Personal Beliefs about Learning and Teaching: Comparison of student teachers in the sciences and humanities at different stages of their studies

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Abstract: The present project deals with teachers' beliefs as implicit, steady assumptions about learning and teaching and especially with 'participation', as the least investigated. This exploratory study analyzes (1) the representation of beliefs regarding 'participation' in student teachers' views, the impact (2) of the stage of their studies, and (3) of their discipline studied on the beliefs. Student teachers were interviewed regarding their views on learning and teaching (N = 30). The content analysis shows different multifaceted beliefs. The results reveal an alteration in the beliefs during the studies: At the beginning there is a 'transmissive-emotional' focusing which changes progressively to a more cognitive focus including 'construction' and 'participation', and still 'transmission'. Furthermore, the internal structure of 'participation' in the views of the interviewees does not correspond with the theoretical concept. On the basis of these results the possibility of developing a questionnaire for closer investigation of 'participation' is being discussed.

Introduction

Teachers' beliefs have become a focal point of research in the hope of gaining a better understanding of teacher behavior. Furthermore, since the rise of cognitive psychology, an more and more attention has been paid in particular to the juxtaposition of two opinions (Anderson, 1997; Greeno, 1997): the view of teaching as a 'direct transmission' (Resnick & Hall, 1998), with learning seen as an 'acquisition' of knowledge; and a 'cognitive construction' view of learning. The current research shows typical patterns: 'transmission' vs. 'construction' views (e.g., Staub & Stern, 2002). In addition we find 'acquisition' vs. 'participation' metaphors (Sfard, 1998), and 'content-centered' vs. 'learning-centered' teaching (Kember & Kwan, 2000). Empirical research so far concentrates on the 'transmission' vs. 'construction' views (Dubberke, Kunter, McElvany, Brunner, & Baumert, 2008); 'participation' is still being neglected. According to Sfard (1998), the role of 'participation' in the learning process, which was introduced as 'situated learning' (Greeno, 1997), should be considered to a greater extent in research.

Therefore, the current project centers on teachers' beliefs in general and on 'participation' in particular. This study is an exploration of the self-reflected views of learning and teaching as they emerged in interviews with student teachers. The purpose of this paper is to create a better understanding of student teachers' beliefs regarding participation. First, the theoretical framework will be presented, defining the term "teachers' beliefs" and showing the relevant research as well as different views of learning and teaching. The research questions of this study will then be presented. Next, the methodological information will be described. Finally, the findings will be presented and the possible implications will be outlined.

Theoretical framework

The term "teachers' beliefs"

Beliefs are subjective and experience-based perceptions of learning and teaching. Martinez, Sauleda, and Huber (2001) use the metaphor 'blueprint of thinking' to illustrate the type of influence exerted by beliefs on perception and behavior. Beliefs about teaching are well established by the time a student gets to college (Pajares, 1992); they do not change easily or rapidly and are not independent of the discipline taught (Boulton-Lewis, Smith, McCrindle, Burnett, & Campbell, 2001; Staub & Stern, 2002; van Driel, Bulte, & Verloop, 2007).

'Belief' is still a 'messy construct', as Pajares (1992) called it. Among the terms used to describe teachers' thinking we find: beliefs, conceptions, orientations (Kember, 1997), perspectives, intentions, teaching approaches (Trigwell, Prosser & Taylor, 1994), and teaching perspectives (Pratt, 2002). Because of largely congruent contents all these work will be equally employed for the present study.

We define teachers' beliefs as implicit, steady, experience-based assumptions about the nature of learning and teaching: about the learner, the teacher, the learning and teaching process, instruction, classroom management, the genesis of knowledge and its growth.

Research on teachers' beliefs

Before addressing the relevant studies, the theoretical background of different beliefs should be briefly outlined. As pointed out by Sfard (1998), the theoretical paradigms of learning can provide a suitable frame of reference on teachers' beliefs. The author differentiates between two basic metaphors: 1) individual acquisition of knowledge and 2) participation in the community of practice. Here, learning is regarded as a process of becoming a member of a certain community, which requires the ability to communicate in the language of the community and to act according to its particular norms. The learner is interested in participating in various activities rather than accumulating personal possessions. In contrast to this position, the individual acquisition metaphor considers learning as the result of a transmission process of information from the teacher to the student. Sfard (1998) describes both metaphors under the following aspects: goal of learning, learning, student, teacher, knowledge, knowing, and motivation. Kember (1997) also employs several dimensions to delimit the conceptions of teaching: teacher, teaching, student, learning, content, knowledge.

