

Pre-service Teachers' Assumed and Own Epistemic Beliefs and Their Relation to the Propagated Teaching Philosophy in Vocational Schools and Colleges in Germany

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ABSTRACT

The way teachers accomplish tasks and assignments in their work environment is also influenced by their epistemic beliefs and the beliefs they assume their learners have (e.g., Brownlee, 2004; Feucht, 2010). Despite the importance of knowing pre-service teachers' epistemic beliefs for developmental purposes, little research thus far has focused on gaining further insights into these beliefs. To address this gap, 182 pre-service teachers enrolled in teacher training at the University of Oldenburg (Germany) took part in our survey research and completed a German version of the Epistemic Beliefs Questionnaire by Schraw, Bendixen, and Dunkle (2002) about their beliefs and those they assume of their learners. Latent Class Analyses identified a large heterogeneity of teachers' assumed beliefs, differentiating between a group that presumes absolutist views of their learners and one that presumes less absolutist or even evaluativistic views. Even though the identified groups of teachers differ with respect to the assumed beliefs, these assumed beliefs largely coincide with their own beliefs. Only the group of teachers that presume their learners tend to hold absolutist beliefs (e.g. knowledge is simply structured and stable over time) differ in all dimensions regarding their own beliefs and those assumed of their learners; they hold less absolutist or evaluativistic own beliefs (e.g., knowledge is interrelated and changeable) than their learners. In contrast, the group that assumed that their learners hold less absolutist or even evaluativistic beliefs show similar beliefs themselves.

These results point to inconsistencies in teachers' epistemic beliefs systems. Given the significant reforms within the German vocational education system and their implications on teachers' roles, it seems important to actively work on teachers' epistemic beliefs. An essential element of teacher education and especially initial teacher education should be to support pre-service teachers in understanding their own epistemic beliefs in order to develop both their own beliefs and to support the development of their learners' epistemic beliefs to ensure they are aligned with the prerequisites of the reformed education system and to maximise the learning opportunities.

INTRODUCTION

Teachers are faced with a multitude of complex tasks and decisions in the daily classroom environment. Their performance is not only based on their professional knowledge of didactics (i.e. knowledge on instruction) or the subjects they teach. Teaching decisions and

mannerisms are also affected by a teacher's attitudes and beliefs about knowledge and its acquisition, i.e., epistemic beliefs (Ariza & Del Pozo, 2002; Brownlee, 2004; Cheng, Chan, Tang, & Cheng, 2009; Gullberg, Kellner, Attorps, Thoren, & Tärneberg, 2008). These beliefs may affect the way teachers view their role as teachers, how they view their students' role as learners and their potential, or how they structure and present information and knowledge (Cheng et al., 2009; Hashweh, 1996; Topcu, 2011).

Developmental models of epistemic beliefs act on the assumption that with continuous experience, starting from teacher education to actually working in the profession, teachers may gradually develop epistemic beliefs that are more beneficial for teaching (Brownlee, 2004; Topcu, 2011). These models recommend that teacher education should explicitly address pre-service teachers' epistemic beliefs and assist and encourage them in the development of conducive beliefs (i.e. beliefs that facilitate learning in vocational schools and colleges). Such support however requires more information on how pre-service teachers think about and reflect on knowledge and knowledge acquisition. The present study therefore aims to capture pre-service teachers' epistemic beliefs, as little research has been conducted in this area thus far.

Important to note is that not only a teacher's belief but also her/his assessments and assumptions of learners' beliefs may have an impact on professional behaviour. For example, several studies show relationships between learners' epistemic beliefs, preferences for reading strategies, motivation, and achievement (e.g. Bråten, Strømsø, & Samuelstuen, 2008; Cano, 2005; Paulsen & Feldman, 1999; Ryan, 1984; Schommer, 1990, Strømsø, Bråten, & Samuelstuen, 2008). Thus,

“teachers who become aware of their own personal epistemology and learn to assess the epistemic notions underlying their students' belief systems can make informed choices with regard to their instructional approaches and use of educational materials to guide students toward a more advanced and school/discipline-specific epistemological understanding.” (Feucht, 2010, p. 82)

“Given their power, understanding students' beliefs about knowledge can provide insights into their learning and motivation” (Buehl & Alexander, 2001, p. 386). So teachers should not only be conscious of their own but also of their learners' beliefs and consider them in their lesson planning (Ariza & Del Pozo, 2002; Gullberg et al., 2008). We assume that teachers can support their students more successfully when they know what students assume about learning. Therefore the findings of this study should be important for teacher education. Based on this perception, the present study also investigates which epistemic beliefs pre-service teachers presume of their learners and to which degree they are homogeneous or heterogeneous regarding these assumed beliefs.

THEORETICAL BACKGROUND

Epistemic Beliefs

Schommer (1990, 1993a, 1993b; Schommer-Aikins, 2002) generated a model of epistemic beliefs that is widely used in research (e.g. Bråten & Strømsø, 2005; Cheng et al., 2009; Chan & Elliott, 2004; Elby & Hammer, 2010; Schraw, Bendixen, & Dunkle, 2002). It assumes five dimensions of beliefs: structure, stability, and source of knowledge; and control and speed of knowledge acquisition (see Fig. 1).

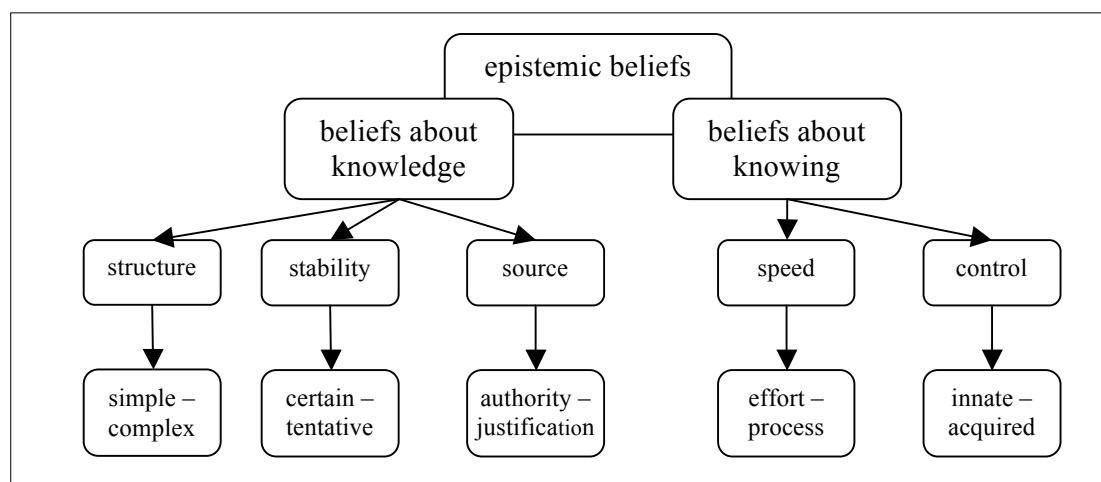


Figure 1: Schommer's Multidimensional Model of Epistemic Beliefs (1990).

