

WHY BELIEF RESEARCH RAISES THE RIGHT QUESTION BUT PROVIDES THE WRONG TYPE OF ANSWER

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Abstract: Belief research has tried to develop understandings of the relationship between teachers' beliefs about mathematics and mathematics teaching and learning on the one hand and the classroom practices on the other. A dominant implicit premise has been that beliefs may serve as an explanatory principle for practice, i.e. that in the case of apparent compatibility between the two there is nothing else to explain, while in other situations mediating factors are called upon to explain the discrepancy. Based on the results of an empirical study of three novice teachers' beliefs and practices I question this premise and briefly present a different approach to belief research.

Over the last decade *belief research* has grown big in mathematics education. It has been part of the research agenda at least for the last 20 years, but it has gained further momentum in the 1990s. In 1996 Törner and Pehkonen identified 764 titles in an incomplete list of the field, and from conference proceedings and journals it is evident that it still attracts a lot of attention. Further, the interest in one aspect of belief research may even have increased further, namely the one of teachers' meta-mathematical understandings (including those of the related teaching-learning processes), of how these beliefs are developed, and of how they may influence the classroom practices.

These questions have been addressed theoretically and empirically with a wide range of quantitative and qualitative research methods, the former often in terms of factor or cluster analyses, the latter using open ended questionnaires, semi-structured interviews, and classroom observations. In this paper my main intention is to challenge what appears to be a basic rationale or premise underlying many of both the quantitative and the qualitative studies in the field: that teacher beliefs are to be seen as a factor that does or at least should explain the practices of the mathematics classroom. In this paper I shall challenge this premise. However, before doing so I shall describe some of the background of the growing interest in the field and question some of its substantive findings.

1. Fuelling belief research: the forced autonomy of mathematics teachers

The increased interest in the teacher's meta-mathematical understandings follows from a change in the role envisaged for the teacher in current reform documents and journal articles (for a summary of the theoretical underpinnings of the reform see Skott 2000, chapter 2). The reform is epistemologically framed by both constructivism (von Glaserfeld 1995a, 1995b, 1996) and socio-cultural theory (Vygotsky 1986; Wertsch 1985), and mathematically it is inspired by

fallibilism and by emphases on the social constitution of mathematical knowledge (Lakatos 1976, Davis and Hersh 1981). Consequently mathematics classrooms are envisaged to develop into small communities of mathematical practice in which the individual students' learning and the microculture of the classroom are seen reflexively related (Cobb 2000; Cobb and Yackel 1998). The teacher is expected to play an essential role for the emergence of these communities, as (s)he is expected to develop and flexibly use a wide range of different tasks in order both to encourage the students' involvement in mathematical processes of experimenting, investigating, generalising, formalising, etc. and to support their conceptual understanding and procedural competence on the way. This requires the teacher for instance to support the emergence of an atmosphere in which the mathematical contributions of individuals and of groups of students are valued; to interpret these contributions and make them become an accepted part of the public domain in the classroom; and to pick out mathematically and pedagogically significant aspects of these different contributions and make them part of the mathematical discourse of the classroom. This role of the teacher was succinctly phrased in the draft of *Standards 2000* (NCTM 1998):

“Curricular frameworks and guides, instructional materials, and lesson plans are only the first elements needed to help students learn important mathematics well. Teachers must balance purposeful, planned classroom teaching with the ongoing decision-making that can lead the teacher and the class into unanticipated territory from an effective mathematical and pedagogical knowledge base.” (p. 33)

In this situation teachers have come to be seen not only as important contributors to educational reform, but also as potential obstacles to change. In particular the beliefs about mathematics and its teaching and learning have become a focal point in the literature, as these beliefs are expected to significantly influence the ways in which the teachers cope with the situation of forced autonomy. Consequently current reform initiatives in mathematics education have fuelled the interest in the part of belief research linking teachers' school mathematical priorities to the classroom practices. Three main questions have been addressed in this connection:

- What are teachers' beliefs about mathematics and its teaching and learning? This question deals with the relative emphases on mathematical processes and products; with the teacher's perception of his/her own role what role in the classroom as explicators of knowledge or unobtrusive facilitators of learning; and with students as receivers of information or as constructors of knowledge.
- How may these beliefs change or develop? Generally perceived to be relatively stable and resistant to change beliefs need to be challenged in

order to develop. This question is concerned with how this development may come about, for instance through student teachers' reflective activity in pre- or in-service programmes conceived in line with current reform initiatives (Cooney et al. 1998).

- do teachers beliefs about mathematics and its teaching and learning play for the ways in which mathematics classrooms develop?