Sfard (1998) assignes behaviouristic and constructivistic notions of learning to the first metaphor and notions of situated learning to the second metaphor (Bruner, 1996; Greeno, 1997; Lave, 1987; Lave & Wenger, 1991). Contrary to this position, Martinez et al. (2001) differentiates three main metaphors: 1) learning as transmission of knowledge, 2) the constructivist metaphor, and 3) teaching and learning as a social process. According to the constructivist metaphor, learning is described as an active, constructive process which is influenced by the subject's prior knowledge and takes place in particular contexts (e.g., Bereiter, 1994; Staub & Stern, 2002). According to Trigwell and Prosser there is also the distinction between 'conceptual-change/student-focused' and 'information-transmission/teacher-focused' approaches of teaching (see also Norton, Richardson, Hartley, Newstead, & Mayes, 2005; Postareff & Lindblom-Ylänne, 2008; Trigwell, Prosser & Taylor, 1994).

Of equal interest is the research that takes into consideration more than two opposing beliefs: for instance Pratt, Collins, and Jarvis-Selinger (2001) and Alger (2009). Pratt et al. (2001) worked out five teaching perspectives: 1) transmission: Effective teaching requires a substantial commitment to the content or subject matter; 2) apprenticeship: Effective teaching is a process of students enculturation into a set of social norms and ways of working; 3) developmental: Effective teaching must be planned and conducted "from the learner's point of view"; 4) nurturing: Effective teaching assumes that long-term, hard, persistent effort to achieve comes from the heart, as well as the head; and 5) social reform: Effective teaching seeks to change society in substantive ways.

There is a growing consensus in research that teachers' beliefs affect the learning of the students. Teachers' beliefs influence their own perceptions, which in turn affect their practices in the classroom (Calderhead, 1996).

Empirical studies have already shown that the 'cognitive construction' view, which deals with the cognitive activation and constructive support of the learners, seems to be more promising in promoting a deeper understanding during students' learning than the 'direct transmission' view (Aquirre & Speer, 2000; Dubberke et al., 2008; Staub & Stern, 2002). In contrast to this, the 'participation' view has been addressed less, and there are no suitable questionnaires to measure teachers' beliefs about learning and teaching in terms of 'participation'. Therefore, in this study, we focus on the 'participation' aspects of teachers' beliefs.

Research questions and hypotheses

We designed the present study to answer three main questions:

1. To what extent are the beliefs about learning and teaching described above represented in the views of student teachers?

   It is necessary to find out more about what the student teachers' views of learning and teaching are in general and how important they regard 'participation' in the learning process in particular.

2. Are there any similarities among the student teachers at the same stage of their studies?

   We want to compare the beliefs of the student teachers at the beginning, in the middle and at the end of their studies. This question should provide more insight into the assumption that the increased knowledge and practical experience which the students gather during their studies results in more sophisticated beliefs about learning and teaching.

3. Are there any similarities among the student teachers in the related disciplines?

   This question should illuminate whether there are any similarities among the specific discipline communities. It can be assumed that differences will exist between the beliefs of student teachers in the sciences and student teachers in the humanities.

Consequently, the current study was designed to investigate the beliefs of student teachers with the aim of highlighting their opinions regarding the role of 'participation' in the learning process. Moreover, if the answers to the latter two questions should yield converging results, the design would provide an insight into the structure of beliefs of student teachers dependent on their knowledge and practical experience, related to the specific discipline.

Method

Sample and Design

The sample consisted of a total of $N = 30$ interviewees (11 male, 19 female, mean age: 23.7 years), who were all students undergoing their teacher preparation program at the University of Goettingen. Two discipline communities were represented in the sample: a) the sciences, e.g. mathematics, physics, chemistry, biology and geography ($n = 15$); and b) the humanities, e.g. languages, history and theology ($n = 15$). Furthermore, the participants were at different stages of their studies: a) at the beginning ($n = 10$, mean age: 20.9 years), b) in the middle ($n = 10$, mean age: 23.1 years), and c) at the end ($n = 10$, mean age: 27.2 years).

