

When asked to describe the biggest *enablers* to their technology integration practices, five teachers mentioned internal factors (their own attitudes and beliefs or knowledge

and skills) as the strongest contributing factor. Four teachers mentioned the important role professional learning networks (e.g., Twitter, blogs, professional development) played in their integration of technology. Three teachers mentioned the support of their administrators, while two mentioned student motivation and engagement as most influential.

9.3.3 Role of Technology

It is important to note that finding close levels of alignment among the beliefs and practices of 11 teachers doesn't mean they were using technology in identical, or even similar, ways. Two teachers described using technology to help students *learn content and skills*, six teachers used technology to *complement or enrich* the current curriculum, and three teachers reported using technology in *transformative* ways (see Table 9.3). The one teacher, for whom beliefs and practices did not closely align, described using technology in ways that both reinforced skills and enriched the curriculum.

Technology to deliver content and reinforce skills
On their websites, as well as in their interviews, two teachers provided evidence of using technology to help students learn skills. For example, in her interview, Cross described using technology to help her deliver math content and reinforce math skills: "*I think that the main goal has still got to be delivering the content."* When asked to describe the most successful technology project she had implemented, Cross described using technology during her math stations to allow her to work with small groups of students – a task with which she previously had difficulties. Thus, the students who were *not* working with her used technology to reinforce specific skills they were learning: *"I wanted to work with children in small groups to deliver math instruction, but it was always a struggle for me. Technology has allowed me to fix this because I'll teach one small group and then another small group can be working with the technology, playing games that are reinforcing the exact same skills."*

Coley believed that since students already used technology for other purposes outside of school, technology in the classroom should be leveraged for educational purposes: "*Kids have iPods already. You might as well leverage them for educational purposes. Create content that could go on these iPods or on their cell phones… you can leverage it."* As evidenced on his website, Coley created a series of podcasts to help his students study for exams. In addition, students summarized content they were learning by working in groups to create their own podcasts. Coley commented on the successfulness of these types of uses: "*That's been very successful because it is a great way to review the material; whether before or after the test, it is a great way to [reinforce] what they have learned."*

Technology to complement or enrich the curriculum

Six teachers used technology to enrich the current curriculum. For example, students in Abernethy's fifth-grade class created book summaries using a variety of Web 2.0 tools as part of their work for literature circles. Abernethy explained that by offering students more choices, they were more excited to participate in weekly literature circles and seemed more excited about reading. Similarly, Travis asked her fourth-grade students to complete a teacher-created WebQuest to gather information about how math is used in the real world. Students then created their own videos of a job they wanted and how it could involve math. Travis reported that this project was successful because her students were engaged in their learning and were able to make connections to the real world. Goneau allowed her second-grade students to select an animal group to research and then create a Mimio presentation, which they presented to the entire class. Students were encouraged to explore the software on their own while Goneau served as a facilitator: "*You have to be a guide on the side where you're walking around, and helping them as they are learning."*

Teachers in this category were observed to use technology in ways that enabled students to go beyond what they were learning in specific subjects and to give students more choices for demonstrating their learning. These teachers also believed that students were more motivated and engaged when they worked on the computer. As DeHaan stated, "*Technology is a great hook for catching kids' imagination and their attention."* Tanya elaborated, "*To me, that's what it's about. Because of the technology my kids either become excited about something new or go home and want to do it, even when I'm not there."*

Technology to transform teaching and learning

The three teachers classified in this category described uses of technology that supported a new kind of pedagogy. For example, Garcia adopted "challenge-based learning" – a method that combined inquiry-based science learning with project-based technology learning (Johnson & Adams, 2011) – as his approach. Barnes coined the term ROLE, *Results only Learning Environment*, modeled after the Results only Work Environment (Pink, 2009), to portray his innovative approach. Similarly, Crosby referred to what was happening in his classroom as "a new pedagogy, a new way of doing school."

For these three teachers, technology was a tool that allowed them to experiment, implement, and refine these new approaches to teaching and learning. According to Garcia, he developed his approach through trial and error over four years of traditional teaching. He credits his evolution to three factors: 1) professional development in both content and pedagogy, gained through his master's degree program, 2) support from his administration to think outside the box, and 3) being in the right place at the right time. Given his belief that *"You cannot use traditional methods to teach the new student, the 21st century student,"* Garcia was committed to enacting an approach that more deeply engaged his students.

Barnes, a secondary language arts teacher, described his efforts to find more effective ways to reach his students as constantly evolving. After doing "a lot of research," he experimented with a few small projects involving message boards and gradually *"it [technology] reshaped the way I teach*." This eventually led to the development and implementation of his ROLE philosophy, which comprises a project-based approach, focused on results, with students assuming the lead role in their learning. Barnes explained: "*If you walk into my room and you are not sure if I am even there, but the kids are engaged, I feel I am successful because it really has to be student centered."*

Crosby, a fifth grade teacher with 30 years experience, has been using technology since his second year of teaching. Given the very diverse, at-risk population with which he works, Crosby stressed the importance of "giving students opportunities to build schema for the world." His goal is for students to "learn a ton" and to "learn deeply." Like Barnes, Crosby uses a project based approach and explained how "technology leverages that to the max." In his interview he stated, *"I want to give people a taste of what a classroom that does 21st century pedagogy could look like."* In his TED talk, made at the 2010 ISTE (International Society for Technology in Education) conference, he explained further:

> *That type of environment should not be the exception, the unearned privilege of the children of privileged parents and those lucky enough to attend a school with high test scores. That type of education is the birthright of every child. ... We need to build schools that honor kids and make this happen for everyone* (from http://www.youtube.com/watch?v=66mrAzz7nLw)

As shown in Table 9.3, simply achieving alignment among beliefs and practices may not lead to the same types of integration practices, even among award-winning technology using teachers. What is unclear, however, is if continued use will lead to more transformative beliefs and/or practices. And if so, which aspect, beliefs or practices, should be targeted first?

9.3.4 Discrepant Case: Non-Alignment among Beliefs and Practices

In this study, we observed an apparent mismatch between the beliefs and practices of one of our 12 teachers, with espoused beliefs appearing more student-centered than enacted beliefs/practices. More specifically, Buller, a fourth grade teacher at a small parochial school, expressed her belief that learning should be hands-on for students: *"[Students] need to be hands-on and they need to be involved."* However, this belief did not consistently translate into higher levels of technology use. For example, students completed web-based programs, such as *Study Island,* once a week to practice their math and language arts skills. In contrast, she described her most successful technology project as the Oreo project in which students stacked Oreos, posted their data, and then compared their results with those from other classes around the world.

She rated this project as successful because it was "*hands on, interest was high, and because of the collaboration aspect,"* which Buller noted was *"the best part."* These different uses of technology suggest that Buller may be "in transition," moving from an emphasis on skills to one in which she uses technology to enrich the curriculum.

To explain this observed mismatch, we examined the potential barriers that may be impacting, or constraining, Buller's practices. Not surprisingly, Buller worked in a school context with very few resources available. Her school had just recently installed a fiber optic line, thus, severely limiting her previous access to web resources. In addition, Buller's students had access to only two classroom computers and one computer lab, which they could use "once every couple of weeks." Given these constraints, it is quite possible that her beliefs have not yet been fully enacted simply due to her limited access. This is similar to findings reported by both Berg et al. (1998) and Ertmer et al. (2001). Revisiting this teacher in the future, after greater access is achieved, could inform our growing understanding of this critical relationship.

9.4 Discussion

9.4.1 Alignment among Beliefs and Practices

In this study, we examined the alignment among the beliefs and practices of award winning technology-using teachers, as well as their perceptions of the factors impacting their practices. Our findings suggest that teachers were able to enact technology integration practices that closely aligned with their beliefs. For example, teachers who believed that technology was best used for collaboration purposes described interesting projects in which students collaborated with local and distant peers. Teachers who believed that technology provided more opportunities for student choice, described examples in which students chose to demonstrate their learning using a variety of technology tools (see Table 9.3). This finding, however, is in contrast to what others have reported (Ertmer et al., 2001; Fang, 1996). For example, Fang's review of the beliefs and practices of reading teachers indicated that although teachers could articulate their beliefs, practices were influenced by "classroom realities" (p. 53) such as student needs, student-teacher relationships, the school culture, and textbooks. We propose three possible explanations for these differences in findings: change in access, change in students, and change in curricular emphases.

Change in access

As noted by Gray et al. (2010), student-computer ratios are at an all-time low, with almost all U.S. teachers now having access to the Internet in their classrooms. In addition, the wide availability of Web 2.0 tools (Schrum & Levin, 2009) has allowed teachers to readily circumvent the "limited resource" barrier previously reported (Hew & Brush, 2007). In this study, all 12 teachers were using Web 2.0 tools to engage students in the curricula. This included teachers working at the elementary, middle, and

high-school levels. It also included teachers who had high numbers of available classroom computers, as well as those with a limited number. Whereas Internet access, when first introduced, provided students with access to information, the evolution of Web 2.0 tools has enabled a greater level of participation, collaboration, and knowledge construction among students (Brandon, 2008). In essence, this has provided a whole new platform for student learning, and one on which the teachers in this study were quick to capitalize.

Change in students

Another possible reason we saw strong alignment among teachers' beliefs and practices relates to teachers' growing understanding of the "new, 21st century" student and how they learn. According to Prensky (2010), "more and more young people are now deeply and permanently technologically enhanced, connected to their peers and the world in ways no generation has been before" (p. 2). This growing realization of the differences between today's students and those of even a few years ago have led many teachers to reflect on the way they teach and to begin to try new methods and tools that are more relevant and engaging. As noted by Taylor and Fratto (2012), "Our education systems must reflect our students' world or we will not only miss the opportunity to capture their attention, but also forgo their full potential to learn and grow" (p. 8). In general, the teachers in this study were all committed to finding ways to prepare their students for the future by leveraging the technology, including Web 2.0 tools, students were already using in their personal lives.

Change in curricular emphases

It is also possible that the alignment observed in this study relates to the current push to prepare our students for the 21st century (Bellanca & Brandt, 2010). The U.S. Department of Education (2010), national curricular organizations (ISTE, 2008), and educational researchers have all called for teachers to incorporate 21st century skills within their curricula (Dede, Korte, Nelson, Valdez, & Ward, 2005). Not surprisingly, school corporations are responding by including this goal in their revised strategic plans (Partnership for 21st Century Skills, 2007). As just one example, the Indiana Department of Education (2011) recently reported that 57% of 392 school corporations now formally address 21st century skills in their curricula. Thus, teachers are being encouraged and supported by their administrators to implement classroom strategies aimed at developing students' self-directed learning, collaboration, and problem-solving skills (Overbay, Patterson, Vasu, & Grable, 2010), all of which support a student-centered pedagogy.

Furthermore, as teachers begin to make these changes, they are finding almost unlimited support (via social networks) to try new ideas, and have more readily found people with whom they can collaborate. Two teachers in our study referred specifically to these networked supports as invaluable in their efforts to integrate technology, claiming that access to an online community of educators was key to their technology uses.

Influencing Factors

This is not to suggest that teachers no longer encounter barriers, they do. However, the primary barriers, at least for these teachers, tended to be first-order, or external, rather than second-order, or internal. In this study, every teacher rated their attitudes and beliefs as "not a barrier" – in fact, five teachers indicated that this was one of the most influential factors enabling them to integrate technology. Not only were their attitudes and beliefs *not* a barrier, they served as a *facilitative* factor, providing the passion and drive needed to devote extra time and effort to enact meaningful technology practices. This is similar to the results Ertmer, Ottenbreit-Leftwich, and York (2006-2007) reported after surveying 25 award-winning technology-using teachers regarding the differential influence of 19 factors. Teachers rated two internal factors (inner drive and personal beliefs) as the most influential. This suggests that the best way to bring more teachers on-board is *not* by eliminating more first-order barriers, but by increasing knowledge and skills, which in turn, have the potential to change attitudes and beliefs. Previous studies have shown that as teachers develop knowledge about how technology can be used to support student-centered learning, beliefs tend to change (Sandholtz & Ringstaff, 1996).

In this study, participating teachers viewed their own attitudes and beliefs as the least impactful barrier, but the attitudes and beliefs of others as the most impactful. That is, while their beliefs did not impede their integration of technology, other teachers' technology attitudes and beliefs were the strongest barrier to the integration of technology within their schools. This is similar to results of Overbay et al. (2010) who reported, "constructivist practices and beliefs were significant predictors of technology use" (p. 103).

However, it is important to remember that when teachers *begin* the process of implementing new pedagogical approaches, resource barriers may more easily impede the enactment of new, as opposed to more established, beliefs (Pajares, 1992). This seemed particularly true for at least one teacher in this study, whose beliefs appeared to be in transition. According to Bebell and Kay (2010), even in situations in which positive changes in teacher attitudes and practices are reported, it still can take several years to reach full implementation and the first year can require a steep learning curve (Suhr, Hernandez, Grimes, & Warschauer, 2010).

As illustrated by our discrepant case, teachers working in schools with very limited technology access may have difficulty aligning beliefs with practice. An alternative explanation, however, is that, as Munby (1982) suggested "different and weightier" beliefs are at work. Perhaps if core beliefs were more aligned with student-centeredness, first-order barriers would not prevent implementation of student-centered practices. In this study, this was certainly true for Hillman, Cross, and Coley, who all brought in their own equipment to facilitate student use. According to Ertmer (1999), the more significant difference between high- and low-level users was not the barriers themselves, but the "relative weight that teachers assigned to first-order barriers" (p. 52). Thus, even if access and resources were low, teachers might overcome these barriers due to strong beliefs about the value of technology.

