

Chapter 1

Are Researchers in Educational Theory Free of Beliefs: In Contrast to Students and Teachers?—Is There an Overseen Research Problem or Are There “Blank Spots”?



Günter Törner

Abstract In this article, the author gives an overview of current research on the topic of beliefs and raises the question whether beliefs of researchers themselves have been overlooked.

1.1 Belief Research in Mathematics Didactics—Anno 2018

By now, the amount of research articles dealing with the role of beliefs in mathematical teaching and learning processes has become almost unmanageable. It is questionable what exactly the respective researchers refer to when using the term “belief,” only very few of them explicitly explain the terminology underlying their works. More so, a unification of terms, as recommended by the author, has only reached a couple of inclined readers (Törner, 2002). Eventually, every author uses his personal definition and these subjective definitions of beliefs have become excellent examples for actual beliefs.

However, there has been a significant change since 2002, as in those days beliefs had still been described as “hidden variables” by Leder, Pehkonen, and Törner (2002). By now, beliefs—however defined—have proven to be a multifaceted and important factor of explanation and already in Goldin, Rösken and Törner (2009) we have been able to announce: Beliefs are no longer a hidden variable!

Given that, within the frame of scientific publications, beliefs are only seldom further defined as being constructs, a functional understanding of beliefs seems to offer a complementary frame of research. The doctoral dissertation by Rolka (2006) has made a major contribution in this respect. Already in Abelson (1986) we can find corresponding approaches. Very often, beliefs disclose learning impediments and barriers within learning processes. The failure of the curricular

G. Törner (✉)
University of Duisburg-Essen, Duisburg, Germany
e-mail: guenter.toerner@uni-due.de

Problem-Solving-Initiative is an excellent example since its implementation failed due to inadequate beliefs (cf. Frank, 1988, 1990; Schoenfeld, 1985). Schoenfeld (2010) follows a similar approach when using the term “orientation” instead of “beliefs” in order to refer to the often unreflected “personal subjective theories” of the active players in question. This is especially true for decision-making processes, as emphasized by Schoenfeld.

Furthermore, it has become apparent by now that we should not diametrically oppose beliefs to what we consider as “knowledge” (Abelson, 1986). The author modifies a metaphor deriving from the field of history and being attributed to the renowned German historian Nipperdey (1927–1992); we formulate analogously:

The colors symbolizing knowledge and beliefs are not those of a chessboard, namely black and white, instead they are constituted by infinite nuances and shades of gray.

Such a view helps us get rid of what is occasionally suggested when knowledge is graded as being good and beliefs as being bad. At this point we also need to recall the title of a book by Lakoff and Johnson (1980) dealing with the role of metaphors: *Metaphors We Live By*. We have come to realize: Yes indeed, we all live with beliefs. In the end this is both inevitable and very normal. Alan Schoenfeld has personally stated to the author: We are all victims of our beliefs structures which are shaped by both our experience and our communities. Very often we do not reflect on this circumstance.

Very often it seems—and the author has been able to pin this insight in his surveys—as if beliefs simply prevent us from having a cognitive vacuum. Elements of unknowingness in our knowledge networks are compensated by beliefs, whereby the respective networks undergo stabilization. In those subject-specific mathematical contexts in which we are not able to store reliable elements of knowledge, the resulting gaps are filled by beliefs. It happened once that in an interview the author tried to explain the aspect of exponential growth in further detail, when the interviewee answered by pointing out that during World War I, the North Sea could not be fished heavily due to military ships which resulted in an exponential growth of populations.

Even though we often speak of a so-called “body of knowledge,” it appears beneficial to also include the numerous beliefs in these considerations instead of separating them. Apparently, it seems likely that beliefs and elements of knowledge can coexist “peacefully,” and that even very contradictory and dissenting beliefs do not necessarily need to cause conflicts.

1.2 Bearers of Beliefs: The Case of Researchers

Lately, the author has often been dealing with a lack of discussion with regard to beliefs in specific areas of research literature. As already pointed out in an article included in the book by Leder et al. (2002), beliefs can initially be differentiated by the objects they refer to (their beliefs’ objects), meaning the context of the specific

belief. According to the author, a further coordinate axis is constituted by the specific bearers of beliefs.

In literature (and also during congresses) the differentiation of beliefs very often only goes as far as “beliefs of teachers” on the one hand, and “beliefs of students” on the other hand. Occasionally also outsiders experience discussion: parents, political stakeholders, or any people of a given society. If we take a closer look into our investigations, we will find that in the literature of mathematics education, there are hardly any articles dealing with the beliefs of (mathematics education) researchers. They seem to have been neglected. Why so?