Inquiry Method

For the current study, we used the methodology described by White and Gunstone (1992). We elicited the participants' views on learning and teaching by asking them to draw a picture which showed their concept or theory of learning and teaching. The participants were invited to the interview without much prior information about the topic of our study. The intention was to let them communicate their own thoughts with as little external influence as possible. After about 15 minutes of drawing, we asked the participants to explain the picture, thus describing their concepts of learning and teaching. When they had finished doing so, we asked them pre-designated questions on certain aspects that were of interest within our theoretical framework, like: Is the teacher or the learner at the center of the learning process? Who is more important in the learning process: the learner or the teacher? What is the role of the learner in the learning process?

The interviews were audiotaped and transcribed. In addition, in order to be able to analyze nonverbal information, we videotaped the participants together with their picture during the interview. All of the interviews were codenamed to ensure that the data (both verbal and videotapes) remained anonymous and inaccessible to third parties.

Data Analysis

The method we used to analyze the data was based on Chi's "Quantifying Qualitative Analysis of Verbal Data" (1997). The author recommends the application of this method for verbal data such as explanations or reports. She emphasizes the main goal of this analysis method as understanding the representation of the knowledge. Further, we used the computer program MAXQDA, which supports the coding procedure of verbal data. As preparation for the coding, the interviews were first segmented into single coding units. For this purpose, we used a procedure originally suggested by Chi (1997). Each interview transcript was divided into segments so that each segment could be coded independently. The preferred segmentation technique was based on semantic futures, according to which the content of the utterances had to be interpreted to determine the segment boundaries, such as knowing that the topic of discussion has been changed. In general, it is a proposition or an idea. Mostly, one segment is one idea unit:

Example:

…and that I refer to my experiences that I gained when I was a pupil//

Furthermore, the granularity is referred to as a main point of analysis (see Chi, 1997). Grain sizes can vary from coarse to fine. For our interview analyses, we opted for the fine grain. Consequently, one segment is limited to one sentence, as in the above examples. However, the structure of the speech was often unclear and disorganized; sometimes, it took more than one sentence to express an idea to its conclusion. In this case, one segment might have been longer than in other interviews:

Example:

> …for this purpose, I thought to myself, it should be some sort of old-fashioned seating arrangement, for example one pupil sitting on a bench at a table, then the next row, then the next, and the teacher standing here at the front holding the pointer in his hand and teaching at the blackboard//

The first step was to develop a deductive coding scheme. Therefore, we used aspects as 'goal of learning' or 'knowledge' (e.g., Kember, 1997; Sfard, 1998). The coding process was performed by two raters who were trained for this coding procedure. After discussing the category system, they coded the interviews independently. The inter-rater reliability as determined by Cohen's Kappa was good ($\kappa = 0.82$).

The results of this coding process revealed a quite accurate correspondence with the categories of the "Teaching Perspectives Inventory" (TPI) according to Pratt et al. (2001). In the following section, we present these categories as well as the results of the study.

Results

Category System

Table 1 shows the category system. Due to space restrictions, the description of each category cannot be presented in complete detail here. The table presents a small excerpt of all of the aspects from each category.

Table 1: The category system.

Name of the category	Content description of the category
Transmission	• learning as gaining achievement and competencies by the individual • teacher as an instructor of learning • knowledge as substance and property by the individual
Nurturing	• productive without fear of failure • teacher's responsibility to create an atmosphere without fear • the importance of self-efficacy or self-esteem of the pupils
Participation	• learning as a process of enculturation of students into a set of social norms and ways of working • teacher is an expert in his/her discipline and a moderator and supporter of learning processes
Construction	• learning as an active and constructive process, depended on the previous knowledge • teaching from the learner's point of view • suitable methods: experience-based and discovery-based learning
Social Reform	• collective as an object of teaching rather than individual • encouragement of learners to take a critical stance • learning as developing a world view and opinions

To demonstrate two of these categories, the subcategories with anchored examples will be presented in the following:

Subcategory of 'nurturing' – well-being:

The school and the lesson must take place in a protected space, where the teacher creates emotional safety so that the children feel happy and comfortable and do not have any fears regarding learning.

Subcategory of 'participation'- 'supporting class community':

As a pillar of the classroom community, the teacher supports the development of the perception of the class as one community. He/she has to ensure that the pupils act as a group and not as individuals.

Supplementary Categories

Also of interest are the categories that do not concern the theoretical learning paradigms, but rather address some supplementary influences on interviewees' thoughts during the interviews. For instance, there were ideas about learning, which could be described as naïve positive attitudes, for example about the effects of some specific teaching methods, as well as idealistic attitudes about the teaching profession.