9.4.2 Limitations and Suggestions for Future Research

Given the relatively small number of participants in this study, results are not readily generalizable. Teachers in this study were selected based on their high levels of technology use, thus providing little insight into how beliefs and practices align for *typical* teachers or for those who are in transition. Our discrepant case suggests that beliefs change before practice and that practices may be limited by first-order barriers, especially if beliefs are in transition. However additional cases are needed to support this conclusion. Finally, teachers' practices were not directly observed, but rather inferred from their websites and *descriptions* of practice, provided during interviews. Observations would provide a richer understanding of enacted beliefs.

9.4.3 Implications and Conclusion

The results of this study have implications for practice, specifically related to the professional development of teachers. First, even among award-winning teachers, barriers (e.g., lack of resources, lack of administrative support, technology problems, standardized tests) are still considered issues by some (U.S. DOE, 2010). Yet, 11 of the 12 teachers in this study were able to enact practices that closely aligned with their beliefs, suggesting that second-order, not first-order, barriers are the true gatekeepers. Although efforts are still needed to provide ubiquitous technology access to teachers and their students, little will be gained if second-order barriers (knowledge and skills, attitudes and beliefs) are not addressed.

The participants in this study viewed their own attitudes and beliefs as *facilitating* technology integration, but the attitudes and beliefs of others as *constraining* integration efforts. Given that our participants were working in schools in which resources were relatively consistent across classrooms, the primary difference was viewed as being internal to others – their knowledge, skills, attitudes, and beliefs. This suggests that professional development should focus, first, on increasing teachers' knowledge and skills, which can then help increase their confidence and reduce the fear associated with using technology (Ertmer & Ottenbreit-Leftwich, 2010).

Before teachers will be persuaded to attempt new student-centered practices, however, it will be important to provide evidence that these practices result in meaningful learning outcomes (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010), especially on standardized tests (Geier et al., 2008). In this study, participants recognized they were not exempt from helping their students master state content standards. However, by putting the responsibility for learning on students, and employing technology as a motivational tool, students were succeeding beyond expectations. For example, 98% of the students in Garcia's class performed at a Level 4 (the highest level) on the most recent state science test compared to previous groups of students whose scores averaged around 30%. These are the types of results teachers need to

hear about to be convinced that using technology will enable their students to succeed on state assessments.

The results of this study suggest we should be utilizing the same technology tools for professional development that teachers are able to use in their classrooms. In a recent report on teacher professional development in the U.S., Darling-Hammond, Wei, Andree, Richardson, and Orphanos (2009) urged educators to provide current and authentic professional development. In this study, Web 2.0 technologies, such as blogs and wikis, enabled many of the teachers to develop new ideas for their classrooms. Perkins (2010) argued that professional development is effective when it comprises "individualized focus, context-based learning, and empowerment of teachers" (p. 15).

Although many teachers are still struggling to achieve meaningful technology integration in their classrooms (NEA-AFT, 2008), recent changes in access, student characteristics, and curricular emphases may provide some much needed impetus in moving teachers' efforts forward. Our hope is that these changes will coalesce into a perfect "technology integration" storm that continues to empower more and more teachers to use technology in ways that prepare our students for the future they will inherit.

References

Andrew, L. (2007). Comparison of teacher educators' instructional methods with the constructivist ideal. *The Teacher Educator, 42*(3), 157–184.

Bebell, D., & Kay, R. (2010). One to one computing: A summary of the quantitative results from the Berkshire Wireless Learning Initiative. *Journal of Technology, Learning, and Assessment, 9(*2). Retrieved June 14, 2011, from http://ejournals.bc.edu/ojs/index.php/jtla/

Becker, H. J. (1994). How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education, 26*, 291-321.

Bellanca, J., & Brandt, R. (Eds.). (2010). *21st century skills: Rethinking how students learn*. Bloomington, IN: Solution Tree Press.

Berg, S., Benz, C. R., Lasley II, T. J., & Raisch, C. D. (1998). Exemplary technology use in elementary classrooms. *Journal of Research on Computing in Education, 31*(2), 111-122.

Brandon, J. (2008). Web 2.0 definition for non-techies. *Computer World*. Retrieved April 18, 2011, from. http://blogs.computerworld.com/web_2_0_define_2_0

Bryan, L. A., & Atwater, M. M. (2002). Teacher beliefs and cultural models: A challenge for science teacher preparation programs. *Science Teacher Education, 86*, 821-839.

Darling-Hammond, L., Wei, R., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad.* National Staff Development Council. Retrieved November 23, 2011 from http://www.nsdc.org/news/ NSDCstudy2009.pdf

Dede, C., Korte, S., Nelson, R., Valdez, G., & Ward, D. (2005). Transforming learning for the 21st century: An economic imperative. *Learning Point Associates.* Retrieved November 21, 2011, from http://www7.nationalacademies.org/BOSE/ICT_Fluency_Transformation_Article.pdf

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47-61.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, *53*(4), 25-39.

Ertmer, P. A., Gopalakrishnan, S., & Ross, E. M. (2001). Technology-using teachers: Comparing perceptions of exemplary technology use to best practice. *Journal of Research on Computing in Education, 33*(5). Available online.

Ertmer, P. A., & Hruskocy, C. (1999). Impacts of a university-elementary school partnership designed to support technology integration. *Educational Technology Research and Development, 47*(1), 81-96.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*, 255-284.

Ertmer, P. A., Ottenbreit-Leftwich, A., & York, C. S. (2006-2007). Exemplary technology-using teachers: Perceptions of factors influencing success. *Journal of Computing in Teacher Education*, *23*(2), 55-61.

Fang, Z. (1996). A review of research on teacher beliefs and practices. *Educational Research, 38*(1), 47-65.

Geier, R., Blumenfeld, P. C., Marx, R. W., Krajcik, J. S., Fishman, B., Soloway, E., & Clay-Chambers, J. (2008). Standardized test outcomes for students involved in inquiry-based science curricula in the context of urban reform. *Journal of Research in Science Teaching, 45*, 922-939.

Gray, L., Thomas, N., & Lewis, L. (2010). *Teachers' Use of Educational Technology in U.S. Public Schools: 2009* (NCES 2010-040). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Hadley, M., & Sheingold, K. (1993). Commonalties and distinctive patterns in teachers' integration of computers. *American Journal of Education, 101*, 261-315.

Hermans, R., Tondeur, J. van Braak, J., & Valcke, M. (2008). The impact of primary school teachers' educational beliefs on the classroom use of computers. *Computers & Education, 51*, 1499-1509.

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current Knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55*, 223-252.

Indiana Department of Education (2011). *DOE Online: Indiana Technology Trends Report*. Retrieved November 23, 2011, from https://dc.doe.state.in.us/doeonline/Main.aspx?pageid= 278

International Society for Technology in Education (ISTE). (2008). *National educational technology standards for teachers.* Eugene, OR: Author.

Johnson, L., & Adams, S., (2011). *Challenge based learning: The major findings of the implementation project*. Austin, Texas: The New Media Consortium.

Kagan, D. M. (1992). Professional growth among pre-service and beginning teachers. *Review of Educational Research*, *62*(2), 129-169.

Lincoln, Y., & Guba, E. (1985). *Naturalistic Inquiry.* New York: Sage.

Munby, H. (1982). The place of teachers' beliefs on research on teacher thinking and decision making, and an alternative methodology. *Instructional Science, 11*, 201-225.

National Education Association – American Federation of Teachers (NEA – AFT) (2008). *Access, adequacy, and equity in education technology: Results of a survey of America's teachers and support professionals on technology in public schools and classrooms*.

Washington DC: Author. Retrieved March 5, 2012, from http://www.nationaltechcenter.org/index.php/2009/09/09/access-adequacy-and-equity-in-educational-technology/

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies, 19*(4), 317-328.

Ottenbreit-Leftwich, A., Glazewski, K. D., Newby, T. J., & Ertmer, P. A. (2010). Teacher value beliefs associated with using technology: Addressing professional and student needs. *Computers and Education, 55*, 1321-1335.

Overbay, A., Patterson, A., Vasu, E., & Grable, L. (2010). Constructivism and technology use: Findings from the IMPACTing leadership project. *Educational Media International, 47*(2), 103-120.

Pajares, M. F. (1992). Teachers' beliefs and educational research: cleaning up a messy construct. *Review of Educational Research, 62*(3), 307-333.

Park, S. H., & Ertmer, P. A. (2007-2008). Impact of problem-based learning on teachers' beliefs regarding technology use. *Journal of Research on Technology in Education, 40*, 247-267.

Partnership for 21st Century Learning. (2007). *Framework for 21st century learning*. Retrieved April 9, 2009, from http://www.21stcenturyskills.org

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Perkins, J. (2010). Personalising teacher professional development: Strategies enabling effective learning for educators of 21st century students. *Quick*, 15-19.

Pink, D. H. (2009). *Drive: The surprising truth about what motivates us*. New York: Penguin Books.

Prensky, M. (2010). *Teaching digital natives: Partnering for real learning*. Thousand Oaks, CA: Corwin.

Ravitz, J. L., Becker, H. J., & Wong, Y. T. (2000). *Constructivist-compatible beliefs and practices among U.S. teachers* (Report no. 4). Irvine, CA: Teaching, Learning and Computing. Retrieved October 28, 2011, from http://www.crito.uci.edu/TLC/findings/report4/startpage.html

Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula (Ed.), *Handbook of Research on Teacher Education* (pp. 102-119). New York: MacMillan.

Rokeach, M. (1968). *Belief, attitudes, and values*. San Francisco: Josey-Bass.

Sandholtz, J. H., & Ringstaff, C. (1996). Teacher change in technology-rich classrooms. In C. Fisher, D. C. Dwyer, & K. Yocam (Eds.), *Education and technology: Reflections on computing in classrooms* (pp. 281-299). San Francisco, CA: Jossey-Bass Publishers.

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). *Teaching with technology: Creating student-centered classrooms.* New York: Teachers College Press.

Schrum, L., & Levin, B. B. (2009). *Leading 21st century schools: Harnassing technology for engagement and achievement*. Thousand Oaks, CA: Corwin.

Strauss, B., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.

Suhr, K.A., Hernandez, D.A., Grimes, D., & Warschauer, M. (2010). Laptops and fourth-grade literacy: assisting the jump over the fourth-grade slump. *Journal of Technology, Learning, and Assessment, 9*(5). Retrieved June 14, 2001, from http://www.jtla.org.

Taylor, L. M., & Fratto, J. M. (2012). *Transforming learning through 21st century skills*. Upper Saddle River, NJ: Pearson.

U.S. Department of Education, Office of Educational Technology (2010). *Transforming American Education: Learning powered by technology*. National Educational Technology Plan 2010. Retrieved October 29, 2011, from http://www.ed.gov/technology/netp-2010

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Chapter 10
Primary School Teachers' Beliefs about Bilingualism

Inka Wischmeier

Abstract

This article examines the epistemological beliefs that primary school teachers hold about bilingualism. 84 primary school teachers from a rural area and 27 teachers working in a medium-sized town, both in Bavaria, were surveyed on their epistemological beliefs about bilingualism in an exploratory questionnaire-based survey. The key findings of the study are twofold: firstly, the primary school teachers showed broadly diverging beliefs about bilingualism and secondly, their beliefs cannot be clearly classified using existing theoretical approaches towards bilingual language acquisition. One striking feature of the study is that factors which are typically thought to influence teachers' beliefs, such as a consensus within a school on how to deal with language diversity, do not in fact have the effect on beliefs previously thought. The number of students in a class with a migration background seems to have an effect on teachers' beliefs about bilingualism, although further research in this area is necessary. This study indicates that future research should draw a clearer distinction between knowledge and beliefs and that the difficult question of the empirical operationalisation of beliefs systems needs further attention.

Keywords:
bilingualism; teachers' beliefs; teachers' knowledge; extracurricular education

10.1 Theoretical Framework

In response to international comparative studies such as PISA and IGLU there has been an increase in research carried out on teachers' professional knowledge. The weak performance of German pupils in these studies has been the subject of much discussions and follow-up studies have been carried out to examine how pupils' attainment can be improved and, more importantly for this article, how to improve the knowledge and performance of teachers (Schmidt, Tatoo, Bankow, Blömeke, 2007; Blömeke, Kaiser, & Lehmann, 2010; Blömeke, Bremerich-Vos, Haudeck, & Kaiser, 2011).

One of the PISA study's findings has been of particular interest to researchers: children whose parents are born in Germany and are both native speakers of German perform better in the German school system than children with at least one foreign-born parent (Baumert et al., 2001; Prenzel et al., 2004; 2007 Bos et al., 2004; see also

Limbid & Stanat, 2006). This finding is significant given that in Germany the proportion of children under five with a migration background is very high, at 30 percent. The PISA and IGLU studies put this figure at 25 per cent with diverse countries of origin (ibid; Schwippert, Hornberg & Goy, 2008). As a consequence, schools, and in particular primary schools, have to find ways of teaching pupils for whom the language of instruction is a second language. Multilingualism in the classroom can be considered enriching or it can be considered problematic and an excessive demand on teachers' time. Either way teachers must deal with these multilingual situations in German lessons and in other subjects (Leisen, 2010; 2011).