Each dimension specifies a continuum ranging from an absolutist to an evaluativistic belief. The dimension “structure” varies from an absolutist position that knowledge is simply structured and consists of isolated components, to an evaluativistic position that knowledge is complex and interrelated. The dimension “stability” can be distinguished by a position that knowledge is absolute and stable over time on the one hand, and is subject to a constant process of development on the other. The dimension “source” extends from assumptions that there is an omniscient authority to impart knowledge, to a position that knowledge is acquired through individual experiences. The dimension “control” depicts a continuum varying from the view that the ability to learn is fixed at birth, to the view that the ability to learn is acquired through experience. The dimension “speed” ranges from the view that learning is a process which proceeds on an ad-hoc basis, to the view that learning is a gradual process.

While most models of epistemic beliefs coincide on the first three dimensions as core elements, it is sometimes discussed whether the last two dimensions regarding the acquisition of knowledge should be included (Greene, Azevedo, & Torney-Purta, 2008; Hofer, 2001). However, when individuals look more closely at the nature of knowledge, they very likely also activate cognitions on the nature of knowledge acquisition (Pintrich, 2002). It therefore seems reasonable to include both types of beliefs, especially when epistemic beliefs are explored in the context of learning and teaching. Elby and Hammer (2010, p. 421) advocate the inclusion of both because

“what we see students doing in class ... almost always involves aspects of both. Because we are ultimately interested in how students approach knowledge and learning in situations such as these, it serves us to treat knowledge and learning together as part of epistemic cognition.”

Areas of Learning

This study focuses on pre-service teachers in vocational colleges and vocational schools in Germany. This school type provides professional basic and/or specialized training as well as general education at an upper secondary level. Vocational colleges belong to the “dual

education” system in which students do an apprenticeship at a company while attending a vocational college part-time. Vocational schools are mainly high schools offering general education as well as professional education in a more broadly-defined occupational field (Pätzold, 2009). The majority of learners at vocational schools and colleges are between 15 and 25 years old.

Vocational schools and colleges have had to undergo significant reforms since 1996, a result of initiatives introduced by the German school authority relating to school organization (KMK, 2004). At its core, these reforms strive to achieve a constructivist and activity-oriented approach to instruction (Rebmann, 2004; Rebmann, Tenfelde & Schlömer, 2011) aiming to stimulate and promote the development of professional competencies. Different legislative and organisational measures have accompanied its implementation, with curricula being changed so that learning content is no longer divided into separate subjects, but is now instead organized into so-called “areas of learning” (KMK, 2004). This introduction of areas of learning suggests a transformation of traditional school subjects and disciplines into a cross-curricular approach. Here, learning contents are organized into comprehensive tasks and problems as they are carried out at the workplace or in an everyday situation (Ertl & Sloane, 2004). Examples of areas of learning in the first year of commercial education are “conversation with customers,” “presentation of goods,” or “advertising and promotion of sales.” Areas of learning can be understood as a didactical transformation of business and working processes. Consequently, learning objectives describe competencies that learners are expected to develop within an area of learning, and their grades are based on their (cross-curricular) performance within it.

The organisation of curricula along these areas of learning requires a teaching philosophy, teaching arrangements, and activity-oriented learning environments that allow a meaningful engagement with ideas and reasoning; the learners’ linking of different sources of information and knowledge; and the understanding of the complex processes in working and private life. With this being the case, it would be safe to assume that evaluativistic beliefs would be required regarding the structure, source, and stability of knowledge. This approach also assumes that all learners come to school with resources for understanding, finding, and trying out solutions, and for reflecting on their errors and their consequences. In these kinds of learning and teaching environments, the role of a teacher changes to a facilitator of learning who stimulates autonomous learning processes. This again tends towards more evaluativistic beliefs about the speed of knowledge acquisition. The teacher here needs to provide learners with experiences that enable them to inform, *inform*, plan, act, monitor, and evaluate. This is why he/she also needs a comprehension of the learners’ beliefs about knowing and learning.

It remains to be seen to which degree these reforms have been implemented successfully – after all, they involve profound changes in the role of teachers, the complexity of their tasks, as well as their attitudes and beliefs towards knowing and learning.

Against this background, this study explores the epistemic beliefs of pre-service teachers in vocational colleges and schools. It focuses on the following research questions:

- How can the epistemic beliefs pre-service teachers assume of their learners be characterized? Can groups of teachers that differ with regard to these assumed beliefs be identified?
- Which epistemic beliefs do pre-service teachers hold themselves?

- To what extent do teachers' assumptions about learners' beliefs differ from their own beliefs?

METHODOLOGY

Participants and Procedure

Participants were 182 pre-service teachers, all enrolled in teacher training at the University of Oldenburg (Germany). They were recruited during courses preparing for the internships in vocational schools and colleges and participated voluntarily in this study. The sample included 105 (57.7%) female and 77 (42.3%) male students, with ages ranging from 20 to 43 years ($M = 25.7$, $SD = 3.74$). Most of the participants were Bachelor's students ($n = 126$, 69.2%); a smaller proportion were Master's students ($n = 56$, 30.8%). All participants majored in the subject "business and economics" – one of the subjects they are going to teach in vocational schools and colleges upon graduation. The data was gathered from only one university and focused on the domain of business and economics. Thus, the results can most probably be generalized only to pre-service teachers in vocational schools in the respective subject because the contents and the study organization differs for pre-service teachers for other school types (e.g., primary school).

Participants were given two questionnaires at two points in time: At time 1, they described their own epistemic beliefs. This means for the bachelor students that they filled in the first questionnaire during their third semester and for the master students that they filled in the questionnaire during their second semester. At time 2, approximately ten weeks after the first assessment and after their five-week internship, the participants were asked to describe the beliefs they assume about a typical learner. Consequently, this was at the beginning of the fourth bachelor semester and third master semester for bachelor and masters students respectively.

Measures

Pre-service teachers' assumptions on their learners' beliefs were measured with the "Epistemic Beliefs Questionnaire" (EBI) (Schraw et al., 2002). The EBI was chosen because to our knowledge it is the only tool in German that has been investigated with respect to its internal validity (Paechter, Rebmann, Schlömer, Mokwinski, Hanekamp, & Arendasy, 2013). Internal validity of the instrument was further investigated for this survey (see below).