2. An implicit premise of belief research

The most dominant explicit or implicit answers to the last of the three questions mentioned above are in the affirmative. Indeed, if this were not the case it is difficult to explain why the first two questions were to attract more than minimal attention. However, these affirmative answers differ greatly from very direct and causal descriptions claiming that the teacher's espoused views of mathematics determine both the classroom practices and the students' learning (Schoenfeld 1992; and to a lesser extent Ernest 1991), over an insistence on an unspecified reciprocal relationship between the two (e.g. Thompson 1992), to a claim that there is no relationship between the beliefs espoused in research interviews and the practices of the mathematics classroom and that none should be expected, as beliefs are situated much in the same sense as cognition (Hoyles 1992). The claim in this latter position is not there is no positive correlation between teacher beliefs and the classroom practices, but that the relevant beliefs are those held in the mathematics classroom, and that these are seen as qualitatively different from those held in other situations.

In a large part of belief research, then, the general affirmative answer to the last of the above questions frames the understandings developed in these studies themselves, even to the extent that beliefs come to serve as an explanatory principle in relation to practice¹. This means that in these studies there seems to be no attempt to look beyond teacher beliefs when interpreting what happens in the mathematics classroom. More specifically, if - from an observer's perspective - there is apparent compatibility between the beliefs espoused for instance in research interviews and the classroom practices, there is little more to explain. If no such compatibility is found an argument for the apparent lack of impact of beliefs is made (i) by referring to a school culture that in the particular case dominates belief enactment; (ii) with reference to a highly individualistic and often condemning explanation of teacher inconsistency; (iii) by capitalising

¹ The notion of explanatory principle is borrowed from Bauersfeld (1998) who uses it to describe the role attributed to culture in education.

on the conceptual and methodological problems inherent in the very notion of beliefs, as the classroom practices are judged as dependent on implicit beliefs residing at other levels of consciousness, than the ones described in research interviews or questionnaires. Hoyles' conjecture about the situatedness of beliefs may be seen as one version of this.

In other terms, a dominant premise of belief research is that beliefs are and should be the main influence on the classroom, and although the classroom practices may be mediated by external or internal constraints, they are indeed *the teacher's* practices: The teacher's beliefs - conscious or not and explicit or not - are thought to be directly related to the learning opportunities that unfold.

3. Challenging the substantive results of previous studies

I have previously questioned the substantive conclusions of previous studies that claim a direct relationship between teacher beliefs and classroom practices (Skott 2000; 2001). I did so on the basis of an empirical study of three novice teachers in the Danish *folkeskole*, the municipal school for children in grades 1 to 10. The three teachers were selected for the study, because they all presented visions of school mathematics (school mathematics images or SMIs) that strongly resemble current reform initiatives in mathematics education. In questionnaires and research interviews immediately before and after their graduation from college they described the students' activity in terms of investigations and experimentation; they conceived mathematics as a way of approaching and posing problems; and they presented their visions of teaching in terms that reflected intentions of being unobtrusively supportive in relation to student learning. In short, the SMIs of these teachers were strongly inspired by the reform, and they all seemed confident that they could enact the reform intentions in their prospective classrooms.

In the case of all three teachers, the classroom interactions often developed in ways that resembled certain aspects of their school mathematical priorities. However, there were also episodes in each classroom in which the teacher's contributions to the interactions appeared at odds with his or her SMIs or in which (s)he was apparently tempted to make such contributions. The teachers were asked to comment on video recordings of some of these episodes. When doing so they sometimes referred to mathematical insecurity on their own part as the reason why the interaction developed the way it did. In these episodes they were primarily involved in attempts to manifest professional and mathematical authority, and consequently contributed to the interactions in ways that seemed

counterproductive to student learning and at odds with their SMIs. In other instances the teachers were more concerned with building students' self-confidence by ensuring that they - the students - provided an acceptable solution to a textbook task than with supporting their mathematical learning. As a result they got involved in funnelling types of interaction that in effect depleted the tasks in question of its mathematical contents for the students in question. In yet another type of situation the teachers' activity was primarily directed towards managing the classroom in a stressful situation in which many different (groups of) students simultaneously called for help. In these situations they often became much more explicit in their assistance to the students in order to speed up the process of helping them.