At present, linguistic diversity in the classroom is either overlooked or attempts are made to overcome it through remedial German classes. Language diversity only plays a positive role in bilingual schools, of which there are few (see, for example, the international School Villa Amalienhof: www.is-va.com). Bilingual schools are often private schools and the languages spoken are usually German and English. Bilingual teaching in Turkish or Russian, the languages most commonly spoken by migrants in Germany, is rare.

10.1.1 Teachers' Professional Knowledge

According to Weinert (1999) teacher competences can be broken down into cognitive, motivational and action-related elements. According to Shulman (1987; see also Bromme, 1992; 1997; Baumert & Kunter, 2006) the cognitive elements of teachers' professional knowledge can be broken down into content knowledge, pedagogical content knowledge and general pedagogical knowledge. Teachers' professional knowledge is furthermore divided into formal knowledge, knowledge of practice and case knowledge (Fenstermacher, 1994; Baumert & Kunter, 2006). To this knowledge added (filter function) or protruding or with this playing together – the exact relation is neither theoretical nor empirically finally cleared – beliefs and values, motivational orientations or attitudes and self-regulating abilities which put out the motivational and action-related attributes of the professional teachers' knowledge, are to be called (Blömeke, Bremerich-Vos, Haudeck & Kaiser, 2011). "The basic assumption is that knowledge only guides actions if it is taken on board by teachers in the subjective conviction state" (Blömeke, Müller, Felbrich, & Kaiser, 2008, p. 219).

Professional knowledge as a concept is broadly accepted and is based on tested ideas. The extent to which these ideas are correct is shown "in their compatibility with other ideas in a systematic context" (Schnädelbach, 2002, p. 180; see also Fenstermacher, 1994). Such ideas should be consistent and must stand up to arguments and discursive validation. Green calls the principal difference between knowledge and beliefs the "truth condition" and the "evidence condition" (Green, 1971, p. 69ff.). Both concepts are part of the knowledge concept. It is not enough to believe one knows something, it has to be proven in a comprehensible way and stand up to arguments. Clearly the distinction between beliefs and knowledge can be difficult to

ascertain because of the different knowledge types ascribed to teachers. The distinction between knowledge and beliefs requires practical knowledge to be classified as beliefs, not as knowledge, except where it is possible to establish an objective basis for this knowledge.

Beliefs, the focus of this study, can be described as "psychologically held understandings, premises or propositions about the world that are felt to be true" (Richardson, 1996, p. 103). Teachers' beliefs are effective as a filter for the cognitive processing and integration of new information, the perception of pupil behaviour and lesson planning, in particular setting tasks and deciding on teaching methods. Thus Staub and Stern taking mathematics lessons as an example, point out, that "students whose Grade 3 teachers had a stronger cognitive constructivist orientation (…) displayed higher achievement gains in demanding mathematical word problems than did students whose Grade 3 teachers had less of a cognitive constructivist view, subscribing instead to pedagogical content beliefs that are consistent with a direct-transmission view of learning and teaching" (Staub & Stern, 2002, p. 354).

Calderhead defines teachers' beliefs as "untested assumptions that influence how [teachers] think about classroom matters and respond to particular situations" (Calderhead, 1996, p. 719). He identifies five aspects of teachers' beliefs which have an effect on teaching:

1. beliefs about learners and learning,
2. beliefs about teaching (inclusively objectives for lessons),
3. beliefs about a subject (epistemological beliefs),
4. beliefs about learning to teach,
5. beliefs about oneself and the role of a teacher (Calderhead, 1996, p. 719ff).

Knowledge can be considered a belief if, through (epistemological) extension, the original theories are changed and these changes are not accepted by the teacher (who sticks to his/her previous convictions). Inversely, a belief can become knowledge if it is generally accepted and thought to be objectively true. This means that it is difficult to make a distinction between knowledge and beliefs in empirical studies on epistemological beliefs in areas which have not yet been clarified.

Even if most experts accept the division between knowledge and beliefs, existing empirical evidence should be considered with caution. Woolfolk, Hoy, Davis and Pape state that the division has not yet been proved by existing research. In their answers the interviewees do not distinguish between beliefs and knowledge (Woolfolk, Hoy, Davis, Pape, 2006; cf. also Trautmann, 2005). As a result the methodical conversion of the theoretical construct is difficult. Beliefs cannot be measured directly and must be imparted and operationalised. It should be noted that the operationalisation of the constructs in many of the studies leaves much to be desired.

10.1.2 Learning opportunities for bilingual teaching during teacher training

In its resolution 10/16/2008, the *Kultusministerkonferenz* (The Standing Conference of the Ministers of Education and Cultural Affairs of the *Länder* in the Federal Republic of Germany) fixed minimum standards for the training of primary school teachers in different subjects. German as a second language is listed under "subject basics" under the recommendations for German. Language acquisition theory for first and second languages is listed as course content under "specialised didactic bases" (KMK, 2010, p. 48). The *Länder* are responsible for incorporating these regulations into their programmes of study and their exam regulations. In Bavaria the previous examination regulations, which dates from 7 November 2002, did not contain any course content which included linguistic and cultural diversity. German as a second language could not be studied as part of the main primary school programme, although it could be taken as an additional subject. In the new version of the curriculum, dated 13th of March 2008 (a modular programme divided into BA and MA courses), German as a second language can be studied as an optional subject. Looking at Bavaria and across Germany, different approaches have been adopted to German as a second language but only teaching students who study German as a second language develop specific knowledge about bilingualism through their courses of study.

10.1.3 Theories of first and second language acquisition

As the majority of multilingual children grow up speaking two languages, this article will focus on bilingualism. This is understood as an individual's language ability "resulting from the natural acquisition (without lessons) of two languages as mother tongues as an infant" (Müller et al., 2007, p. 15). The child is exposed to the second language from the age of three at the latest and learns it at the same time as he/she acquires the first language. If the second language is introduced after the age of three then reference is made to successive bilingualism or second language acquisition (Bickes & Pauli, 2009). It is thought that in successive bilingualism the way the second language is learnt closely resembles the way an adult would learn a language. The second language is not acquired as quickly as the first and is influenced by the first language. This assumptions are, however, now being challenged (see Müller et al, 2007; Bickes & Pauli, 2009; Reich & Roth, 2002). Academics are divided as to the influence and the significance of early bilingualism for general language acquisition. It is also not clear whether language acquisition is subject to the same processes for both languages, whether languages influence one another and if so, how. Up until now language acquisition after the age of three has been somewhat neglected. There is also a knowledge gap in the language acquisition of migrant children in Germany. It is not clear whether these children learn German and the language spoken by their parents simultaneously or whether one or other of the languages is learnt as a second language.

It is agreed that one language can be dominant in a bilingual child (cf. Bickes & Pauli, 2009) – it is spoken better than the other. If one of the languages is dominant, a child's abilities in both languages are usually classified as unbalanced. Alongside language dominance language mixing also has a role to play. Language mixing is considered both positively and negatively. It is seen "as a deficit when it comes to linguistic separation, as a result of language dominance and lexical gaps" (Müller et al., 2007, p. 208). However, it can be viewed positively as a "strategy used by bilingual children drawing on the stronger, more developed language" (ibid.).

In the current discussion social context has a role to play alongside linguistic aspects. "A language's cultural limitations and the socio-cultural conditions in which it is used are important starting points" (Oksaar, 2003, p. 90). Bilingual language acquisition depends on the conditions in which it is acquired. Background variables such as the level of education in a child's family, the languages spoken at home, the way in which spoken language is used, the significance of written language in everyday life or the way in which a family communicates (how often communication takes place and in how much depth) influence the language acquisition and the relation between the languages concerned (Bickes & Pauli, 2009; Gogolin, Neumann, & Roth, 2003).

Numerous other approaches and ideas exist. Certain theories taken from cognitive science are relevant to this discussion on second language acquisition. These theories do not suppose that language acquisition processes follow a set logic but rather that it is part of a general learning mechanism. Put simply this means that there are certain characteristics which promote language acquisition and these are genetically determined. Researchers are also examining whether language and cognition are two independent systems which influence one another, or whether they are identical. Language acquisition theory can help answer these questions. It is still not possible "to establish a plausible causal relationship between intelligence and bilingualism and to say with confidence that bilingualism promotes intelligence and not the other way around" (Bickes & Pauli, 2009, p. 91).

Currently there are researchers who consider that bilingual children who distinguish language systems early on still mix languages. In this context there are three important hypotheses. These include controversial assumptions about bilingualism which significantly influence the discussion about second language acquisition.

The interdependence hypothesis

The interdependence hypothesis (Cummins, 1981) assumes that the learner's first language influences the acquisition of the second. Identical elements and rules in the first and second language are easily learnt and mistakes are rare. Differing elements and rules cause difficulties and lead to mistakes (Bausch & Kasper, 1979; Oksaar, 2003; Günther & Günther, 2007). According to this theory the second language is acquired by drawing on the first language and the differences between the first and second languages influence the acquisition of the second. There are three steps in bilingual language development:

1. semilingualism (low competence into both languages),
2. dominant bilingualism (high competence in one of the two languages),
3. high-level competence into both languages.

It is thought that a high-level can only be achieved in the second language if that level has already been achieved in the first. There is a distinction made between Basic Interpersonal Communication Skills (BICS) and Cognitive Academic Language Proficiency (CALP). "Using [the interdependence hypothesis], development in both languages is seen as a unit and connections are established between competences and problems even if these only appear in one of the two languages, usually the second" (Rösch, 2011, p. 26). The interdependence hypothesis is used "mostly by educationalists in the context of the language education of children with a migrant background to support their calls for bilingual education" (ibid.). In the discussion on second language acquisition there are calls for the first language to be supported, the belief being that if children speak their mother tongue with mistakes they will not be able to learn German properly.

The identity hypotheses

The second language acquisition hypothesis is the identity hypotheses or the L1 = L2 hypothesis. The assumption here is that first and second language acquisition are identical and are the result of innate abilities (Oksaar, 2003, p. 104; see also Günther & Günther, 2007). According to this theory there are clear parallels between the way in which a first and a second language are acquired. "The acquisition of the L2 language is the same as the acquisition of the L1 language: in both cases the learner activates innate mental processes, which means that rules for and elements of the second language are acquired in the same way as for the first language. Just as mistakes in the acquisition of the first language can be identified, mistakes in the second language are determined by the structure of the second language (and not the first)" (Bausch & Kasper, 1979, p. 5).

Today both the identity hypotheses and the interdependence hypothesis are considered to be outdated (Rösch, 2011), but they have guided the discussion on second language acquisition for decades.

The interlanguage hypothesis

The third hypothesis, the interlanguage hypothesis, is also controversial, but is being widely discussed in language acquisition research. According to this theory the second language is learnt through "interlanguages" (Günther & Günther, 2007; Oksaar, 2003). Second language acquisition is considered to be a creative process of development which is steered by the learner (Rösch, 2011).

10.2 State of research

Up until now research into teachers and teacher training has focused on mathematics teachers and lessons (Blömeke et al., 2011). The examination of epistemological beliefs has advanced furthest in this field. The study *Teacher Education and Development Study: Learning to Teach* (TEDS-LT) by Blömeke et al. (2011) has gone some way to filling the gap which exists by expanding the research to cover English and German teachers and trainee teachers.

Studies examining teachers' beliefs in relation to pupils with a migration background or pupils who belong to an ethnic minority or a stigmatised group focus primarily on teachers' expectations for pupil attainment and the effect of these expectations on actual attainment. Anglo-American research leads the way here. The effects of expectations are usually small, but statistically significant. Teachers' expectations become self-fulfilling prophecies and have a medium to significant effect when they are based on a pupil's membership of a particular stereotyped group and not, as in most experiment situations, through a chance affiliation. Teachers' expectations are particularly low when they are founded on social categories such as social status or ethnicity (Jussim & Harber, 2005; Alexander & Schofield, 2006).

In German-speaking countries there are currently few comparable studies which are not focused on theoretical attainment expectation constructs and carried out with small samples. The research is inconsistent when it comes to teachers' evaluation of pupils from a migration background. Some results suggest that pupils with a migration background are disadvantaged, whereas others indicate that this group is not discriminated against or that it benefits from positive discrimination (Kristen, 1999; Lehmann, Peek, & Gänsfuß, 1997). Furthermore, in the German-speaking context the assessment of the language proficiency of pupils with a migration background plays a key role. Gomolla and Radtke (2002) were able to identify patterns in the explanations given by teachers in interviews to justify the poor marks given to foreign children and the fact that they were then sent to the *Hauptschule*. These included problems with language, alongside the pupils' family and social background (ibid.). Marburger, Helbig and Kienast (1997) have examined the way in which teachers deal with multi-ethnic school populations. For the most part, the influence of children from migrant backgrounds in the classroom is seen as negative. The presence of children with a migration background in the classroom is seen as pulling down the level of the class or as "throwing a spanner in the works" as it holds back German pupils' progress. Children with a migration background are also seen as an additional burden on teachers who are overwhelmed by cultural diversity in their classrooms, seeing the pupils as increasing their workload and wasting their energy (ibid., p. 26).