All 182 students participating in the study were asked to look back at their internships at a vocational school. Then they were asked to imagine a typical learner and describe this learner's epistemic beliefs. In other words, they had to answer the EBI items from the viewpoint of this imagined learner. The EBI consists of 28 items by which students assess their epistemic beliefs on a five-point Likert scale ranging from 0 (strongly agree) to 4 (strongly disagree). Higher scores indicate more evaluativistic beliefs, lower scores more absolutist beliefs. The original structure encompasses the five subscales of structure, stability, source, control, and speed of knowledge acquisition.

All 28 items of the (English) EBI were translated into German and translated back into English by two experts with a Master's degree in English. In a pre-study, the psychometric

properties of the translated version were $\alpha = .88$ in a sample of 367 pre-service teachers studying at the University of Oldenburg (Rebmann, Paechter, & Mokwinski 2012). Excluding one missing case, this sample included 201 (54.9%) female and 165 (45.1%) male students; 289 (79%) of them Bachelor's and 77 (21%) Master's students. Items with difficulty indices of p below 0.2 or above 0.8 were excluded. To investigate the internal validity of the EBI, orthogonal factor analysis was carried out on the 18 remaining items. It yielded four factors with eigenvalues > 1 . These factors describe the dimensions of structure (five items), speed/stability (four items), control (five items), and source (four items). The factors explained 41.9% of the total sample variance. Cronbach's α coefficients for the factors ranged from .57 to .71 (see Table 1). This structure corresponds to two former analyses of the EBI: In one study, the same 28-item EBI version was used; in the other study the 28-item version plus an additional set of new items were used (Hanekamp, Mokwinski, & Rebmann, 2010; Paechter et al., 2013). In both studies, similar samples, i.e. pre-service teachers and social science students, were investigated. All studies found the same four-factorial structure and thus support the internal validity of the questionnaire.

		Structure	Speed/ Stability	Control	Source
I2	Too many theories just complicate things.	.710			
I5	Things are simpler than most professors would have you believe.	.651			
I11	If a person tries too hard to understand a problem, they will most likely end up being confused. ^a	.595			
I13	The best ideas are often the most simple.	.554			
I14	Instructors should focus on facts instead of theories.	.546			
I19	Working on a problem with no quick solution is a waste of time. ^a		.629		
I17	If you haven't understood a chapter the first time through, going back over it won't help. ^a		.617		
I16	If two people are arguing about something, at least one of them must be wrong. ^b		.611		
I18	What is true today will be true tomorrow. ^b		.508		
I14	Smart people are born that way.			.680	
I12	Really smart students don't have to work as hard to do well in their course.			.626	
I11	People's intellectual potential is fixed at birth.			.622	
I13	How well you do in school depends on how smart you are.			.607	
I10	Students who learn things quickly are most successful. ^a			.582	
I17	When someone in authority tells me what to do, I usually do it.				.749
I15	People should always obey the law.				.664
I18	People shouldn't question authority.				.609
I16	Parents should teach their children all there is to know about life.				.447
Eigenvalue		1.75	1.80	4.00	1.66
Guttman's λ_4		.65	.68	.67	.57
Cronbach's α		.64	.71	.67	.57

^a item was assumed as belonging to "speed". ^b item was assumed as belonging to "stability".

Table 1: Pre-Study: Factor Structure of the EBI, Items, and Factor Loadings ($n = 367$)

The stability of the factorial structure was cross-examined in the sample of the 182 students who took part in the investigation of teachers' assumed epistemic beliefs. Confirmatory factor analyses showed satisfactory fit indices and supported the four-factorial structure. RMSEA was .05, CFI was .94, and SRMR was .06. Generally, values of $RMSEA < .06$ ($N \leq 250$), and $SRMR < .11$ are considered as indicators of good model fit (Hu & Bentler, 1999; Tabachnick & Fidell, 2007). $CFI \geq .90$ can be considered as an indicator of acceptable fit (Byrne 2001; Hu & Bentler, 1999). Thus, the questionnaire with 18 items (EBI assumed beliefs) was used for measurement of teachers' assumed beliefs.

Pre-service teachers' own epistemic beliefs were also measured using the "Epistemic Beliefs Questionnaire" (EBI) (Schraw et al., 2002). Confirmatory factor analyses to test whether the four-factorial structure of the questionnaire on assumed beliefs also applies to the questionnaire on own beliefs showed satisfactory fit indices with $RMSEA = .06$, $CFI = .91$, and $SRMR = .08$ (Hu & Bentler, 1999).

Ethical Principles

This study was conducted following the guidelines for good scientific practice at the University of Oldenburg as well as the "Proposals for Safeguarding Good Scientific Practice," a memorandum which includes recommendations on professional self regulation in science that was published in 1998 by the German Research Foundation. These principles are in line with ethical guidelines of the European Educational Research Association (EERA) for upholding high academic and professional standards.

Regarding the rights of test persons, we followed the German Educational Research Association's code of ethics: The personal rights of the persons involved were respected. The test persons were informed about the objectives and methods of the research project as comprehensively as possible within the framework of the study. The consent of the participants was obtained. The study avoided any harm or disadvantage to the test persons while preserving their integrity and anonymity. Information obtained from test persons was and continues to be treated as confidential, and data protection was ensured.

RESULTS

Pre-service Teachers' Assumed Beliefs

A Latent Class Analysis (LCA) of all items belonging to the respective dimension was carried out to identify groups of pre-service teachers who differ in their epistemic beliefs from the beliefs they assume of their learners.