Is this due to the fact that beliefs are not considered being as noble as knowledge and that we consequently should not assume researchers to have such inferior beliefs? Are beliefs parts of a fake-news-reality? Is not the sole presence of knowledge considered the manifestation of researchers’ rationality?

So far, the author’s database includes exactly three articles discussing the beliefs of mathematics teacher educators (Aydin, Baki, Kögce, & Yildiz, 2009; Aydin, Baki, Yildiz, & Kögce, 2010; Nathan & Koedinger, 2000). These works are definitely interesting; however, they do not primarily focus the differentiation of teachers’ and researchers’ beliefs. Instead, they focus the confirmation of slightly differing perceptions. The works cited do not answer the posed question. This much being said as an introduction. A first answer will be dealt with in the following section.

1.3 Beliefs as Myths

In the following we will deal with the question whether in relevant literature there is proof for researchers having beliefs after all, eventually just referred to by using different terms.

Given our reference to the terminology, orientation, preferred by Schoenfeld, it becomes apparent that the term belief may be worn and unclear. In German research literature the term “belief” has experienced untranslated establishment in order to underline its status of being a specialist term. All possible Germanizations of the term are unclear and in parts contextually fraught.

The author repeats himself when emphasizing that beliefs are multifaceted fuzzy constructs appearing in different coverings. There is no denying about Pajares’ (1992, p. 308) comment that: “... the most fruitful concepts are those to which it is impossible to attach a well-defined meaning. The respective terms may vary, but the functional patterns and modes of action only differ slightly.”

This being said, in some educational scientific contexts, beliefs are often referred to as myths. Oser (2014) explains this by the fact that our understanding of the variables and their optimal combination in teaching and learning processes within the classroom is not yet satisfying (see also Rauin (2004)). Oser continues (p. 764):

The search for the optimal combination of those variables, enabling subjectively and objectively successful teaching and learning processes, resembles the search for the Holy Grail: There is something we keep looking for and even though it is selectively apparent in single elements, we cannot really get hold of it.

This search for the Holy Grail encourages subjective theories—beliefs in the end—to grow and to get out of control. At this point we need to mention the example of *empirical myths*.

The author does not want to deal with these empirical myths in further detail; however, please note: Empirical myths arise from educational sciences being divided into an empirical and a non-empirical branch, as well as from an often detectable incorrect mutual interpretation of the different theoretical principles. It happens that explorative models are reinterpreted as loadable theory statements, so that we need to assume specific and mostly unreflected beliefs on the parts of some researchers. These are the beliefs we keep looking for.

In a 2006 talk, the well-known (German) educationalist Helmke touched upon the so-called *method-myths*. He listed a couple of examples and spoke of the following method-myths:

- Confusion of quantity and quality: Researchers equate the so-called “innovative methods” (such as open classroom instruction, activity-oriented lessons, project teaching, and learning cycles) with good teaching.
- The same group is convinced that teacher-centered instruction necessarily results in receptive and superficial learning.
- Often, we can come across representatives of a faction of educationalists who propagate that especially weaker students could benefit from open classroom instructions (or the so-called extended forms of learning).
- During classroom observations, the author has come to notice that currently active teachers and maybe even the mentor himself live by the thesis: The more various the methods, the better...

Surely the reader can confirm having come across such statements (beliefs). The examples given should have highlighted that there are convictions in the different factions among researchers which are, upon closer examination, nothing but beliefs. In literature, however, they are only seldom discussed under this specific headline even though they do have about the same effects.

At this point we could surely mention numerous beliefs—on mathematics and on the teaching and learning of it—being stated by mathematical researchers with full conviction of their propriety. However, we are eager to deliberately restrict our considerations to researchers in the field of mathematics education.

In the following we will mention three further areas of beliefs’ objects by mathematics educationalists which the author refers to as “blank spots” since they show stereotypical standard statements. In fact, these are nothing but beliefs.

1.3.1 Blank Spots in Beliefs Research?

Numerous papers by researchers deal with teachers, the institution school and the belonging students.

1.4 Teachers, School, Students

Surely, numerous didactical research papers address school reality. They give the impression that the newly gained insights are of relevance for school practice and that they should consequently be implemented. However, which idea of teachers is implicitly rooted in the statements of the researchers involved?

Teachers are the immediate addressees of researchers. They are always open-minded, interested and thankful for being able to gain new insights based on current research. Why should experience from different cultural environments not be rewarded and thus exploited for our own practical application?