There is a lack of empirical data on the way in which teachers deal with linguistic diversity in the classroom. Research into how teachers judge the multilingualism of their pupils is also yet to be carried out (do they consider multilingualism to be enriching or do they find it difficult to cope with?). Information relating to teachers' professional knowledge and their epistemological beliefs regarding bilingualism has also

not yet been collated. Several studies have been carried out on teachers' foreign language teaching (Woods, 1996; Borg, 1998, 2005; Tsui, 2003). However there is also a shortfall in empirical data here: "In contrast to the study of teacher cognition in general education, (…) research on language teacher cognition is relatively underdeveloped" (Song & Andrews, 2009, p. 8).

10.3 Methodology and description of the sample

10.3.1 Approach and instruments

The project, which is introduced here, is an attempt to develop an instrument to record primary school teachers' epistemological beliefs about bilingualism.

A quantitative approach was chosen for recording the epistemological beliefs about bilingualism. The data were collected using a questionnaire. Different scales relating to first and second language acquisition were used to assess the epistemological beliefs. Epistemological beliefs "relate to the structure and genesis of knowledge" (Blömeke, Müller, Felbrich & Kaiser, 2008, p. 221). Several issues need careful consideration when studying bilingualism, such as the possible influence of the first and second language on the other or whether the processes of language acquisition are the same or different for both languages. If bilingualism is viewed from a general anthropological perspective then it is worth considering whether children should speak two languages as early as possible.

Because professional knowledge and the epistemological beliefs of primary school teachers regarding first and second language acquisition have not yet been systematically recorded, the scales for the study were developed by the author. The subjects of the study were all primary school teachers who had gone through the traditional German teacher training system. The study draws on the interdependence theory and the L1 = L2 theory as these have been prominent in the debate on these issues for decades. An additional scale was developed which contained teachers' anthropological point of view on first and second language acquisition, which meant that there were three scales in total. The response categories for the scales were divided into "agree", "don't agree" and "don't know".

- Children who grow up speaking two languages end up speaking neither language properly.
- Second language acquisition depends on previous language learning experiences.
- Bilingualism has a positive effect on the ability to learn the grammatical structures of both languages.
- Bilingualism affects the development of metalinguistic abilities.
- If the school supports the first language, this has negative consequences for the acquisition of the second language.
- Good literacy levels in the first language have a positive impact on the acquisition of the second language.
- Long-term support of the first language has a positive effect on the development of skills in other subjects too.

Figure 10.1: Items for the interdependence hypothesis

The scale for the interdependence hypothesis contained seven items (see Figure 10.1). The scales were checked using a reliability analysis. Due to the fact that the sample was very small (n = 67) it was decided not to undertake a confirmatory factor analysis. The critical value in beliefs research is $\alpha = 0.60$ (see Blömeke, Müller, Felbrich & Kaiser, 2008). Values above 0.70 are considered good. The reliability of this scale is good at $\alpha = 0.74$.

- First language acquisition and second language acquisition are not connected to one another.
- When multilingual children mix languages it is a sign of disturbed language development.
- The acquisition of the second language does not depend on the child's linguistic abilities in the first language.
- It is normal for multilingual children to mix languages. This is not a sign of disturbed language acquisition.
- Special language teaching in a child's first language should include curriculum content.
- It is enough for a child to learn just to speak their first language (without learning to read and write).
- Literacy in the first language has no influence on the acquisition of the second language.

Figure 10.2: Items for the L1 =L2 hypothesis

- Difficulties in German are a sign of more general learning difficulties in children with a migrant background.
- All children should learn two languages as early as possible.
- Speaking two or more languages as a child has many advantages for language acquisition and cognitive development.
- Growing up with two languages leads to disturbed language development.
- Bilingualism at an early age is advantageous for linguistic development in general.

Figure 10.3: Items for the anthropological hypothesis

The scale for the L1 = L2 theory was also made up of seven items (see Figure 10.2). The reliability of this scale was insufficient at $\alpha = 0.43$. The last of the three scales uses a scale with five items which examines general, anthropologically orientated beliefs (see Figure 10.3). The reliability of this scale was insufficient at $\alpha = 0.56$.

First of all the scales were checked. Then the influence of a number of variables was tested. At school level the idea of a model for dealing with diversity as well as a concept for languages which regulates the way in which the school deals with linguistic diversity were introduced. Two of Mächler's scales (2000) were introduced (see Figure 10.4 and Figure 10.5). The reliability of the first scale is $\alpha = 0.59$ – a level which is barely satisfactory. The reliability of the second scale is good at $\alpha = 0.87$.

- The school has a concept which takes into account its multicultural situation.
- The school team agrees that one of its most important aims is to guarantee the integration of all pupils regardless of their origin.
- Diversity and difference are visible in school life and in lessons and are evaluated positively.
- The school is sensitive to stereotypes and prejudice (negative or idealising).
- Teachers and students work to overcome prejudice.

Figure 10.4: Diversity concept items

- The school has a comprehensive concept for dealing with language diversity (German as a first language, German as a second language, non-native speakers of German).
- In the school there are rules as to when and where different languages are to be used.
- Courses in the first language and culture are integrated into the school programme of work.
- Teachers working in languages other than German are part of the school team.
- The teaching staff value their pupils' linguistic diversity.
- The pupils value the language diversity of the school.
- The teachers know who speaks which language in each class.
- Teachers responsible for teaching German as a second language have the necessary training in this field.
- All teachers have received adequate training to teach classes with high levels of cultural and linguistic diversity.

Figure 10.5: Linguistic diversity items concept

The study also considered the following aspects to be possible indicators of teachers' beliefs about bilingualism: whether the school is located in a town or a rural area, the number of pupils with a migrant background in the class, the number of years a teacher has been in service, their gender and their collective and individual assessment of their own abilities.

10.3.2 Sample

A rural district and a medium-sized town, both in Bavaria, were chosen for the sample. The original aim was to involve all the primary schools in the two areas. The schools were informed about the project in person and on the telephone before the questionnaire was sent out. In the rural district 14 of the 47 schools agreed to take part in the project as did five of the 18 schools in the town. The questionnaires were sent to all the classroom teachers as well as the head teachers.

The sample included 111 primary school teachers (326 questionnaires were sent out). About 25 percent of the teachers who received a questionnaire answered it. The response rate was 34 percent in total, which is low and cannot be considered representative. The results of the study are heuristic and explorative in nature, but can still give important indicators for future research.

84 of the teachers surveyed worked at schools in the rural district and 27 of them worked in the town. The average age was 44.5 years old. 88.6 percent of the teachers were women and 11.4 percent were men. The fact that more women than men were surveyed reflects the gender balance of teaching staff across the primary school sector.

On average the teachers had been in the profession for 17 years. Only 3 percent of them came from a migrant background themselves. This also reflects the reality in German primary schools as a whole.

10.3.3 Results

The following is a review of the most important results taken from the study.

Number of students with a migrant background in the classroom and language diversity

Almost one quarter of the teachers (22.5 percent) teach classes in which 40 to 60+ percent of the pupils have a migrant background (see Table 10.1). This distribution is approximately in line with the proportion of foreign students at Bavarian primary schools as a whole, which was 9.2 percent in 2006/07 (*Bayerisches Staatsministerium für Unterricht und Kultus*, 2009, p.115).

Table 10.1: Percentage of students with migrant background

Pupils with a migration background	Frequencies	Percent
no pupils	28	28.6
less than 10 %	15	15.3
10-20%	14	14.3
21-40%	19	19.4
41-60%	13	13.3
more than 60	9	9.2
Total	98	100.0

Differences in the distribution of the results emerge primarily when the results are divided down into the town and the rural district. More than one third of the teachers who teach in the rural district (36 percent) do not have any pupils with migration background in their class and none of them have more than 60 percent. In the town the situation is different: 39.1 percent of the teachers teach classes in which more than

60 percent of the pupils come from a migrant background. The sample for the rural district reflects reality when it comes to the proportion of children with a migration background, as the average figure for the academic year 2006/07 was 5.4 percent. The sample for the town gives a slightly distorted picture as the figure is 15.2 percent for the overall population. Nevertheless, these general statistics should be handled with caution because the number of migrants attending schools varies a great deal from district to district. This is also the case in the rural districts where there are some villages where the number of migrants is significantly above average, whereas in others there are no migrants at all. Generally speaking, though, the sample is a good representation of the situation at Bavarian primary schools.

The sheer number of languages spoken in Bavarian classrooms gives an indication of just how diverse the situation is. Ten languages were listed in the questionnaire and the teachers listed a further ten. As expected the most commonly spoken languages were Turkish (30.3 percent) followed by Russian (19.9 percent), Serbo-Croat (16.4 percent) and Polish (11.4 percent). Italian is also still fairly widely spoken (10 percent). Far fewer children spoke the other languages listed.

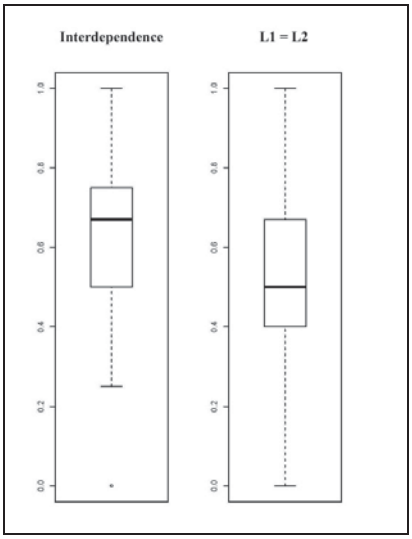
Epistemological beliefs about bilingualism

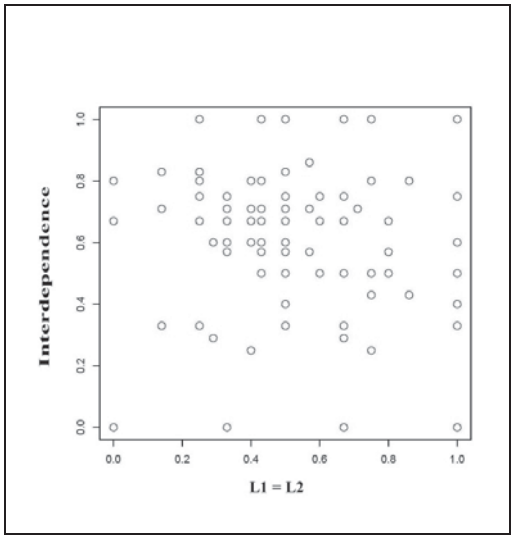
As outlined above the three scales on beliefs about bilingualism could be answered either "agree", "don't agree" or "don't know". This was to guarantee clear answers. The non-response rates for the interdependence hypothesis scale was 4.9 percent (n = 111), for the L1 = L2 hypothesis it was 5.2 percent (n = 111) and for the general, anthropological scale it was 4.4 percent (n = 111). These very low non-response rates increase when the "don't know" answer category is added. The rates are then 34 percent for the interdependence hypothesis and 28.6 percent for the L1 = L2 hypothesis. The reliability of this data is therefore limited (see Blömeke, Müller, Felbrich & Kaiser, 2008). The non-response rates for the general, anthropological scale were 17.4 percent, which is still acceptable (ibid.). The high number of teachers answering "don't know" suggests that the teachers do not have clear ideas about first and second language acquisition and diverse and unclear beliefs about bilingualism. This can be illustrated using two examples from the L1 = L2 scale. All items with a low non-response rate had a very high number of "don't know" answers.

Item 3 on the L1 = L2 scale ("The acquisition of the second language does not depend on the child's linguistic abilities in the first language") was answered by 106 of the 111 teachers. More than one third of the teachers (39.6 percent) answered "don't know", nearly half of them agreed with the statement and less than ten percent did not agree. The pattern becomes clearer still when looking at item 7 (see Table 10.3).

Item 7 on the L1 = L2 scale ("Literacy in the first language has no influence on the acquisition of the second language") was answered by 110 of the 111 teachers. Nearly half of the teachers answered "don't know" (47.3 percent). This means that nearly half of the teachers are unsure. As in the first example less than 10 percent of the teachers do not agree with the statement and 43.6 percent say they agree.

The ratings on the two scales relating to first and second language acquisition are in the mid-range. This means that the research instrument can differentiate between the various answers given by the surveyed teachers, as the two charts in Figure 10.6 illustrate.





Figures 10.6 and 10.7: Ratings for the interdependence and the L1 = L2 hypotheses

The basic hypothesis for both scales was that teachers who agree with the interdependence scale would reject the L1 = L2 scale and vice versa. There are theoretical assumptions behind each of these scales which clearly contradict one another (for example the items "First language acquisition and second language acquisition are not connected to one another" in the L1 = L2 scale and "Second language acquisition depends on previous language learning experiences" in the interdependence scale). However, the teachers' answers show scattered agreement in both scales with a tendency (albeit an insignificant one) to agree with the interdependence scale (see Figure 10.7). The correlation between the two scales is r = 0.66. Owing to the data's low reliability an attenuation correction was carried out. After the attenuation correction the value of the correlation was = 0.74.

Table 10.2: Percentage of pupils with a migration background

	Min	Max	Mean	3rd Quartile
Interdependence scale	0	1	0.5966	0.7500
L1 = L2-scale	0	1	0.5431	0.6700

The teachers seem to have very diverse beliefs about bilingualism which cannot be clearly associated with a theoretical approach. As described above, the teachers do not deal systematically with first and second language acquisition in their training and as a result their beliefs are rather fuzzy and also contradictory. In addition, epistemological knowledge about first and second language acquisition is itself contradictory and incomplete and existing research is partially unstructured. When teachers work with unstructured knowledge in the classroom they tend to follow their beliefs rather than knowledge. When knowledge is unstructured, beliefs become very diverse. Against this backdrop it becomes clear that beliefs systems are complex, blurred and contradictory and, as a result, that it is difficult for researchers to establish methodological approaches.