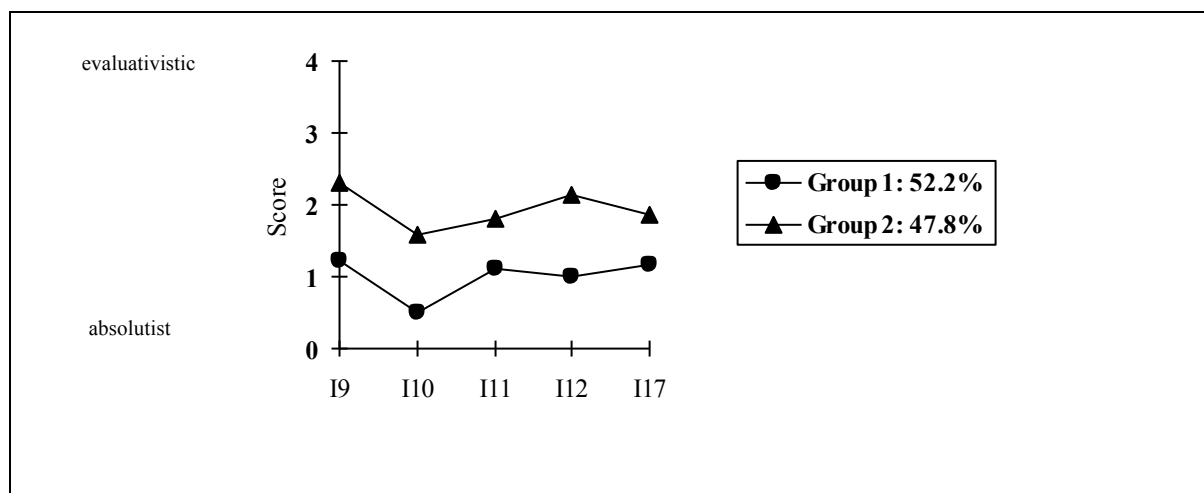
LCA can be seen as a special case of cluster analysis (McLachlan & Peel, 2000). It uses maximum likelihood estimation to fit a hypothetical model in which membership in a specified number of latent classes is related to answers on the respective items and to fitted probabilities of class membership for individuals. Each latent class can be interpreted as a subpopulation with homogeneous profiles on the multiple observed measures included in the analyses, while the differences between the latent classes indicate heterogeneity in the sample. LCA uses fit indices to determine the ideal number of conceptually meaningful classes. Due to the sample size, Consistent Akaike's Information Criterion (CAIC), the

Bayesian Information Criterion (BIC), and the n/k ratio were used to test the model fit of the LCA solution (von Davier, 1997; Tabachnick & Fidell, 2007). In this instance, the n/k ratio should reach a minimum of 10.

LCA was performed using the software WINMIRA (von Davier, 2001). The multidimensional model of epistemic beliefs and the associated measurement instrument (the EBI) assume that the dimensions of epistemic beliefs are independent of each other (Schommer-Aikins, 2002; Schraw et al., 2002). In other words, evaluativistic beliefs about one dimension may be accompanied by absolutist beliefs about another dimension. Because of this, for each dimension of epistemic beliefs (structure, speed/stability, control, source) a separate LCA of all items belonging to the respective dimension was carried out.

Differences between pre-service teachers' own beliefs and the ones they assume their learners have with regard to the dimension "structure"

LCA was carried out on the sample of 182 pre-service teachers on the five items belonging to the dimension "structure." A rating scale model with two classes fitted the data best. Compared to other models, it had the lowest BIC (2,397.78), the lowest CAIC (2,414.78) and a favorable n/k ratio of 10.71. LCA indicates two classes (subgroups) of pre-service teachers: The majority hold rather absolutist beliefs (group 2: 52.2%, $n = 95$), i.e. they believe that knowledge is more likely to be simply structured than being interrelated. A smaller group of pre-service teachers (group 1: 47.8%, $n = 87$) shows absolutist views that are still clearly pronounced (see Fig. 2). In this group, the mean values of all five items clearly lie below the scale mean of 2.0. These pre-service teachers agree that learners assume that knowledge is simply structured or that it consists of isolated components. This is expressed by items such as "too many theories just complicate things", "instructors should focus on facts instead of theories", or "if a person tries too hard to understand a problem, they will most likely end up being confused".



Horizontal axis:

I9 = If a person tries too hard to understand a problem, they will most likely end up being confused.

I10 = Too many theories just complicate things.

I11 = The best ideas are often the most simple.

I12 = Instructors should focus on facts instead of theories.

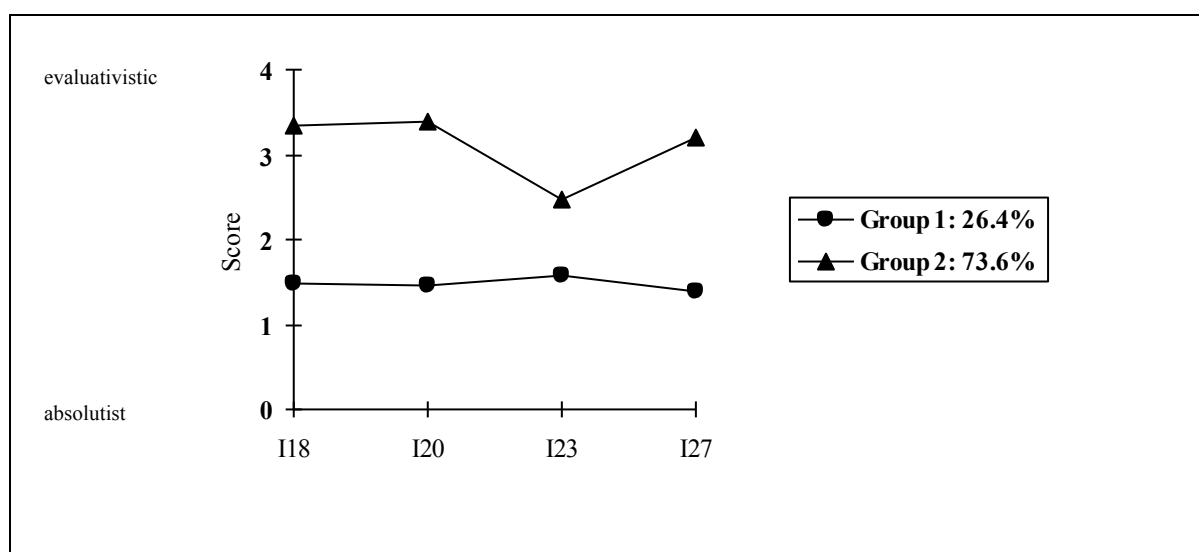
I17 = Things are simpler than most professors would have you believe.

0 = strongly agree; 1 = agree; 2 = neither agree nor disagree; 3 = disagree; 4 = strongly disagree.

Figure 2: Dimension "Structure" (Assumed Beliefs) ($n = 182$).

Differences between pre-service teachers' own beliefs and the beliefs they assume their learners have with regard to the dimension "speed/stability"

LCA of the four items of the dimension "speed/stability" advocated a rating scale model with two classes (BIC = 1,929.54, CAIC = 1,944.54, $n/k = 12.13$). The majority of pre-service teachers hold highly evaluativistic beliefs (group 2: 73.6%, $n = 134$). A smaller group holds absolutist beliefs (group 1: 26.4%, $n = 48$). In this group, the mean value of all four items lie clearly below the scale mean of 2.0. These pre-service teachers agree that learners assume knowledge is stable over time and that learners assume learning is a process which succeeds on a more ad-hoc basis. This is expressed by items such as "if two people are arguing about something, at least one of them must be wrong", "if you haven't understood a chapter the first time through, going back over it won't help", or "what is true today will be true tomorrow" (see Fig. 3).