Eventually, at this point researchers inadmissibly project their own self-perception onto other people. We imply that researchers are constant learners, that they have time for this process at their disposal, that they are diversely interested and curious about others' actions in the process of teaching and learning at schools. These features constitute the ideal of any scientific profession. However, these features only seldom apply to teachers working at school.

Initially we have to remark that teachers do not merely concentrate on teaching, instead they have to cover numerous duties accompanying the teaching processes at school: consultations with parents, correction of class tests, preparation of lessons, cooperation among colleagues, and many more. Other features include administrative tasks like curriculum or teacher conferences. The time of actual teaching may consume about 26 h per week. Roughly estimated this covers about 60% of the total working hours at best. With other words: There is only little time for autonomous and freely organized learning.

It is quickly neglected that only very few teachers are able to take note of the articles in research journals. Given the number of journals this is already tough for researchers who are usually confined to one specific area of research. We cherish an illusion in believing that teachers go sit in the library of the nearby university in order to go through the latest publications. How should they even take note of them?

Even if we assume that (some) highly interested teachers were fond of falling back upon external suggestions from the research sector, do not such teachers need to struggle with the belief that researcher often lack broad practical teaching experience? Following the author's observations, teachers are often skeptical towards well-meant recommendations by researchers. A renowned scientist from the USA has confirmed to the author:

... but they resonate with my experience in the US—there is, in my opinion (and as a gross abstraction) a gulf between content-focused researchers and policy-related researchers/practitioners.

Those content-focused researchers who have “lived” in schools for some time may be somewhat realistic (I hope to count myself among them), but for the most part, the content-focused and policy communities seem to live separate realities. This causes difficulties in both directions—a neglect of school realities on the part of content-focused researchers, which is as you describe, and a neglect of content-based necessities on the part of most policy people.

Further arguments cannot be neglected: Are not teachers closely bound to the curricular teaching guidelines in most countries? Besides, in most schools (recommended) consultations take place among the group of colleagues when specific contents in parallel courses are taught by different teachers. How should one single teacher step out of line just because he or she has been recommended a modification of lessons by a researcher?

1.5 Research and Practice

This conceptual couple highlights a central task being in store for research: Influencing the practice with newly gained insights. Admittedly, this conceptual couple raises a lot of questions which are not answered easily. Berliner (2002) refers to this dilemma when describing *Education Research as the Hardest Science of All*.

Many colleagues agree with the author in admitting that answering a research question is far easier than using the gained insights as implications for actual teaching. We have not realized this only yesterday, but this insight is in fact about as old as the attempt to improve teaching. Writing about this in further detail would surely fill dozens of pages. At this point we refer to a recently published special issue of the *Journal for Research in Mathematics Education* and the article (Cai et al., 2017):

In our May editorial (Cai et al., 2017), we argued that a promising way of closing the gap between research and practice is for researchers to develop and test sequences of learning opportunities, at a grain size useful to teachers, that help students move toward well-defined learning goals. We wish to take this argument one step further. If researchers choose to focus on learning opportunities as a way to produce usable knowledge for teachers, we argue that they could increase their impact on practice even further by integrating the implementation of these learning opportunities into their research.

1.6 Continuous Professional Development of Teachers

The author believes in having found a further “blank spot” in relation to researchers. This topic, however, can only shortly be touched on. It is to be judged favorably that this obligation for teachers is becoming more evident and indisputable within the scientific community. It is B. Rösken’s (2011) credit who, in her PhD thesis, highlighted the fact that continuous professional development of teachers is loaded with various beliefs of which adequacy often needs to be questioned. Furthermore, the author points to the work by Timperley, Wilson, Barrar, and Fung (2008) which underlines that in order to be successful it is necessary to question and contrast many of the beliefs uttered by the teacher clientele.

Especially the political side and sometimes also the research side occasionally make the suggestion that it would merely (?) take an investment in further education in order to liberate the tedious deficits in greater areas of teaching methodology.

In doing so, they ignore that there are various conditional factors that need to be influenced positively in order to guarantee change. But how does an averagely engaged teacher learn? When it comes to adult learning, the respective individuals are often occupied with the question: Does this expenditure of energy and time really pay off? It takes massive efforts of motivation from the parts of teacher educators. We have to keep in mind that the introduction of a new curriculum results—among other expenses—in the fact that many of the teachers’ teaching transcripts become outdated. Many of the documents designed for teaching lessons need massive revision or have simply become invalid. Do researchers have this in mind when propagating ad hoc curricular changes? Are the teachers who need to be taught ready for this?