The general, anthropological scale shows that teachers generally have a positive attitude to bilingualism and see it as something which is desirable (see Figure 10.8).

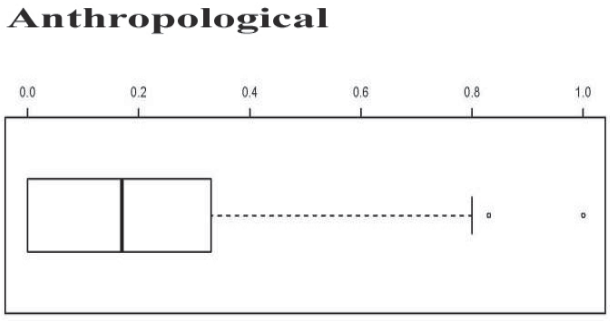


Figure 10.8: Ratings for the anthropological hypothesis

A variance analysis was carried out to examine whether there is a link between the interdependence, L1 = L2 scale and the variables of gender, length of service, whether the school has a diversity concept, the management of language diversity, collective and individual self-assessment. The difference when it comes to the number of pupils with a migration background is only marginally significant ($p < .05$; see Table 10.3). The more pupils with a migration background there are in a class, the stronger the support for the interdependence hypothesis. For this analysis, the number of pupils with a migration background was divided into three groups: low (0 – 20%), middle (21 – 40%), high (41 – 60+%).

Table 10.3: Analysis on the influence of the number of pupils with a migration background in a class

	DF	*Sum Square*	*Mean Square*	*F*	*p*
Interdependence by Percent of Migration background	*2*	*0.377*	*0.18870*	*3.425*	*0.0367*
L1 = L2 by Percent of Migration background	*2*	*0.076*	*0.3786*	*0.659*	*0.52*

This can be taken as an indication that epistemological beliefs about first and second language acquisition are based on experiences in the classroom. The unclear answers provided by teachers relating to the interdependence and the L1 = L2 hypotheses could also point in this direction. Future research should examine in more depth the extent to which the number of migrant pupils in a classroom affects teachers' beliefs about bilingualism.

On the whole, linguistic diversity in the classroom seems to be a source of uncertainty for teachers. More than three quarters of the teachers (81.1 percent) said that they did not feel prepared to deal with a linguistically diverse class. In response to the item "All teachers have received adequate training to teach classes with high levels of cultural and linguistic diversity", 47.8 percent said that they did not agree at all and 33.3 percent said they agreed to a limited extent. It is clear that teachers require further training in this sphere. Trainee teachers must be better prepared to deal with multilingual classes and be given help to prepare effective lessons, in particular when it comes to promoting writing skills and oral expression.

10.4 Discussion

This study has shown that the epistemological beliefs about first and second language acquisition held by Bavarian primary school teachers are very diverse. The following conclusions can be drawn from the answers given by the teachers: (1) the teachers' beliefs vary a great deal; (2) the teachers cannot, as originally thought, be divided in two groups, one adhering to the L1 = L2 hypothesis and the other to the interdependence hypothesis; (3) the teachers are very uncertain about their beliefs (and also their knowledge) about first and second language acquisition. The ratings on the general, anthropological beliefs scales support these assertions. The response rates for these beliefs were low. The teachers found it easier to respond to generalised statements about bilingualism than to statements about the structure and genesis of first and second language acquisition.

When it comes to beliefs about the interdependence hypothesis and the L1 = L2 hypothesis, the teachers tend to agree more with the interdependence hypothesis. However, this difference is not significant. The result is, however, interesting as the interdependence hypothesis has been much discussed by experts in the field of educational science. There is more chance that teachers will come into contact with the

interdependence hypothesis during their studies than with the L1 = L2 hypothesis. The interdependence hypothesis may have received more approval simply because the teachers were more aware of it.

Two results from the survey stand out: firstly teachers do not generally see bilingualism as problematic, they have a positive attitude towards multilingual children; secondly the teachers do not feel that their training has prepared them sufficiently to deal with multilingual children. As stated above, it is a requirement of teacher training courses that they acknowledge the existence of language diversity in schools and they provide trainee teachers with the professional skills to deal with multilingual situations.

Beliefs about bilingualism seem to be mostly influenced by practical experience related to the number of children with a migrant background in a school and less (in this study, not at all) with the collective and individual feeling of one's own effectiveness or with school guidelines for dealing with diversity or language diversity. Further research is necessary here. Future research should also attempt to distinguish more between knowledge and beliefs. As a whole this study also shows that beliefs are difficult to operationalise because beliefs systems are often very diverse, inconsistent and contradictory. Further research is urgently required because of the important filter function in assimilating and processing knowledge, in lesson preparation and because of their influence on teachers' expectations of pupil attainment.

References

Alexander, K., & Schofield, J. W. (2006). Erwartungseffekte: Wie Lehrerverhalten schulische Leistungen beeinflusst [Expectation effects: How teacher behavior influences achievements at school]. In J. W. Schofield (Ed.), *Migrationshintergrund, Minderheitenzugehörigkeit und Bildungserfolg. Forschungsergebnisse der pädagogischen, Entwicklungs- und Sozialpsychologie* [Migration Background, Minority-Group Membership and Academic Achievement. Research Evidence from Social, Educational, and Developmental Psychology] (pp. 47-70). Berlin.

Baumert, J. et al. (2001). *PISA 2000: Basiskompetenzen von Schülerinnen und Schülern im internationalen Vergleich* [Basic competences of students in national and international comparison]. Opladen: Leske + Budrich.

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keyword: Professional competence of teachers]. *Zeitschrift für Erziehungswissenschaft, 9*(4), 469-520.

Bausch, K.-R., & Kasper, G. (1979). Der Zweitspracherwerb: Möglichkeiten und Grenzen der „großen" Hypothesen [Second language acquisition: opportunities and limits of the „big" hypothesis]. *Linguistische Berichte, 64*, 3-35.

Bayerisches Staatsministerium für Unterricht und Kultus. (2009). *Schule und Bildung in Bayern 2009. Statistische Übersichten*. [Schools and Education in Bavaria 2009. Statistical Overview] München.

Bickes, H., & Pauli, U. (2009). *Erst- und Zweitspracherwerb* [First and second language acquisition]. Paderborn: W. Fink (UTB).

Blömeke, S., Bremerich-Vos, A., Haudeck, H., & Kaiser, G. (2011). *Kompetenzen von Lehramtsstudierenden in gering strukturierten Domänen: erste Ergebnisse aus TEDS-LT* [Competence of teaching post students in low structured domains: the first results from TEDS-LT]. Münster: Waxmann.

Blömeke, S., Kaiser, G., & Lehmann, R. (Eds.). (2010). *TEDS-M 2008 – Professionelle Kompetenz und Lerngelegenheiten angehender Primarstufenlehrkräfte im internationalen Vergleich* [Professional competence and learning opportunities of prospective primary school teachers in an international comparison]. Münster: Waxmann.

Blömeke, S., Müller, C., Felbrich, A., & Kaiser, G. (2008). Epistemologische Überzeugungen zur Mathematik [Epistemic beliefs about Mathematics]. In S. Blömeke, G. Kaiser, & R. Lehmann (Eds.), *Professionelle Kompetenz angehender Lehrerinnen und Lehrer. Wissen, Überzeugungen und Lerngelegenheiten deutscher Mathematikstudierender und -referendare. Erste Ergebnisse zur Wirksamkeit der Lehrerausbildung* [Professionel competence of prospective school teachers. Knowledge, Beliefs and learning opportunities of german teachers students education in mathematics. First Results of the effectiveness of teacher education] (pp. 219-246). Münster: Waxmann.

Borg, S. (1998). Teachers' pedagogical systems and grammar teaching: A qualitative study. *TESOL Quarterly, 32*(1), 9-37.

Borg, S. (2005). Experience, knowledge about language and classroom practice in teaching grammar. In Bartels (Ed.), *Applied linguistics and language teacher education* (pp. 325-340). New York: Springer.

Bos, W. et al. (2004). *IGLU: Einige Länder der Bundesrepublik Deutschland im nationalen und internationalen Vergleich* [IGLU: Some countries of the Federal Republic of Germany in national and international comparison]. Münster [u.a.]: Waxmann.

Bromme, R. (1992). *Der Lehrer als Experte* [The Teacher as an expert]. Bern: Hans Huber.

Bromme, R. (1997). Kompetenzen, Funktionen und unterrichtliches Handeln des Lehrers [Teacher Competences, Teacher functions and teachers action]. In F. E. Weinert (Ed.), *Enzyklopädie der Psychologie: Psychologie des Unterrichts und der Schule* [Psychological encyclopaedia: Teaching and School Psychology] (pp. 177-212). Göttingen: Hogrefe.

Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. Berliner (Ed.), *Handbook of educational psychology* (pp. 709-725). New York.

Cummins, J. (1981). The role of primary language development in promoting educational success for language minority students. In C. S. D. o. Education (Ed.), *Schooling and language minority students: a theoretical framework* (pp. 3-49). Los Angeles: Evaluation, Dissemination and Assessment Center California State University.

Fenstermacher, G., D. (1994). The Knower and the Known: The Nature of Knowledge in Research of Teaching. *Review of Research in Education, 20*, 3-56.

Gogolin, I., Neumann, U., & Roth, H.-J. (2003). *Förderung von Kindern und Jugendlichen mit Migrationshintergrund* [Advancement of children and youngsters with migration background]. (No. 107). Bonn: Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung.

Gomolla, M., & Radtke, F.-O. (2002). *Institutionelle Diskriminierung. Die Herstellung ethnischer Differenz in der Schule* [Institutional discrimination. Producing ethnic difference in school]. Opladen: Leske + Budrich.

Green, T. F. (1971). *The Activities of Teaching*. New York u.a.: Mc Graw-Hill.

Günther, B., & Günther, H. (2007). *Erstsprache, Zweitsprache, Fremdsprache. Eine Einführung* [First langage, Second language, Foreign language. An Introduction]. Weinheim und Basel: Beltz.

Jussim, L., & Harber, K. D. (2005). Teacher expectations and self-fulfilling prophecies: Knowns and unknowns, resolved and unresolved controversies. *Personality and Social Psychology Review, 9*(2), 131-155.

Kristen, C. (1999). *Bildungsentscheidungen und Bildungsungleichheit – ein Überblick über den Forschungsstand* [Educational choices and educational disadvantage – an overview of the state of research]. Mannheim.

Kultusministerkonferenz. (2010). *Ländergemeinsame inhaltliche Anforderungen für die Fachwissenschaften und Fachdidaktiken in der Lehrerbildung* [Joint Requirements of the German federal states' for the subject discipline and the subjekt (matter) didactics in teacher education]. Bonn: Kultusministerkonferenz 16.10.2008.

Lehmann, R., Peek, R., & Gänsfuß, R. (1997). *Aspekte der Lernausgangslage von Schülerinnen und Schülern der fünften Klassen an Hamburger Schulen. Bericht über die Untersuchung im September 1996* [Aspects of students learning in the fifth grade of school in Hamburg. Report of the 1996th survey]. Berlin.

Leisen, J. (2010). *Handbuch Sprachförderung im Fach – Sprachsensibler Fachunterricht in der Praxis*. [Handbook language support assistance – Practicing language sensitive teaching in subject lessons]. Bonn: Varus.

Leisen, J. (2011). Sprachsensibler Fachunterricht. Ein Ansatz zur Sprachförderung im mathematisch-naturwissenschaftlichen Unterricht. [Language sensitive teaching. Language support assistance in mathematics and science lessons]. In S. Prediger, & Ö. Erkan (Eds.), *Mathematiklernen unter Bedingungen der Mehrsprachigkeit* [Learning mathematics under the condition of multilingualism] (pp. 143-162). Münster: Waxmann.

Limbid, C., & Stanat, P. (2006). *Sprachförderung bei Schülerinnen und Schülern mit Migrationshintergrund: Ansätze und ihre Wirksamkeit* [Students with migration background and language support assistance: Programs and their effectiveness]. Wiesbaden: Verlag für Sozialwissenschaften.

Mächler, S. (Ed.). (2000). *Schulerfolg: kein Zufall. Ein Ideenbuch zur Schulentwicklung im multikulturellen Umfeld* [Success in school is no matter of chance. A book of ideas about developing multicultural schools]. Zürich.

Marburger, H., Helbig, G., & Kienast, E. (1997). Sichtweisen und Orientierungen Berliner Grundschullehrerinnen und -lehrer zur Multiethnizität der bundesdeutschen Gesellschaft und den Konsequenzen für Schule und Unterricht. [Perspectives and Orientations of primary Scholl teachers in Berlin about the multi-ethnic character of the German society and consequences for school and teaching]. In A. Heintze, H. Helbig, & P. Jungbluth (Eds.), *Schule und multiethnische Schülerschaft* [School and multi-ethnic students] (pp. 4-62). Frankfurt.

Müller, N., Kupisch, T., Schmitz, K., & Cantone, K. (2007). *Einführung in die Mehrsprachigkeitsforschung* [Introduction of the research into multilingualism]. (Vol. 2). Tübingen: Gunter Narr Verlag Tübingen.