Horizontal axis:

I18 = If two people are arguing about something, at least one of them must be wrong.

I20 = If you haven't understood a chapter the first time through, going back over it won't help.

I23 = What is true today will be true tomorrow.

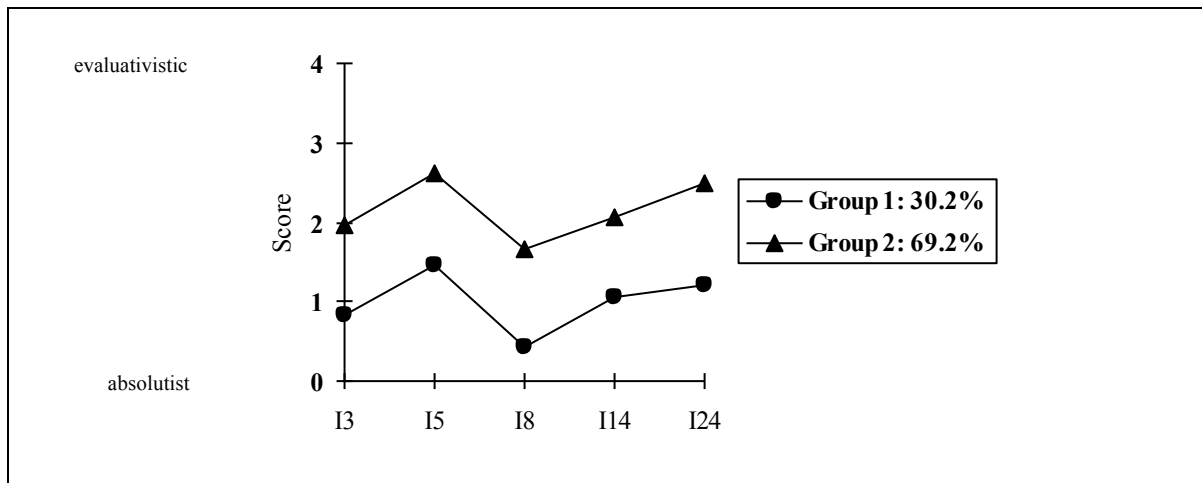
I27 = Working on a problem with no quick solution is a waste of time.

0 = strongly agree; 1 = agree; 2 = neither agree nor disagree; 3 = disagree; 4 = strongly disagree.

Figure 3: Dimension "Speed/Stability" (Assumed Beliefs) ($n = 182$).

Differences between pre-service teachers' own beliefs and the ones they assume their learners have with regard to the dimension "control"

LCA of the five items of the dimension "control" advocated a rating scale model with two classes (BIC = 2,442.00, CAIC = 2,459.00, $n/k = 10.71$). A large group of pre-service teachers holds evaluativistic beliefs about four items and absolutist beliefs about the item "really smart students don't have to work as hard to do well in their course" (group 2: 69.8%, $n = 127$). A smaller group holds absolutist beliefs (group 1: 30.2%, $n = 55$). In this group, the mean value of all five items lie clearly below the scale mean of 2.0. These pre-service teachers agree that learners assume that the ability to learn is fixed at birth. This is expressed by all five items (e.g., "students who learn things quickly are most successful", or "how well you do in school depends on how smart you are") (see Fig. 4).



Horizontal axis:

I3 = Students who learn things quickly are most successful.

I5 = People's intellectual potential is fixed at birth.

I18 = Really smart students don't have to work as hard to do well in their course.

I114 = How well you do in school depends on how smart you are.

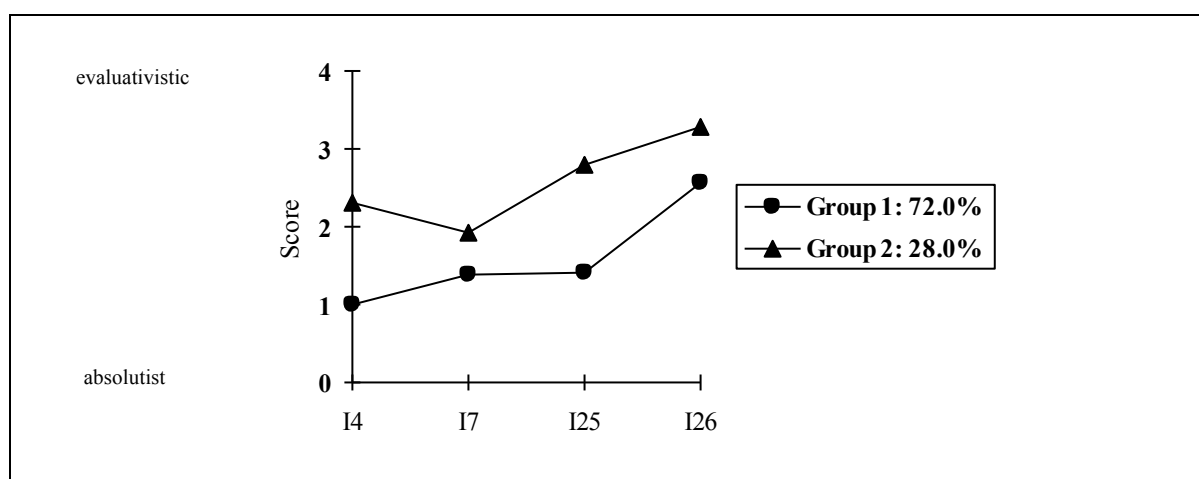
I124 = Smart people are born that way.

0 = strongly agree; 1 = agree; 2 = neither agree nor disagree; 3 = disagree; 4 = strongly disagree.

Figure 4: Dimension "Control" (Assumed Beliefs) ($n = 182$).

Differences between pre-service teachers' own beliefs and the ones they assume from their learners with regard to the dimension "source"

LCA of the four items of *the dimension "source"* advocated an equidistance model with two classes (BIC = 1,959.89, CAIC = 1,976.89, $n/k = 10.71$). A large majority of the pre-service teachers (group 1: 72.0%, $n = 131$) hold absolutist beliefs about three items (e.g., "people should always obey the law", "parents should teach their children all there is to know about life") and evaluativistic beliefs about the item "people shouldn't question authority" (see Fig. 5). A smaller group (group 2: 28.0%, $n = 51$) holds absolutist views on the item "parents should teach their children all there is to know about life" but evaluativistic views on all other items. These items express the belief regarding whether authorities can/should be challenged or not.



Horizontal axis:

I4 = People should always obey the law.

I7 = Parents should teach their children all there is to know about life.

I25 = When someone in authority tells me what to do, I usually do it.

I26 = People shouldn't question authority.