1.7 Final Remarks

It should have been pointed out that in research literature dealing with beliefs, researchers’ beliefs are often neglected. This may be due to the assumption that researchers should not be accused of having beliefs in the first place. Beliefs are regarded as features of subordinate teachers, students, parents, educational administrators and further stakeholders, but not as features of researchers. In research literature, this lack of self-reflection is hardly ever mentioned. We believe that this can be regarded as a “blank spot.” This circumstance is tragic since researchers have to be seen as important players in terms of educational change. Especially the school sector requires the important educational agents to cooperate on equal terms. Given this background, this work is supposed to encourage a detailed stocktaking. The author believes that it appears inevitable to refer to the work by Abelson (1979, 1986). Despite its year of publication, it is still a good read as it describes beliefs as possessions and warns that the costs associated with the adoption of beliefs should not be lost sight of.

References

- Abelson, R. (1979). Differences between belief systems and knowledge systems. *Cognitive Science*, 3, 355–366.
- Abelson, R. P. (1986). Beliefs are like possessions. *Journal for the Theory of Social Behavior*, 16, 223–250.
- Aydin, M., Baki, A., Kögce, D., & Yıldız, C. (2009). Mathematics teacher educators’ beliefs about assessment. *Procedia Social and Behavioral Sciences*, 1, 2126–2130.
- Aydin, M., Baki, A., Yıldız, C., & Kögce, D. (2010). Mathematics teacher educators’ beliefs about teacher role. *Procedia Social and Behavioral Sciences*, 2, 5468–5473.
- Berliner, D. C. (2002). Educational research: The hardest science of all. *Educational Researcher*, 31, 18–20.
- Cai, J., Morris, A., Hohensee, C., Hwang, S., Robison, V., & Hiebert, J. (2017). Making classroom implementation an integral part of research. *Journal for Research in Mathematics Education*, 48(4), 342–347.

- Frank, M. L. (1988). *Problem solving and mathematical beliefs. The Arithmetic Teacher*, 35(5), 32–34.
- Frank, M. L. (1990). What myths about mathematics are held and conveyed by teachers? *The Arithmetic Teacher*, 37(5), 10–12.
- Goldin, G., Rösken, B., & Törner, G. (2009). Beliefs—no longer a hidden variable in mathematical teaching and learning processes. In J. Maaß & W. Schölglmann (Eds.), *Beliefs and attitudes in mathematics education* (pp. 9–28). Rotterdam: Sense Publishers.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: Chicago University Press.
- Leder, G. C., Pehkonen, E., & Törner, G. (2002). *Beliefs: A hidden variable in mathematics education*. Dordrecht: Kluwer Academic Publishers.
- Nathan, M. J., & Koedinger, K. R. (2000). Teachers' and researchers' beliefs about the development of algebraic reasoning. *Journal for Research in Mathematics*, 31(2), 168–190.
- Oser, F. (2014). Wirkung und Wirkungselemente im Lehrerberuf: Leistungen, Grenzen und Perspektiven aktueller Forschung. In E. Terhart, H. Bennewitz, & M. Rothand (Eds.), *Handbuch der Forschung zum Lehrerberuf. S* (pp. 764–777). Münster: Waxmann.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307–332.
- Rauin, U. (2004). Die Pädagogik im Bann empirischer Mythen. Wie aus empirischen Vermutungen scheinbare pädagogische Gewissheit wird. *Pädagogische Korrespondenz*, 32, 39–49.
- Rösken, B. (2011). *Hidden dimensions in the professional development of mathematics teachers. In-Service education for and with teachers*. Rotterdam: SensePublishers.
- Rolka, K. (2006). *Eine empirische Studie über Beliefs von Lehrenden an der Schnittstelle Mathematikdidaktik und Kognitionspsychologie*. PhD thesis, University of Duisburg-Essen, Duisburg, Germany.
- Schoenfeld, A. H. (1985). *Mathematical problem solving*. Orlando, FL: Academic Press.
- Schoenfeld, A. H. (2010). *How we think—a theory of goal-oriented decision making and its educational applications*. New York: Routledge.
- Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2008). *Teacher professional learning and development: Best evidence synthesis on professional learning and development*. Wellington: Report to the Ministry of Education.
- Törner, G. (2002). Mathematical beliefs—a search for a common ground. In G. C. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 73–94). Dordrecht: Kluwer Academic Publishers.