Oksaar, E. (2003). *Zweitspracherwerb. Wege zur Mehrsprachigkeit und zur interkulturellen Verständigung* [Second language acquisition. Strategies for Multilingualism and intercultural understanding]. Stuttgart: Kohlhammer.

Prenzel, M. et al. (2004). *PISA 2003: Der Bildungsstand der Jugendlichen in Deutschland. Ergebnisse des zweiten internationalen Vergleich.* [PISA 2003: Standard of education of the youngsters in Germany. First results of the second international survey]. Münster [u.a.]: Waxmann.

Prenzel, M. et al. (2007). *PISA 2006: die Ergebnisse der dritten internationalen Vergleichsstudie* [PISA 2006: Results of the third international Survey]. Münster [u.a.]: Waxmann.

Reich, H. H., & Roth, H.-J. (2002). *Spracherwerb zweisprachig aufwachsender Kinder und Jugendlicher* [Language acquisition of bilingual children and youngsters]. Hamburg: Freie und Hansestadt Hamburg, Behörde für Bildung und Sport, Amt für Schule.

Richardson, V. (1996). The Role of Attitudes and Beliefs in Learning to Teach. In V. Richardson (Ed.), *Handbook of Research on Teacher Education* (Vol. 2, pp. 102-119). New York: Macmillan

Rösch, H. (2011). *Deutsch als Zweit- und Fremdsprache* [German as a second and foreign language]. Berlin: Akad.-Verlag.

Schmidt, W. H., Tatoo, M. T., Bankow, K., Blömeke, S., et al. (2007). *The Preparation Gap: Teacher Education for Middle School Mathemtics (MT21 Report)*. Michigan.

Schnädelbach, H. (2002). *Erkenntnistheorie zur Einführung* [Epistemology]. Hamburg: Junius.

Schwippert, K., Hornberg, S., & Goy, M. (2008). Lesekompetenzen von Kindern mit Migrationshintergrund im nationalen Vergleich. [Reading literacy skills of children with migration background in a national comparison]. In W. Bos, S. Hornberg, K.-H. Arnold, & G. Faust (Eds.), *IGLU-E 2006. Die Länder der Bundesrepublik Deutschland im nationalen und internationalen Vergleich* [IGLUE-E 2006 The federal states of the Federal Republic of Germany in a national and international comparison] (pp. 111-126). Münster: Waxmann.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Song, Y., & Andrews, S. (2009). *The L1 in L2 Learning – Teachers' beliefs and practices*. München: LINCOM.

Staub, F., & Stern, E. (2002). The Nature of Teachers' Pedagogical Content Beliefs Matters for Students' Achievement Gains: Quasi-Experimental Evidence From Elementary Mathematics. *Journal of Educational Psychology, 94*(2), 344-355.

Trautmann, M. (2005). Überzeugungen vom Englischlernen [Beliefs about learning English language]. *Zeitschrift für Erziehungswissenschaft, 8*(1), 38-52.

Tsui, A. B. M. (2003). *Understanding expertise in teaching: Case studies of second language teachers*. Cambridge: Cambridge University Press.

Weinert, F. E. (1999). *Konzepte der Kompetenz* [Concepts of competence]. Paris: OECD.

Woods, D. (1996). *Teacher and cognition in language teaching.* Cambridge: Cambridge University Press.

Woolfolk Hoy, A., Davis, H., & Pape J. S. (2006). Teacher Knowledge and Beliefs. In P. A. Alexander, & P. H. Winne (Eds.), *Handbook of Educational Psychology* (Vol. 2, pp. 715-737). London: LEA

Chapter 11
Teachers' Beliefs about Retention: Effects on Teaching Quality

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Abstract

This article focuses on teachers' beliefs regarding the use of retention (repeating a school year) in schools. It seeks to identify the possible effects on teaching quality. The analysis is based on data from several thousand teachers and pupils at secondary schools in North Rhine-Westphalia who, in 2009, were asked inter alia about their views and the quality of their teaching. Analyses performed at school level show that teachers' beliefs on retention broadly correlate with the main aspects of teaching quality. In schools where teachers endorse the practice of retention, teaching methods are less often differentiated and the pupils do not receive the same levels of support as they do in schools where teachers oppose the practice. The results are discussed in relation to approaches for dealing with mixed ability teaching groups.

Keywords:
Teacher beliefs, retention, teaching quality, adaptive teaching

11.1 Introduction

A key assumption in the German school system is that when pupils of equivalent ability are grouped together in schools and classes the preconditions for support and learning are particularly favourable. As a result, certain measures have been introduced, such as the qualifying date for starting school, external differentiation into year groups and the early – in comparison with other countries – allocation of pupils into different types of schools, which pursue the aim of creating and maintaining single ability teaching groups. This aim is achieved as international comparisons such as the PISA studies show (Baumert & Schümer, 2001).

In Germany, the organisation of pupils into year groups aims to guarantee that pupils are taught in groups with peers of the same age and ability as themselves (Klemm, 2009). This is especially important when examining the practice of retention, which is often used in Germany. In the 2006/07 school year, for instance, the retention rate in German schools was 2.7 %. This means that roughly 234,000 pupils from primary to sixth form level repeated a year (Autorengruppe Bildungsberichterstattung, 2008). The annual figure accumulates so that by the end of secondary education

(before the sixth form) more than 20% of pupils in Germany have repeated at least one school year (Tillmann & Meier, 2001, p. 473; Prenzel et al., 2004, p. 286).

Generally, pupils repeat a year when they have been unable to meet the standards required of them over the course of the year and are thus unable to keep up with their peers – in this case, with the pupils in their group who progress to the next school year. According to Klemm (2009, p. 5) there are two expectations linked to the decision to require pupils to repeat a year: "firstly, it is presumed that, within a teaching group, weaker pupils hinder the progress of better-performing pupils. By taking the pupils who perform less well out of a teaching group the development of the best pupils is encouraged. Secondly, however, it is also assumed that weaker pupils have struggled to cope in their original group. They should then find that repeating a year provides an environment where they have a better chance of making progress."

These expectations are not necessarily shared in other countries. Germany is one of the few European countries where progression to the next school year does not happen automatically (cf. Eurydice, 2005). In other countries, such as Finland, Sweden or Canada, the practice of streaming pupils is part of the ethos of an "education system that supports diversity" and methods for individual pupil support are used as a matter of course (cf. for example, Ratzki, 2005; Sarjala & Häkli, 2008).

In Germany schools have a legal responsibility to promote pupils' development. For instance, Section 1 of the North Rhine-Westphalia Education Law states that every young person has the right to schooling, education and personal development (Schulgesetz NRW – SchulG, 2009). To a certain extent, it can be argued that by choosing to hold pupils back a year schools are contravening the principle of equal opportunities (cf. Sandfuchs, 2005). Moreover, making pupils repeat a year involves costs and is uneconomical, not only from a financial perspective (cf. summary in Klemm, 2009), but also because of the effects on a young person's personal development. Lastly, there is a lack of empirical data from within Germany or elsewhere which prove that repeating a year improves pupil performance (cf. Belser & Küsel, 1976; Einsiedler & Glumpler, 1989; Bless et al., 2004; Hong & Raudenbush, 2005; Tillmann & Meier, 2001; Krohne & Tillmann, 2006; Ehmke, Drechsel & Carstensen, 2008).

While these findings highlight considerable problems with retention as an instrument for creating single ability learning groups in Germany, its simple abolition would not solve the problems that are – from a practical standpoint – seen as a reason for using the instrument. More than two decades ago now, Roeder and Schümer (1987, p. 25), on the basis of an empirical study on retention, gave the following assessment: "In the discussion on retention, the question of the effectiveness of alternative measures is of crucial importance. Before practical solutions have been found, simply stopping retention will only postpone problems, rather than solve them. And when these occur later on in a different context, both an individual's educational pathway and schools as an institution might be harmed more seriously than they are as a result of a limited use of retention."

In recent years, there have been prominent discussions on suitable approaches to mixed ability teaching. These have ranged from calls for educational reform, a topic which receives clear backing from those in favour of inclusive education (e.g. Reich, 2012), to discussions arising from empirical research into teaching quality (e.g. Baumert et al., 2004; Helmke, 2009) and to international debates (OECD, 2010; 2011; Eurydice, 2011). These discussions have also influenced education policy guidelines on ensuring quality in schools and education.

A first step towards tackling this issue would be to look at the possible causes for retention and the reasons given as to why a pupil is required to repeat a year. Tietze and Rossbach (2001) point to a subdivision into individual and institutional causes or explanations. On the one hand, retention can be traced back to personal factors relating to individual pupils. This might be an unwillingness on the part of the pupil to put in the required effort or a lack of parental support. On the other hand, retention should be viewed alongside other aspects of educational provision, the structure and quality of the school and teaching as well as elements such as the conduct of teaching staff. From research into pupil performance we know – at least in the case of pupils for whom school is an effective environment – that the role of teachers is crucial (e.g. Hattie, 2009; Lipowsky, 2006, as an overview; König, Wagner & Valtin, 2011). When it comes to the institutional reasons for retention, it is worth establishing to what extent retention is of importance to pupils, but also to teaching staff.

Previous studies indicate that teachers do not necessarily feel responsible for retention or pupil failure (Hurrelmann & Wolf, 1986; Lankes et al., 2004). The decision as to whether a pupil has to repeat a year is not necessarily reached simply by assessing the most objective criteria of the pupil's ability; the subjective opinion of a teacher or the collective opinion of a group of teachers can also be taken into account (Bless et al., 2004; Bellenberg & Meyer-Lauber, 2007). Teachers in Germany tend to be in favour of retention as an educational measure (Tietze & Rossbach, 2001). It is seen as providing an opportunity for single ability learning groups to be established; making students repeat a year is also seen as a method for providing individual pupil support (cf. e.g. Tillmann, 2004; Höhmann, 2006). Despite this insight into the way in which teachers deal with retention, and their views and opinions on it, there are very few empirical studies in this area (Tietze & Rossbach, 2001).

11.1.1 Teachers' Beliefs about Retention

In discussions on teachers' professional competence great importance is attached to their beliefs and values (Baumert & Kunter, 2006) since these can play a significant role in determining the way in which a teacher works in the classroom (e.g. Schoenfeld, 1998). When it comes to teachers' values and beliefs, Baumert and Kunter (2006, p. 497) have identified four areas for analysis: values, epistemological beliefs, subjective theories on teaching and learning and goal systems for curricula and the classroom. Our focus is on teachers' views on retention, which are presented in section

11.2.2. These views can be distinguished relatively easily from epistemological beliefs, since the latter relates to the structure and genesis of knowledge (Buehl & Alexander, 2001; Hofer & Pintrich, 2002). Instead, we believe the views on which we are focusing relate closely to values on the one hand and subjective theories about instructive teaching and learning on the other.

11.1.2 Research Question

Models for empirical research into schools and teaching (e.g. Helmke, 2009) assume that, besides teachers' professional skills, their views, beliefs and attitudes relating to school and teaching play a significant role such that they can be used to explain the way teaching and learning is organised and how teaching provision is structured, as well as the interaction between teachers and pupils. Our research is based on the assumption that views on retention are a suitable indicator for explaining aspects of teaching quality, which can be linked to the provision of support and encouragement in particular for pupils who underperform, for instance, those who may be required to repeat a year.

Teachers who are in favour of retention are less likely to support weaker pupils in their class by differentiating their lessons. They provide less individual support for their pupils. In addition, their feedback on performance, which is crucial for pupil progress, is less differentiated, whilst they also place higher demands on their pupils' ability, since they assume that they are prepared to put in a lot of hard work. Against this background, we predict that teachers views on retention will correlate with key aspects relating to the quality of their teaching. This hypothesis will be tested below.

11.2 Method

11.2.1 Sample

The data used below have been taken from the study entitled *Komm mit! – Fördern statt Sitzenbleiben* (Come along! – Support rather than retention). The study is the monitoring element of an initiative of the same name which was launched to reduce the number of pupils having to repeat the year in classes 7, 8 and 9 in North Rhine-Westphalia. The study was started in 2008 by the Institute for General Didactics and School Research of the Faculty of Human Sciences at the University of Cologne under the leadership of Professor Dr Rainer Peek (†) and the coordination of Kerstin Darge and has been carried out with funding from the Ministry of Schools of the State of North Rhine-Westphalia (cf. König & Darge, 2010).[1]

1 After Prof. Dr Rainer Peek passed away in the summer of 2009 the responsibility for leading the project and for continuing the scientific monitoring study entitled *Komm Mit! – Fördern statt Sitzenbleiben* was transferred to Prof. Dr Andreas Helmke of the University of Koblenz-Landau. The data

In December 2008, 70 of the 400 schools that participated in the *Komm Mit! – Fördern statt Sitzenbleiben* initiative were selected as test institutions for the monitoring process, which was conducted using teacher and pupil questionnaires. Although these test schools were selected from the participating schools at random, it should be noted that the 400 schools participating in the state initiative did so on a voluntary basis.

In order to create the most reliable indicators possible at school level, with the aid of the questionnaire data from teachers and pupils collated in later analyses through aggregation, the decision was taken to ask all of the teaching staff to answer questionnaires, along with all of the pupils in class 8 (academic year 2008/09), i.e. to conduct a full survey of the teaching staff and a full survey of pupils from class 8.[2] For this reason, the number of people surveyed (teachers and pupils) is relatively large in comparison with the number of schools (cf. Table 11.1). Various school types are represented within the sample: *Gymnasium*, *Realschule*, *Hauptschule* and *Gesamtschule*.