0 = strongly agree; 1 = agree; 2 = neither agree nor disagree; 3 = disagree; 4 = strongly disagree.

Figure 5: Dimension "Source" (Assumed Beliefs) ($n = 182$).

Differences between pre-service teachers' own beliefs and the ones they assume their learners have

It was further investigated to what extent the identified groups of teachers differentiate between the beliefs they assume of their learners and their own beliefs. A composite score was calculated for each of the four EBI dimensions: The scores on all items belonging to one dimension were averaged to express a participant's belief about it. From this, four scores were derived expressing the beliefs a teacher assumes of a typical learner about the respective dimensions, plus four scores expressing his/her own epistemic beliefs. Descriptive statistics are shown in Table 2 and explained in the following subsections.

	Epistemic Beliefs				<i>n</i>
	Assumed		Own		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
EBI Factors					
Structure	1.49	.64	1.71	.62	182
Group 1	0.97	.36	1.64	.65	87
Group 2	1.97	.43	1.77	.58	95
Speed/Stability	2.66	.88	3.16	.63	182
Group 1	1.45	.62	3.34	.54	48
Group 2	3.10	.44	3.09	.64	134
Control	1.80	.71	2.14	.66	182
Group 1	0.96	.46	2.05	.65	55
Group 2	2.17	.45	2.18	.67	127
Source	1.90	.67	1.88	.58	182

Group 1	1.60	.45	1.76	.52	131
Group 2	2.68	.48	2.21	.59	51

Table 2: Descriptive Statistics (Means, Standard Deviations, n) of Assumed and Own Epistemic Beliefs

Differences between assumed and own beliefs: dimension “structure”

A multivariate analysis of variance (MANOVA) was carried out with the two groups of pre-service teachers' assumed beliefs about the dimension “structure” as a between-subjects factor (group 1: 87 participants with assumed absolutist beliefs, group 2: 95 pre-service teachers with assumed less absolutist beliefs) and the type of beliefs (assumed beliefs versus own beliefs) as a within-subjects factor. MANOVA showed a significant main effect for the factor “group”, $F(1, 180) = 85.25$, $p \leq .001$, $\eta^2 = 0.32$, as well as a significant main effect for the factor “type-of-beliefs”, $F(1, 180) = 24.30$, $p \leq .001$, $\eta^2 = 0.12$. The interaction “group x type-of-beliefs” was significant, $F(1, 180) = 83.43$, $p \leq .001$, $\eta^2 = 0.32$.

Pre-service teachers that assume their learners hold pronounced absolutist beliefs about the dimension “structure” ($M = 0.97$, $SD = 0.36$) differentiate between assumed and own beliefs. They show fewer own absolutist beliefs ($M = 1.64$, $SD = 0.65$). These pre-services teachers agree that their learners strongly assume that knowledge is simply structured. Regarding their own beliefs they also assume that knowledge is simply structured, but their view is less pronounced. Pre-service teachers that assume their learners have absolutist beliefs do not really differentiate between their own beliefs ($M = 1.77$, $SD = 0.58$) and those they assume of their learners ($M = 1.97$, $SD = 0.43$) (see Fig. 6a). These pre-service teachers agree that learners assume that knowledge is simply structured and consists of isolated components and they assume that for themselves.

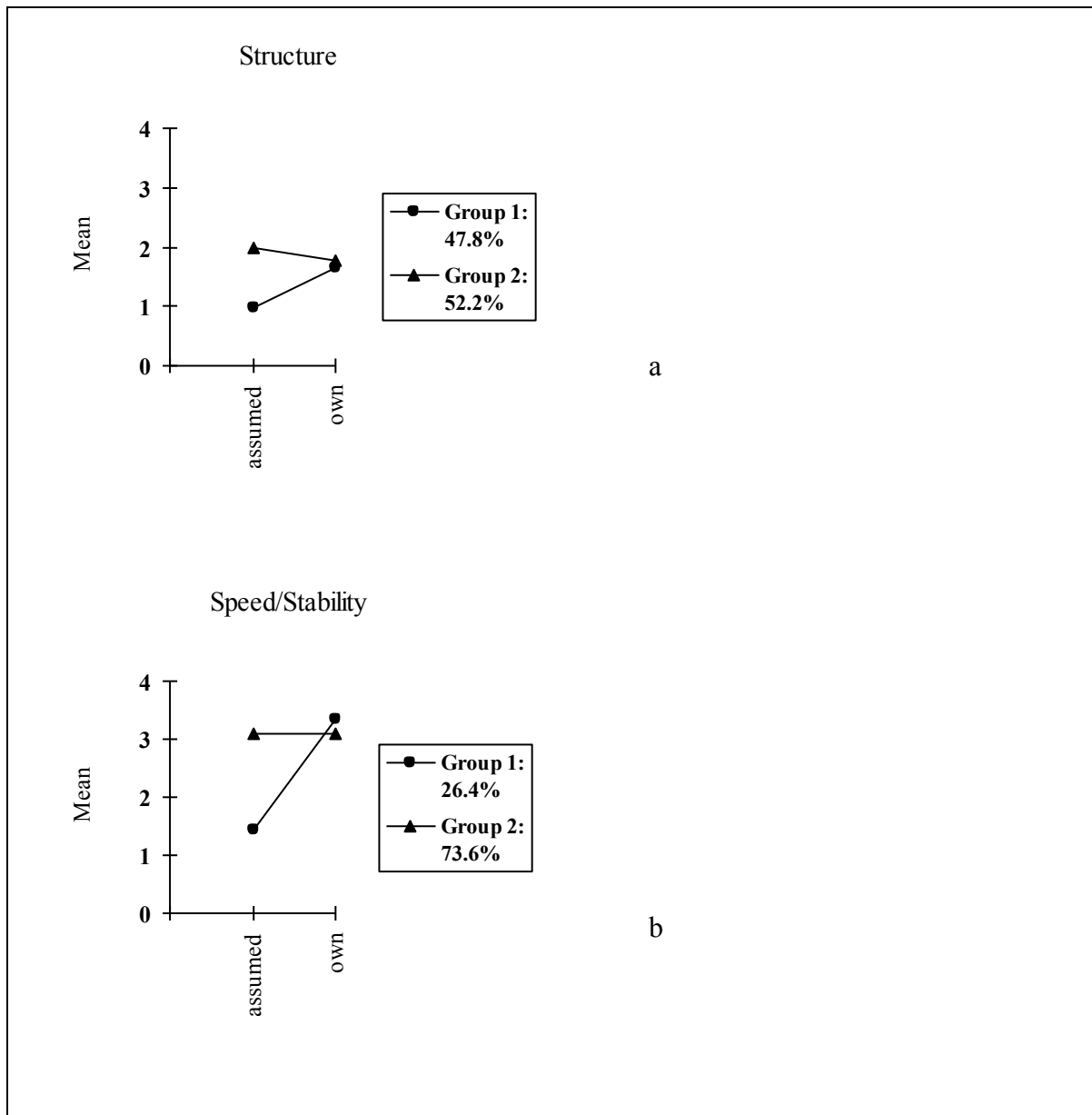


Figure 6: Dimensions “Structure” and “Speed/Stability”: Mean Values of Assumed and Own Epistemic Beliefs for Group 1 and 2.