…so we can make the lessons very, very interesting if we use the new and creative teaching methods//

The smaller the group, the better the learning//

The interviewees addressed their experiences as learners very often, but described their experience as teachers surprisingly rarely, although most of the student teachers were undergoing their school-based teaching practice during their studies. The focus of the present study is not on such aspects, so we will not address them further in our analysis.

Internal Structure of Participation

In the theoretical presentation of the construct 'participation' (e.g., Sfard, 1998), there are many aspects that clarify the understanding of learning and teaching according to 'participation'.

The interviewees in the present study made their statements spontaneously. Consequently, it is conceivable that some aspects of their beliefs were not addressed. Hence, the view of the interviewees regarding 'participation' differs from the theoretical construct. For instance, some of the theoretical aspects were not represented completely. The figure below demonstrates the number of the interviewees who made some statements regarding the respective individual aspect (see Figure 1).

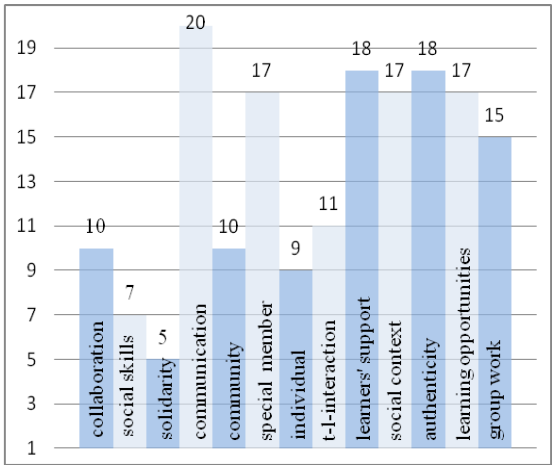

Figure 1.The internal structure of the 'participation'.

Most of the interviewees (n =20) commented on the communication process in the class. Communication, authenticity in learning, support by the learners, social context, the teacher as a special member of the class community, the teacher's responsibility to provide learning opportunities were also called often. Some other aspects as group work, interaction process close this list.

Of interest is also the fact that some aspects could be seen as overlapping with the category 'nurturing' because of their emotional value, for instance 'solidarity'. In conclusion, the first research question can be answered as follows: the beliefs of the student teachers in the present study contained five main beliefs and also some supplementary contents. Furthermore, the beliefs of interviewees contained 'participation', but the structure did not correspond to the theoretical construct. In the following section, a closer look will be taken at the different groups of the student teachers.

Student Teachers' Beliefs

In total, the interviews yielded 2262 segments. 74.2 % of them were assigned to the main categories of beliefs about learning and teaching; the other 25.8 % were described in the section above (see Supplementary Categories). The following table (see Table 2) shows the means (in percent) and standard deviations for the values in the main categories for all the groups of student teachers.

Table 2: Descriptive statistics: Means (in percent) and standard deviations.

	Whole sample (N =30)	Student teachers at the beginning of their studies(n =10)	Student teachers in the middle of their studies (n = 10)	Student teachers at the end of their studies (n = 10)	Student teachers in the sciences (n = 15)	Student teachers in the humanities (n = 15)
Total statements	74.20 (29.13)	73.30 (28.83)	70.10 (20.76)	79.20 (37.74)	64.40 (30.21)	84.00 (25.27)
Transmission	25.77 (12.80)	29.22 (17.34)	23.93 (8.98)	24.17 (11.26)	26.07 (15.47)	25.48 (9.99)
Nurturing	15.18 (12.12)	23.86 (12.85)	11.01 (9.71)	10.69 (9.40)	13.47 (10.92)	16.90 (13.37)
Participation	23.9 (10.83)	19.53 (7.39)	29.85 (12.34)	22.33 (10.37)	25.70 (10.92)	22.11 (10.81)
Construction	19.25 (9.66)	13.21 (9.68)	21.35 (9.03)	23.21 (07.91)	27.30 (13.54)	26.83 (11.94)
Social Reform	03.65 (3.21)	04.50 (3.34)	01.10	0	00.12 (0.47)0.12	00.85 (2.24)

The impact of the stage of studies on the beliefs

The second research question concerned the different stages of the studies. Our sample contained students (a) at the beginning, (b) in the middle and (c) at the end of their studies to compare the influence of experiences from the studies on the beliefs. In order to examine the difference in each belief for each group, we conducted a multivariate GLM model (within subject design). The main effect of beliefs is significant: $F = 26.23$, $p < .001$, and reveals quite strong power, at $Eta^2 = .49$ as well as the interaction between beliefs and the stage of the studies: $F = 2.58$, $p < .05$, $Eta^2 = .16$. The findings are demonstrated in the figure below (see Figure 2).