In total, 84 schools were contacted about collecting data from pupils and teachers using questionnaires. 14 schools decided not to participate in the survey. The reasons given included organisational constraints placed upon the schools, but there were also fears that the survey data could lead to conclusions being drawn about individual teachers. The response rate of the 70 schools that did participate in the survey was relatively high. Around 85% of the pupils in class 8 participated in the survey. The average response rate of teachers was 68%, but varied between schools; roughly half of the schools (36 out of 70) had a response rate of 75% or higher, for roughly one third (23 out of 70) the response rate was 50% to 74% and for the remaining schools the response rate was still 35% or higher, whilst just one school had a very low rate of 6%.

In the interests of data protection, it was decided not to classify teachers and pupils at class level. This means that individual teachers, who taught class 8 during the 2008/09 academic year cannot be identified and, for example, their answers cannot be linked to class 8 pupils from their school. As a consequence the information on retention provided by pupils can only be linked to the teachers' data at school level. Table 11.1 provides an overview of the composition of the sample (for further details see König & Darge, 2010).

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that were collected up to this point also remain at the Institute for General Didactics and School Research of the Faculty of Human Sciences at the University of Cologne. This article relates exclusively to the first part of the study.

2 Since retention is increasingly common in North Rhine-Westphalia from class 8 to the start of the sixth form, and since the monitoring study was originally a longitudinal one, the decision was taken to focus on pupils in class 8. The progress of the pupils involved should be monitored over the next two academic years, so that the aims of the monitoring study can be tested longitudinally.

Table 11.1: Sample for the teacher and pupil survey

	Schools	Teachers (Full survey of staff)	Pupils (Full survey of class 8)
Gymnasium	23	1,070 (46.4%)	2,285 (37.5%)
Realschule	21	591 (25.6%)	1,920 (31.5%)
Hauptschule	21	471 (20.4%)	999 (16.5%)
Gesamtschule	5	176 (7.6%)	882 (14.5%)
Total	70	2,308 (100.0%)	6,086 (100.0%)

11.2.2 Instruments

Teachers' Beliefs about Retention

The measurement of teachers' beliefs about retention was conducted using seven statements, each with a four-point response format (agree completely – partly agree – don't really agree – don't agree at all). The statements were developed as part of a multi-stage process. Firstly, conversations were held with head teachers and teaching staff regarding their beliefs on the practice of retention. Next, these beliefs were written down and the formulations were developed from the material which had been collected. The statements were further examined by educationalists, psychologists, teachers and head teachers, in order to reach a decision on the statements that could be included in the questionnaires. They are listed in Table 11.2.

Table 11.2: Statements used to measure teachers' beliefs about retention

1.	I believe it is right that underperforming pupils should repeat school years.
2.	The practice of retention should be abolished.
3.	My experience has shown that repeating a year definitely has a positive effect on the pupils concerned.
4.	Pupils should not be forced to repeat a year.
5.	Retention has more disadvantages than advantages for pupils.
6.	The practice of retention is a suitable form of individual pupil support.
7.	I consider retention to be an effective way of preventing educational failure.

Items 2, 4 and 5 were recoded when forming the scale.

It was possible to reproduce the overall factorial structure in a confirmatory factor analysis (χ^2 = 536.14, *df* = 14, *p* = .001, *SRMR* = .049, *RMSEA* = .127, *CFI* = .93, *TLI* = .90); the standardised factor weightings varied between .58 and .81 (cf. Darge, König & Schreiber, 2010, p. 19). The scale is reliable (Cronbach's Alpha = 0.86). The construct varies significantly across schools (ICC_1 = 0.15, ICC_2 = 0.85; cf. our explanation of the measures of intra-class correlation in the next section). This means

that the variance between the groups of teaching staff from the schools studied here is 15%. Thus, it is possible, in principle, to conduct summary analyses between this scale on teachers' beliefs and the aspects of teaching quality at school level.

Teaching Quality

The pupils that participated in the study were asked to evaluate various aspects of the quality of their teachers' work. This section of the pupils' questionnaire was introduced with the question: "How do you rate your teachers?" The pupils had to state the extent to which they agreed with the various statements (all – many – few – none). The scales used in this study to record teaching quality were developed with a focus on the key dimensions of teaching quality, as established by empirical research on education (Slavin, 1994; Helmke, 2009; Baumert et al., 2004) or they were taken from existing literature (for more details on this, see Darge, König, & Schreiber, 2010).

Since we have not used the individual pupils' assessments of teaching in the following analyses, but rather we have always used the average values for teaching across the class, we observed, as proposed by Lüdtke, Trautwein, Kunter and Baumert (2006, p. 87), two measures of intra-class correlations: ICC_1 (representativeness of the individual assessments of the whole school class) and ICC_2 (accuracy of the assessment reached by all pupils in a class; should be greater than .7). ICC_1 and ICC_2 in Table 11.3 therefore relate to the splitting of the overall variance into the amount of variance between the pupils within the school class and the amount of variance between school classes.

Table 11.3: Scales for the measurement of teaching quality (pupil questionnaires)

	Number of items	Example of items	Cronbach's α	ICC_1	ICC_2
Feedback	4	Our teachers regularly give us feedback on our learning progress.	.72	.13	.79
Support	7	Our teachers make every effort to help weaker pupils.	.83	.18	.85
Structured instruction	4	Our teachers give us clear instructions in lessons as to what we should do.	.66	.10	.74
Ability focus	4	Our teachers place high demands on us.	.61	.11	.76

In addition, the teachers were asked to state the extent to which they make use of differentiation in their lessons, above all to support weaker pupils. Table 11.4 shows the relevant values. ICC_1 and ICC_2 here relate to the splitting of the overall variance into the amount of variance between teachers within the school and the amount of variance between schools.

Table 11.4: Scales for measuring teaching quality (teacher questionnaires)

	Number of items	Example of item	Cronbach's α	ICC_1	ICC_2
Differentiation in lessons	5	I make efforts to make use of varied and stimulating teaching styles and methods, in particular for pupils who run the risk of having to repeat a year.	.81	.08	.74

11.3 Results

Firstly, it is interesting to discover how far teaching staff accept or reject the scale on retention. On average their approval was towards the middle area (M = 2.58, SD = 0.65), near to the theoretical mean of the scale. Taking into consideration the percentage rate of approval or rejection of the individual statements (see Table 11.5), it becomes apparent that a significant proportion of teachers are in favour of the practice of retention – around 60% are not in favour of its abolition – whilst only around 30% support the idea that pupils should not be forced to repeat a year. As expected, a substantial proportion, roughly one third, view retention as a suitable measure of individual pupil support.

Table 11.5: Percentage approval of teachers to the items in the scale measuring teachers' beliefs about retention

		Agree completely	Partly agree	Don't really agree	Don't agree at all
1.	I believe it is right that underperforming pupils should repeat school years.	15.8	52.3	22.0	9.9
2.	The practice of retention should be abolished.	11.5	28.0	30.0	30.4
3.	My experience has shown that repeating a year definitely has a positive effect on the pupils concerned.	6.7	62.7	24.7	5.9
4.	Pupils should not be forced to repeat a year.	10.4	20.4	29.1	40.1
5.	Retention has more disadvantages than advantages for pupils.	10.7	40.1	42.6	6.6
6.	The practice of retention is a suitable form of individual pupil support.	4.1	31.1	39.3	25.4
7.	I consider retention to be an effective way of preventing educational failure.	5.6	36.1	34.9	23.4

The teachers surveyed tended to agree with the characteristics of good lessons; they described their lessons as differentiated (M = 2.95). The pupils, however, tended to agree with the statements on structured teaching, whilst the scales on feedback,

support and ability focus tended to receive ambivalent responses. Looking at the aggregated values for all five aspects of teaching quality (Figure 11.1), we can see considerable variance between the schools (see also Table 11.6). So our sample includes schools that each show considerable differences in the aspects of teaching quality included. This, in principle, enables testing using statistical correlations of the aspects focused on here.

Table 11.6: Means, standard deviations, scale ranges and variance between schools for the scales measuring teachers' beliefs and teaching quality

Scale	M	SD	Scale range	Variance share (in percent) between schools
TEACHER ASPECTS				
Teachers' beliefs on retention	2.58	.65	1 – 4	14.8
TEACHING QUALITY ASPECTS				
Differentiation (teacher perspective)	2.95	.47	1 – 4	8.0
Feedback (pupil perspective)	2.33	.55	1 – 4	7.2
Support (pupil perspective)	2.64	.52	1 – 4	9.8
Structured teaching (pupil perspective)	3.02	.48	1 – 4	4.2
Ability focus (pupil perspective)	2.83	.50	1 – 4	4.9

M – mean, SD – standard deviation.

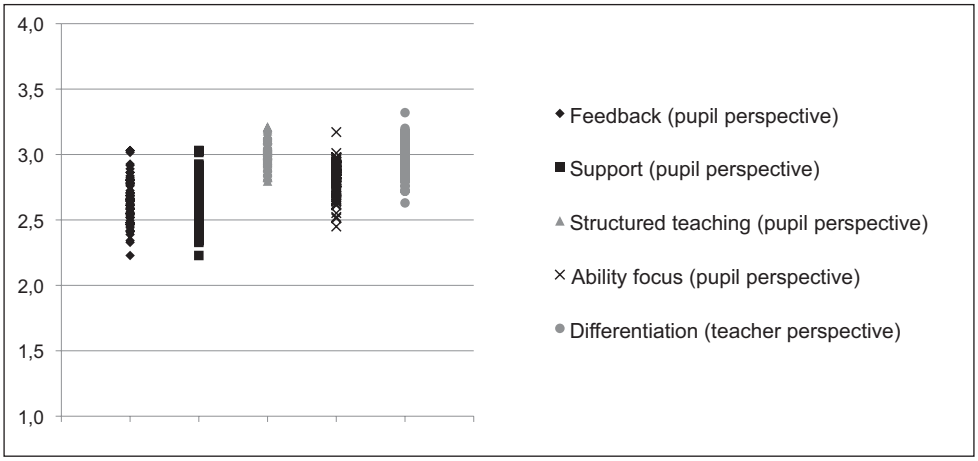

Figure 11.1: Distribution of the aggregated scale values at the school level

The corresponding results from statistical correlation analyses can be seen in Table 11.7. The statistically significant bivariate correlations between the scale for teachers' beliefs on retention and the aspects of teaching quality from the teachers' and pupils' perspectives make it clear that in schools where the teaching staff are generally in favour of the practice of retention the lessons are hold in a less differentiated way (teacher perspective) and the pupils feel less supported in their learning than in schools where the teaching staff are opposed to retention. These statistically significant correlations remain when checked against the variables of school type and the number of books owned by parents.

Table 11.7: Correlative findings at the school level between teachers' views on retention and aspects of teaching quality (n = 70 schools)

	Teachers' beliefs on retention		
		… under control variable of school type	… under control variable of the number of books owned by parents
Differentiation (teacher perspective)	-.34**	-.34**	-.28*
Feedback (pupil perspective)	-.29*	-.10	-.20
Support (pupil perspective)	-.41***	-.30*	-.37**
Structured teaching (pupil perspective)	-.15	-.13	-.12
Ability focus (pupil perspective)	.30*	.19	.24*

* p < .05, ** p < .01, *** p < .001
It was possible to use school type as a control with dummy-coded variables: Hauptschule (yes/no), Realschule (yes/no), Gesamtschule (yes/no).

11.3 Discussion

In Germany pupils are expected to repeat a school year if they do not perform well enough. This practice is not common in other countries (OECD, 2011). Research available to date presents hardly any empirical evidence to justify the decision to make pupils repeat years. In the field of pupil performance, teaching staff, as "pedagogical actors" (Fend, 2008), play a key role in every area where school and teaching can have an effect. Up until now, research on the practice of retention has consistently attached particular importance to teaching staff. However, the topic of retention itself has been the subject to very little research.

This article has approached the correlation between teachers' beliefs about retention and the quality of their teaching. We assumed, above all, that a teacher with a favourable attitude towards pupils repeating a school year would put less effort into teaching differentiated lessons adapted to the learning requirements of their pupils, as well as to providing the necessary individual pupil learning support. Using the

correlative findings of our study, it has become clear that, broadly speaking, a school whose teaching staff is in favour of pupils repeating years will offer teaching that provides only a small amount of differentiation and that supports pupils to a limited degree. Since the data from both the pupils and the teachers all point in the same direction, these correlative findings taken together indicate that this is the case. As a result, the significance of views on retention, which were recorded on a scale developed as part of this study, has been reliably established. In addition, these statements remain true even if pupils in different types of schools are looked at or their social background is considered (through the number of books their parents own).

These results do, however, have a variety of limitations, which must be investigated further. Other studies (e.g. PISA) have shown that the retention rate and pupil achievement vary significantly between pupils attending different types of schools. It is for this reason that we used the school type as a control variable in the contextual analysis. In order to clarify the results obtained here it is important to test other aspects, besides the school type, in contextual analyses against the retention rate at the school level. Presumably indicators on the characterisation of the pupils from a school (such as their average ability level in the core subjects or their social origin) would play a key role. Since we did not have this information in the data set used here, future studies should aim to include these aspects.