Differences between assumed and own beliefs: dimension “speed/stability”

MANOVA was carried out with the two groups of pre-service teachers’ assumed beliefs about the dimension “speed/stability” as a between-subjects factor (group 1: 48 participants with assumed absolutist beliefs, group 2: 134 teachers with assumed evaluativistic beliefs) and the within-subjects factor “type-of-beliefs”. MANOVA showed a significant main effect for group, $F(1, 180) = 89.30, p \leq .001, \eta^2 = 0.33$, as well as a significant main effect for the within-subjects factor “type-of-beliefs”, $F(1, 180) = 261.74, p \leq .001, \eta^2 = 0.59$. The interaction “group x type-of-beliefs” was significant, $F(1, 180) = 268.02, p \leq .001, \eta^2 = 0.60$.

Pre-service teachers in group 2 with assumed evaluativistic beliefs ($M = 3.10, SD = 0.44$) also hold evaluativistic beliefs themselves ($M = 3.09, SD = 0.64$). They do not differentiate between assumed and own beliefs. In other words, these pre-service teachers assume and

agree that learners assume knowledge is subject to a constant process of development and learning is a gradual process. Teachers in group 1 assume that their learners hold absolutist beliefs about the dimension “speed/stability” ($M = 1.45$, $SD = 0.62$). In contrast, their own beliefs are highly evaluativistic ($M = 3.34$, $SD = 0.54$) (see Fig. 6b). In other words, whereas pre-service teachers assume that knowledge is subject to a constant process of development and learning is a gradual process they agree that their learners assume that knowledge is absolute and stable over time and that learning is a process on an ad-hoc basis.

Differences between assumed and own beliefs: dimension “control”

MANOVA was carried out with the two groups of pre-service teachers' assumed beliefs about the dimension “control” as the between-subjects factor (group 1: 55 participants with assumed highly absolutist beliefs, group 2: 127 teachers with assumed evaluativistic beliefs) and the within-subjects factor “type-of-beliefs” showed a significant effect for group, $F(1, 180) = 81.49$, $p \leq .001$, $\eta^2 = 0.31$, as well as a significant effect for type of beliefs, $F(1, 180) = 107.06$, $p \leq .001$, $\eta^2 = 0.37$, plus a significant interaction “group x type-of-beliefs”, $F(1, 180) = 101.64$, $p \leq .001$, $\eta^2 = 0.36$.

Pre-service teachers who assume that their learners hold highly absolutist beliefs ($M = 0.96$, $SD = 0.46$) hold evaluativistic own beliefs ($M = 2.05$, $SD = 0.65$). In other words, pre-service teachers that believe that their learners assume that the ability to learn is fixed at birth and they think that their own ability to learn is acquired through experience. In group 2, the teachers with assumed evaluativistic beliefs do not seem to differentiate between their own beliefs and those assumed of their learners (own $M = 2.18$, $SD = 0.67$; assumed $M = 2.17$, $SD = 0.45$) (see Fig. 7a). These pre-service teachers think that their own ability to learn is acquired through experience and they believe that their learners think that, too.

Differences between assumed and own beliefs: dimension “source”

MANOVA was carried out with the two groups of teachers' assumed beliefs about the dimension “source” as the between-subjects factor and showed a significant effect, $F(1, 180) = 126.35$, $p \leq .001$, $\eta^2 = 0.41$ (group 1: 131 participants with assumed absolutist beliefs, group 2: 51 teachers with assumed evaluativistic beliefs), as well as a significant effect for the within-subjects factor “type-of-beliefs”, $F(1, 180) = 11.36$, $p \leq .001$, $\eta^2 = 0.06$. The interaction “group x type-of-beliefs” was also significant, $F(1, 180) = 44.58$, $p \leq .001$, $\eta^2 = 0.20$.

Pre-service teachers who assume absolutist beliefs of their learners ($M = 1.60$, $SD = 0.45$) hold absolutist beliefs themselves ($M = 1.76$, $SD = 0.52$). These pre-service teachers assume that there is an omniscient authority to impart knowledge and they believe that their learners share that belief. Teachers with assumed evaluativistic beliefs of their learners hold slightly less but still evaluativistic own beliefs (assumed $M = 2.68$, $SD = 0.48$; own $M = 2.21$, $SD = 0.59$) (see Fig. 7b). These pre-service teachers assume that knowledge is acquired through individual experience and they believe that their learners agree even stronger.