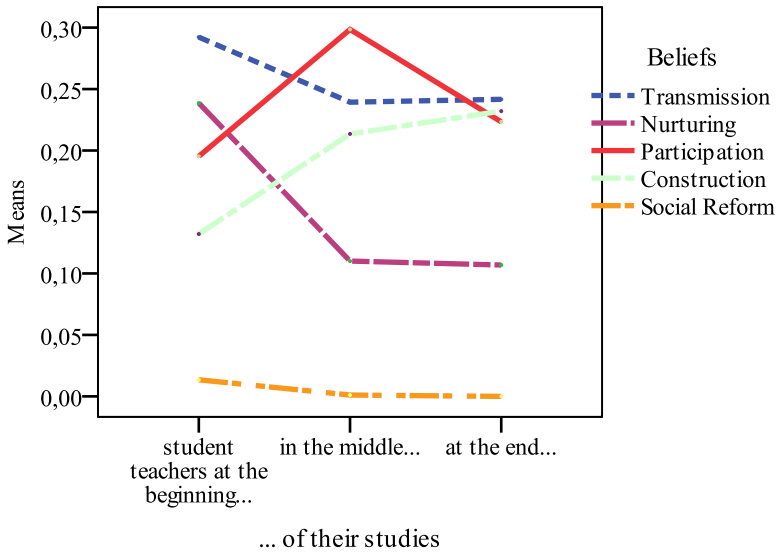

Figure 2. The distribution of the beliefs for each group of student teachers.

The difference between the student teachers at different stages in each belief was tested by means of univariate analysis of variance (ANOVA). The findings show a significant effect of the stages of the studies on the belief 'nurturing' at the .05 level: $F = 4.87$, $p < .05$, $Eta^2 = .27$. The test of contrasts shows a significant difference between the student teachers at the beginning and in the middle of their studies: $F = 23.25$, $p < .001$, $Eta^2 = .46$.

The difference in 'participation' is also significant. The effect of the stage of the studies on 'participation' is, however, significant only at the .1 level: $F = 2.71$, $p < .1$, $Eta^2 = .17$. The difference between the different groups of student appearances as follows: the student teachers in the middle of their studies show the biggest values compared with much lower values of the student teachers at the beginning and lower values of the student teachers at the end of their studies: $F = 62.11$, $p < .001$. This effect power is quite strong, at $Eta^2 = .70$.

Furthermore, the statistics reveal the differences in 'construction'. The effect of the stages of the studies on 'construction' is significant at the .05 level: $F = 3.57$, $p < .05$, $Eta^2 = .21$. The test of contrasts shows that the student teachers at the beginning of their studies have the lowest values in 'construction' compared with quite higher values of the student teachers at the end and also higher values by the student teachers in the middle of their studies.

For all the other beliefs, the differences were not significant. It is noticeable that in some categories, not all groups made statements: For 'social reform', none of the students at the end of their studies made any statements.

The following result could be already seen in the figure 2: The student teachers at the end of the studies possess the three beliefs 'transmission', 'construction', and 'participation' at the quite similar level; the belief 'nurturing' is also represented, but in noticeable smaller extend. This difference was tested by means of t-Test, computing for the beliefs 'transmission', 'construction', and 'participation' a common variable named 'cognitive focus' previously. The means (standard abbreviations) for 'cognitive focus' and 'nurturing' are respectively 23.23 (4.17) and 10.69 (9.40). This difference is significant at the level .05: $t = 3$ ($df = 9$), $p < .05$.

Due to the quite small groups of the students, all statistics were also reconsidered by means of non-parametric tests which carried out the findings like the above. Nevertheless, the conditions for ANOVA are fulfilled: the normal distribution and the homogeneity of variances are given.

To summarize, the student teachers at different stages of their studies have significant different beliefs. The development of the beliefs during the studies changes from the 'transmissive-emotional' focus including 'transmission' and 'nurturing' toward a 'cognitive' focus including 'construction', 'participation', and still 'transmission'.

The impact of discipline on beliefs

To examine hypothesis 3, namely that the beliefs of student teachers in the sciences differ from those of student teachers in the humanities, we conducted analysis of variance (ANOVA), which proved to be insignificant. To sum up these final results, it can be stated that the expected differences between the beliefs of the student teachers from the two disciplines were not found.