An important characteristic of the episodes that challenged the enactment of the teacher's school mathematical priorities, the *critical incidents of practice* (CIPs), is the simultaneous existence of multiple motives of the teacher's activity (Skott, 2001). In each of them the intention of facilitating mathematical learning is submerged by the emergence of other energising elements (Leont'ev 1979) of the teacher's activity beyond the teaching of mathematics. The motives of the teacher's activity, then, should not be as seen as pre-determined by his or her school mathematical priorities. Rather they must be understood as entities that may be transformed or even emerge in and as a result of his or her interactions with the students. Consequently the role of the SMIs is not to control the teacher's activity. Rather it becomes an underlying propensity that may play a part as one possible element contributing to his or her interpretive efforts in relation to the situation at hand. These interpretations sometimes lead to the emergence of other motives of the teacher's activity than facilitating the students' mathematical learning, motives that in turn direct the teacher's contributions to the interaction.

4. Questioning a dominant methodological approach in belief research

The above conclusions not only challenge the *results* of previous studies in belief research. They also question the implicit *premise* that beliefs may serve as an explanatory principle for teacher actions. In the episodes referred to above the classroom practices evolved in and as a result of the instantaneous interpretations on the part of both teacher and students of their mutual intentions and expectations. This supports Bauersfeld's (1988) suggestion to view the classroom from the perspective that "it is a jointly emerging 'reality' rather than a systematic proceeding produced or caused by independent subjects' actions" (p. 29), and it questions whether the classroom should be seen as a field for the

teacher's practice in the possessive sense of that term. This does not necessarily question the existence of sets of beliefs that - at least in the short term - are relatively stable across contexts. It does, however, indicate that the contextual embeddedness of teaching - in the local interactionist sense of context - challenges the extent to which the intention of facilitating the students' mathematical learning remains the dominant motive of the teacher's activity. This means that the social *interactions* of the mathematics classroom have to be perceived exactly as interactions, i.e. as processes "that *form* human conduct instead of being merely a means or a setting for the expression or release of human conduct" (Blumer 1969, p. 8; emphasis in original).

Referring to the use made of beliefs as an explanatory principle in relation to classroom practice (cf. section 2) there is as much to explain, when there is apparent compatibility between beliefs and practice, as when there is none. It is of obvious importance to address the questions of when and how the classroom interactions allow for the teacher's activity to be directed at facilitating mathematical learning and to be influenced by his or her school mathematical priorities. Further, if there is apparent lack of congruence between espoused priorities and observed practices, there may be no need to refer to beliefs residing at other levels of consciousness than those that are expressed in research interviews. Nor does reference to external constraints on belief enactment in the form of a school culture in and by itself explain an apparent discrepancy between beliefs and practice. If a broader school culture is expected to play a role, an account is needed for how the mutual expectations of teachers and students are influenced by this culture, i.e. how it is re-enacted in the classroom. Only then may such a reference contribute to an understanding of how the culturally derived expectations come to play a role in the formation of the motives of the activity of both teachers and students.

Finally, the above study indicates that the teacher instantaneously manoeuvres in relation to a multiplicity of different tasks rather than merely to one of facilitating mathematical learning. This is inherent in the very notion of CIPs and its defining concept of multiple motives of teacher activity. In other terms, the teacher's activity is related to the sense they make of the situation at hand, and it momentarily focuses on some motive, that (s)he tries to pursue. This means that inconsistency is an observer's perspective that does not do justice to the complexity of the teacher's tasks. For classroom research - and for belief research in particular - this means that it should be conducted with the understanding that teachers' and students' activities do make sense; - or phrased

more bluntly in the case of teachers: *teachers cannot be inconsistent*. This, of course, does not mean that teachers necessarily pursue the different motives in what appears to be the most efficient manner, nor that they - even according to their own priorities - strike an appropriate balance between them at any one time. Teacher consistency is a local and instantaneous phenomenon and as such implies that the teacher's activity should be viewed as his or her attempt to relate sensibly to a multitude of different and possibly subjectively incompatible aspects of the situation at hand.

Conclusions

The study referred to in this paper deals with a main question in belief research, i.e. the question of what roles the teacher's beliefs about mathematics and mathematics teaching and learning play for the learning opportunities that unfold in mathematics classrooms. I have claimed the motives of the teacher's activity emerge in the course of the classroom interactions, and that therefore his or her school mathematical priorities may not be so significant as previous studies have suggested. The more general claim is that we need to adopt an interactionistic perspective on mathematics classrooms and approach these from the perspective that teachers are never inconsistent. In other terms, I have found it necessary to challenge what appears to be a dominant *premise* of teacher related belief research in order to address the main question of the field. This premise is that beliefs may serve as an explanatory principle in relation to practice. By doing so the study also questions the usefulness of *types of answers* found in much previous research done in the field. In short the argument is that the main question of the belief-practice relationship should still be addressed, but that the dominant perspective needs to be changed if significant answers to this question are to be provided.

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