It should also be taken into account that no causal-analysis statements can be made using our data. This means that it is still necessary to test whether teachers' beliefs do actually affect the structure of their lessons or, inversely, whether the way lessons are structured contributes to teacher views on retention. Such questions on interdependency cannot be answered on the basis of our data. As a summary, then, future studies should look more closely at these sorts of causal-analysis problems, for example in quasi-experimental investigations on changes in teachers' beliefs (cf. König, submitted).

In spite of the limitations mentioned, the correlations reported here can be linked to the results of previous studies, which demonstrate the importance of teachers' views and beliefs in reaching decisions on pupil retention. That is why teachers should deeply reflect on their beliefs underlying a possible decision regarding the retention of a student they teach. In any case, teachers are recommended to keep in mind their beliefs can make a difference.

References

Autorengruppe Bildungsberichterstattung (Hrsg.) (2008). *Bildung in Deutschland 2008. Ein indikatorengestützter Bericht mit einer Analyse zu Übergängen im Anschluss an den Sekundarbereich I* [Education in Germany 2008. Empirical Report with an Analysis on the Transfer following Middle Schooling]. Bielefeld: wbv.

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften [Keywords: Professional competence of teachers]. *Zeitschrift für Erziehungswissenschaft, 9*(4), 469-520.

Baumert, J., & Schümer, G. (2001). Familiäre Lebensverhältnisse, Bildungsbeteiligung und Kompetenzerwerb [Life circumstances at home, educational career, and student achievement]. In J. Baumert, E. Klieme, M. Neubrand, M. Prenzel, U. Schiefele, W. Schneider, P. Stanat, K.-J. Tillmann, & M. Weiß (Eds.), *PISA 2000. Basiskompetenzen von Schülerinnen und Schülern im internationalen Vergleich* [PISA 2000. International Comparison of Student Competences] (pp. 323-407). Opladen: Leske + Budrich.

Baumert, J., Kunter, M., Brunner, M., Krauss, S., Blum, W., & Neubrand, M. (2004). Mathematikunterricht aus Sicht der PISA-Schülerinnen und -Schüler und ihrer Lehrkräfte [Mathematic Teaching from the Perspective of PISA-students and their Teachers]. In M. Prenzel, J. Baumert, W. Blum, R. Lehmann, D. Leutner, M. Neubrand, R. Pekrun, H.-G. Rolff, J. Rost, & U. Schiefele (Eds.), *PISA 2003. Der Bildungsstand der Jugendlichen in Deutschland. Ergebnisse des zweiten internationalen Vergleichs* [PISA 2003. Education of Adolescents in Germany – Findings from the Second International Comparison] (pp. 314-354). Münster: Waxmann.

Bellenberg, G., & Meyer-Lauber, A. (2007). Sitzenlassen: Unpädagogisch, teuer und wirkungslos [Retention: Un-pedagogical, Expensive and Ineffective]. *Neue Deutsche Schule, 10*, 9-11.

Belser, H., & Küsel, G. (1976). Zum Sitzenbleiberproblem an Volksschulen [On the Problem of Retention in Primary Schools]. In R. Biermann (Ed.), *Schulische Selektion in der Diskussion* [Discussing Selection in Schools] (pp. 101-115). Bad Heilbrunn: Klinkhardt.

Bless, G., Schüpbach, M., & Bonvin, P. (2004). *Klassenwiederholung. Determinanten, Wirkungen und Konsequenzen* [Retention. Determinants, Effects, and Consequences]. Bern: Haupt Verlag.

Buehl, M. M., & Alexander, P. (2001). Beliefs about academic knowledge. *Educational Psychology Review, 13*, 382-418.

Darge, K., König, J., & Schreiber, M. (2010) *Skalendokumentation der Schüler- und Lehrerbefragung im Rahmen des Projektes „Komm Mit – Fördern statt Sitzenbleiben" [Scale documentation of the student and teacher survey of the research project „Komm Mit – Fördern statt Sitzenbleiben"].* Technical Report. Cologne: University of Cologne. Available at: http://kups.ub.uni-koeln.de/3108/

Ehmke, T., Drechsel, B., & Carstensen, C. H. (2008). Klassenwiederholen in PISA-I+: Was lernen Sitzenbleiber in Mathematik dazu? [Grade repetition in PISA-I-Plus: What do students who repeat a class learn in mathematics?] *Zeitschrift für Erziehungswissenschaft, 11* (3), 368-387.

Einsiedler, W., & Glumpler, E. (1989). Analysen zur Entwicklung des Sitzenbleibens (unter besonderer Berücksichtigung der Grundschule) [Analyses on the Development of Retention (with a special focus on Primary School Education)]. *Die Deutsche Schule. Zeitschrift für Erziehungswissenschaft, Bildungspolitik und pädagogische Praxis, 81*(2), 248-259.

Eurydice (2005). *Schlüsselzahlen zum Bildungswesen in Europa* [Key Statistics on Education in Europe]. Luxemburg: Amt für Veröffentlichungen der Europäischen Gemeinschaften.

Eurydice (2011). Grade Retention during Compulsory Education in Europe: Regulations and Statistics. Brussel: EACEA.

Fend, H. (2008). *Schule gestalten. Systemsteuerung, Schulentwicklung und Unterrichtsqualität* [Making Schools. System Regulation, School Development, and Teaching Quality]. Wiesbaden: VS.

Hattie, J. (2009). *Visible Learning; a synthesis of over 800 meta-analyses relating to achievement.* London: Routledge.

Helmke, A. (2009). *Unterrichtsqualität und Lehrerprofessionalität. Diagnose, Evaluation und Verbesserung des Unterrichts* [Teaching quality and teacher professionalism. Diagnosis, evaluation, and improvement of teaching]. Seelze: Kallmeyer.

Hofer, B. K., & Pintrich, P. R. (2002). Personal Epistemology: The Psychology of Beliefs about Knowledge and Knowing. Mahwah, NJ: Erlbaum.

Höhmann, K. (2006). Sitzenbleiben reduzieren heißt Schule entwickeln [Reducing Retention Means Developing Schools]. *SchulVerwaltung spezial, 4*, 26-29.

Hong, G., & Raudenbush, S. W. (2005). Effects of Kindergarten Retention Policy on Children's Cognitive Growth in Reading and Mathematics. *Educational Evaluation and Policy Analysis*, 27(3), 205-224.

Hurrelmann, K., & Wolf, H. K. (1986). *Schulerfolg und Schulversagen im Jugendalter. Fallanalysen von Bildungslaufbahnen. Personale, familiale und schulische Bedingungen von Schulerfolg und Schulversagen* [School Success and Failure during Adolescence. Case Studies of Educational Careers. Personal, Familial, and School-Related Determinants of School Success and School Failure]. Weinheim: Beltz.

Klemm, K. (2009). Klassenwiederholungen – teuer und unwirksam. Eine Studie zu den Ausgaben für Klassenwiederholungen in Deutschland im Auftrag der Bertelsmann Stiftung [Grade retention – expensive and ineffective. A study on the expenses for grade retention in Germany]. Gütersloh.

König, J. (submitted). Methoden und Designs der empirischen Forschung im edukativen Bereich – Bestandsaufnahme und Barrieren für experimentelle Forschung [Methods and Designs of Empirical Educational Research – State of Affairs and Barriers for Experimental Research]. *Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen*.

König, J., & Darge, K. (2010). Sitzenbleiben – Erfahrungen und Einstellungen von Lehrern und Schülern: Erste Ergebnisse aus der wissenschaftlichen Begleitstudie zur Initiative „Komm Mit! – Fördern statt Sitzenbleiben" des Schulministeriums NRW und der nordrheinwestfälischen Lehrerverbände [Retention – Perceptions and Beliefs of Teachers and Students: First Findings from Research on the Initiative „Komm Mit! – Fördern statt Sitzenbleiben" carried out by the School Ministry of Northrhine-Westphalia and Teachers Associations]. In W. Böttcher, J. N. Dicke, & N. Hogrebe (Eds.), *Evaluation, Bildung und Gesellschaft. Steuerungsinstrumente zwischen Anspruch und Wirklichkeit* [Evaluation, Education, and Society. Policy Instruments between Expectations and Reality] (pp. 89-104). Münster: Waxmann.

König, J., Wagner, C., & Valtin, R. (2011). *Jugend – Schule – Zukunft. Psychosoziale Bedingungen der Persönlichkeitsentwicklung – Ergebnisse der Längsschnittstudie AIDA* [Adolescence – School – Future. Psycho-Social Factors of Personality Development – Findings from the Longitudinal Study AIDA]. Münster: Waxmann.

Krohne, J., & Tillmann, K.-J. (2006). „Sitzenbleiben" – eine tradierte Praxis auf dem Prüfstand [„Retention" – Assessing a Traditional Routine]. *SchulverwaltungSpezial, 4*, 6-9.

Lankes, E.-M., Plaßmeier, N., Bos, W., & Schwippert, K. (2004). Lehr- und Lernbedingungen in einigen Ländern der Bundesrepublik Deutschland und im internationalen Vergleich [Factors of Teaching and Learning in Some Federal States of Germany and Internationally Compared]. In W. Bos, E.-M. Lankes, M. Prenzel, K. Schwippert, R. Valtin, & G. Walther (Eds.). (2004). *IGLU. Einige Länder der Bundesrepublik Deutschland im nationalen und internationalen Vergleich* [IGLU. Some Federal States of Germany Compared Nationally and Internationally]. Münster, New York, München, Berlin: Waxmann.

Lipowsky, F. (2006). Auf den Lehrer kommt es an. Empirische Evidenzen für Zusammenhänge zwischen Lehrerkompetenzen, Lehrerhandeln und dem Lernen der Schüler

[Teachers matter. Empirical Evidences on the Correlations of Teacher Competence, Teacher Performance, and Student Learning]. *Zeitschrift für Pädagogik, 51. Beiheft*, 47-70.

Lüdtke, O., Trautwein, U., Kunter, M., & Baumert, J. (2006). Analyse von Lernumwelten [Analysis of the learning environment]. *Zeitschrift für Pädagogische Psychologie, 20*, 85-96.

OECD (2010). *Educating Teachers for Diversity: Meeting the Challenge*. Paris: OECD Publishing.

OECD (2011). *PISA in Focus*. Paris: OECD Publishing.

Prenzel, M. et al. (Hrsg.) (2004): *PISA 2003 – Der Bildungsstand der Jugendlichen in Deutschland – Ergebnisse des zweiten internationalen Vergleichs* [PISA 2003 – The educational level of adolescents in Germany. Results from the second international comparison]. Münster: Waxmann.

Ratzki, A. (2005). Pädagogik der Vielfalt im Licht internationaler Schulerfahrungen [Pedagogy of Diversity in the Light of International School Experience]. In K. Bräu, & U. Schwerdt (Eds.), *Heterogenität als Chance* [Heterogeneity as a Chance] (pp. 37–52). Münster: LIT-Verlag.

Reich, K. (Ed.). (2012). Inklusion und Bildungsgerechtigkeit [Inclusion and educational fairness]. Weinheim: Beltz.

Roeder, P. M., & Schümer, G. (1987). Hauptschullehrer urteilen über das Sitzenbleiben. [Middle School Teachers Judge on Retention]. *Westermanns Pädagogische Beiträge, 39*, (4), 20-25.

Sandfuchs, U. (2005). Fördern und Förderunterricht [Support and Support Lessons]. In W. Einsiedler (Hrsg.) *Handbuch Grundschulpädagogik und Grundschuldidaktik* [Handbook of Primary School Education and Didactic] (pp. 292-298). Bad Heilbrunn: Klinkhardt.

Sarjala, J., & Häkli, E. (Eds.). (2008). Jenseits von PISA. Finnlands Schulsystem und seine neuesten Entwicklungen [Beyond PISA. Finland's School System and its Recent Development]. Berlin: Berliner Wissenschafts-Verlag.

Schoenfeld, A. H. (1998). Toward a theory of teaching-in-context. *Issues in Education, 4*, 1-94.

Schulgesetz für das Land Nordrhein-Westfalen [School Regulations in North-Rhine Westphalia] (Schulgesetz NRW – SchulG). 15 February 2005 (GV. NRW. p. 102).

Slavin, R. E. (1994). Quality, appropiateness, incentive, and time: A model of instructional effectiveness. *International Journal of Educational Research, 21*, 141-157.

Tillmann, K.-J. (2004). System jagt Fiktion. Die homogene Lerngruppe [System Chasing Fiction. The Homogeneous Learning Group]. In: Becker, G., Lenzen, K.-D., Stäudel, L., Tillmann, K.-J., Werning, R., & Winter, F. (Eds.), *Heterogenität. Unterschiede nutzen – Gemeinsamkeiten stärken* [Heterogeneity. Using Differences – Strengthening Commonalities] (pp. 6-9). *Friedrich Jahresheft* 2004.

Tillmann, K.-J., & Meier, U. (2001). Schule, Familie und Freunde-Erfahrungen von Schülerinnen und Schülern in Deutschland [School, Family, and Peers-Experience of Students in Germany]. In Baumert et al. (Ed.), *PISA 2000. Basiskompetenzen von Schülerinnen und Schülern in internationalen Vergleich* [PISA 2000. Competencies of Students Compared Internationally] (pp. 468-509). Opladen: Leske + Budrich.

Tietze, W., & Roßbach, H. G. (2001). Sitzenbleiben [Retention]. In D. Rost (Ed.), *Handwörterbuch Pädagogische Psychologie* [Hanbook of Educational Psychology] (pp. 641-646). Weinheim: Beltz.

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