Conclusions and implications

In this paper, we described a study conducted recently at the University of Goettingen. It was designed with the aim to highlight how the different beliefs are represented in the thinking of the student teachers and what differences there are in these beliefs at various stages of their studies and in different disciplines.

At the beginning of the present study we did not have any expectations as to which beliefs would revealed by the interviews. In a first analysis, we expected two main paradigms such as 'individualistic' vs. 'social' paradigms in learning sciences (Sfard, 1998) or perhaps a 'transmission' vs. 'construction' view on learning and teaching (Staub & Stern, 2002). In the end we found not just one or two, but five different beliefs. These results could be seen in a positive light. An increasing number of researchers are calling for plurality in looking at the beliefs about teaching and learning. Pratt (2002) warns against the "one size fits all" notion of good teaching. Even Sfard (1998) points out the "dangers of choosing just one" of the two metaphors.

In keeping with the recent theoretical framework and empirical research that researchers and educators should pay more attention to the concept of 'participation' in the field of the learning science (Alger, 2009; Lave &Wenger, 1991; Sfard, 1998), our study set out to investigate student teachers' beliefs regarding 'participation' in more detail. In so doing, we analyzed the internal structure of the notion of 'participation' found in our interviews. This analysis showed that the understanding of learning as 'participation' by the student teachers in our study does not correspond to the theoretical concept. This can possibly be explained by the fact that the interviewees spoke spontaneously. Consequently, it is conceivable that some aspects of their beliefs were not addressed. The overlapping areas relate to emotional aspects of group processes like solidarity, which reveals that the future teachers value the idea of 'participation', not only from the perspective of advantages for learning but also in terms of the emotional advantages. In addition, many aspects concern social aspects of group processes. There are no didactic aspects or statements about specific learning processes in a 'learning community', with the exception of 'providing learning opportunities by the teacher'. The constitutive point of 'participation' – learning as enculturation – is lacking. Thus, this indicates that a one-sided view should be changed, and that the teacher education should be able to initiate such a change.

Furthermore, the present study confirmed the hypothesis of underlying similarities among the beliefs of the students at the same stages of their studies. But, the experimental design of the present study was cross-sectional, which is why the differences between the student teachers of different stages of their studies cannot be interpreted as definite changes in beliefs, but should at present rather be understood as hint thereof. Additionally, the teacher preparation program included not the same contents, because of the present system of Higher Education in Germany. Indeed, especially the clear preference of the student teachers in the middle of the studies for 'participation' emphasizes this fact. This especially preference may be a cohorts effect. In addition, the student teachers at the beginning of their studies understood learning primarily in terms of transmission of knowledge from the teacher to the pupil, seeing the main responsibility of the teacher in preparing and presenting of the contents of his/her discipline as well as creating an atmosphere without fear in order to secure of self-efficacy and self-esteem of the children. While the student teachers at the beginning of their studies show this 'transmissive-emotional' focus on the learning and teaching, the beliefs by the student teachers at the end of their studies tend toward the 'cognitive' focus. Thus, this alteration in the beliefs might be attributable to the increased knowledge the students gather during the studies and practical experience from the internships allowing to evaluate the role of teacher training a little deeper. We hope that these findings will be fruitful for educators who work in the field of teacher preparation program.

The sample also comprised student teachers from various disciplines. The recent research confirmed similarities in the beliefs in the same or relative disciplines (Boulton-Lewis et al., 2001; Norton, 2005; Pajares, 1992; Pratt et al., 2001; van Driel et al., 2007). Contrary to this research, in the present study differences between the student teachers in the sciences and the humanities were not found. In the Higher Education program in Germany there are two disciplines which must be studied. Thus, there are students in the sample who study for instance physic and language. The assignment of the students to each group was made according to the favorite discipline named by the student. This method of assignation seems to be not selective enough.

The aim of our study was to highlight the beliefs and how they are represented in the thinking of the interviewees. Restrictions were kept as more as possible. Due to the restrictive nature of questionnaires, we decided to work according to the inquiry method of White and Gunstone (1992). The next step could be to use the results of the present study to develop a questionnaire to measure 'participation' even more closely. Furthermore, a future study could interview other groups of people. Beliefs of experienced teachers seem to be

of particular interest in the light of the present project. As a conclusion of the present study we must bear in mind that our investigation reveals not actual beliefs, but rather, in the best case scenario, the 'blueprints of beliefs' in the particular interview situation.

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