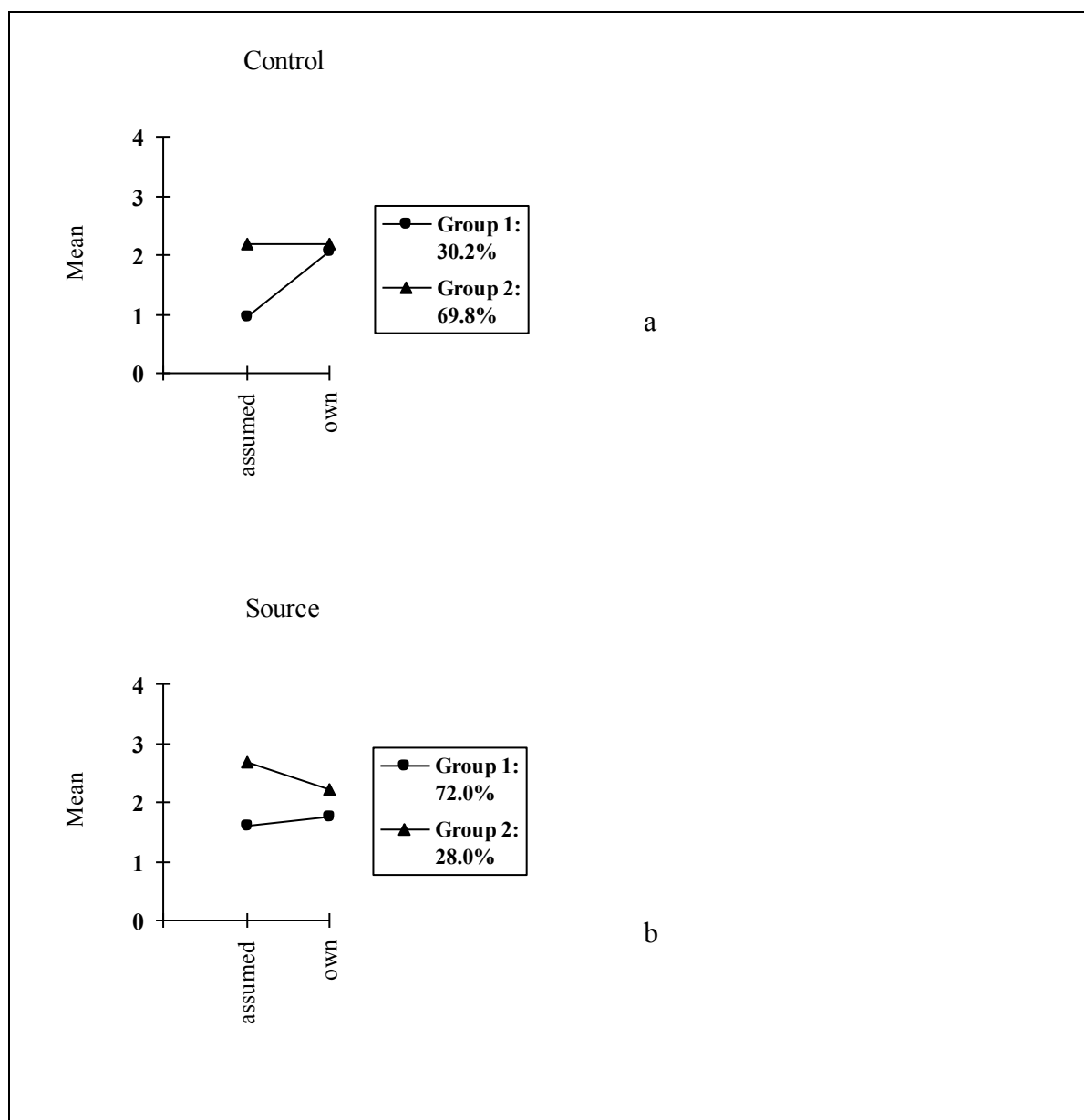


Figure 7: Dimensions “Control” and “Source”: Mean Values of Assumed and Own Epistemic Beliefs for Group 1 and 2.

DISCUSSION AND CONCLUSION

Discussion

The organisation of curricula along areas of learning requires activity-orientated learning environments that allow a meaningful engagement with ideas and reasoning; the learners' linking of different sources of information and knowledge; and the understanding of the complex processes in working and private life. At its core, these reforms strive to achieve a constructivist and activity-orientated approach to instruction (Rebmann, 2004; Rebmann, Tenfelde, & Schlömer, 2011). Such an approach fits better to evaluativistic beliefs.

Empirical studies also support this notion. For example, Aypay (2011) showed that the more pre-service teachers believed in uncertain knowledge, in effort in learning and

assumed that expert knowledge should be questioned the more they preferred a constructivist teaching and learning conception. In contrast, the belief in certain knowledge and fixed ability was related with traditional teaching and learning conceptions. Berding and Lamping (2014) found that the more teachers believed in interconnected and self-constructed knowledge the more they preferred complex and ill-structured tasks in textbooks.

Learners' epistemic beliefs also play an important role because teachers' didactic methods, the learning material, and learning tasks are interpreted by learners through their "epistemic lenses" (Feucht, 2010). Teachers who are aware of their learners' epistemic beliefs can make informed choices with regard to their instructional approaches and use of educational materials as they guide learners towards a desirable epistemic understanding. Although many studies investigate the relationship between epistemic beliefs of teachers and their teaching conceptions (e.g. Aypay, 2011; Chai, Teo, & Lee, 2010; Chan & Elliot, 2004; Cheng et al., 2009), to our knowledge there are no studies on the assumptions that teachers have regarding their learners' epistemic beliefs. Our literature research yielded only one study on assumptions on others' beliefs, namely the case study of Brownlee, Berthelsen, Dunbar, Boulton-Lewis, and McGahey (2008) on child care workers and their beliefs about children's learning. The vocational background as well as the age group of learners differs from our survey.

The questions remain: To what degree are teachers aware of their learners' epistemic beliefs, and are they able to differentiate between their personal beliefs and those of their learners?

Differences between pre-service teachers with regard to their assumptions of their learners' epistemic beliefs

In this study, all teachers had to describe a typical learner's epistemic beliefs. The results of the Latent Class Analyses show that teachers differ widely in the epistemic beliefs they presume of their learners.

With the dimension "structure" both groups of pre-service teachers hold absolutist beliefs; one group of pre-service teachers (47.8%) even held a pronounced absolutist view. In terms of the relative position of the factor mean score below the midpoint 2.0 on the rating scale, these pre-service teachers agree that learners believe that knowledge is simple and clearly structured, that an instructor should focus on facts, or that things are often simpler than they are taught by a teacher. However, in their future profession as teachers in vocational schools, these students are expected to apply the constructivist and activity-oriented approach to areas of learning. The idea of learning areas emphasizes overcoming the compartmentalization of subjects in order to support learners' acquisition of knowledge and skills by comprehensive tasks oriented towards workplace or daily life situations (Ertl & Sloane, 2004). Research has shown that these kinds of approaches harmonize better with evaluativistic beliefs about the structure of knowledge because they are often accompanied by a higher appreciation of teaching styles that support learning by doing and learning from mistakes (Yadav & Koehler, 2007). How will teachers cope with these contradictory attitudes they assume of their learners?

With the dimension "speed/stability", the majority of participants (73.6%) expect their learners to hold highly evaluativistic beliefs, while a smaller group (26.4%) assumes that their learners hold absolutist beliefs. Thus, most of the pre-service teachers expect their

learners to think it is worth working on problems with no quick solution, or that understanding a matter mostly needs time and effort. This is in line with the idea of learning areas. In this didactic approach learners are exposed to tasks and problems that have no quick solutions. However, one out of four teachers thinks his/her learners do not agree with the idea of autonomous learning processes. The question remains regarding how these teachers will cope with these attitudes they assume of their learners.

With the dimension “control”, the majority of pre-service teachers assume their learners hold rather evaluativistic beliefs (69.8%). They reject notions such as success in school is based mainly on stable factors like intelligence or talent, and acknowledge learners’ individual potential to expand their abilities. Their views are consistent with the results of the dimension “speed/stability”, where a majority highly approved how their learners think it is worth working on ambiguous problems or investing time and effort in learning. This again is in line with the idea of learning areas. In spite of this, 30.2% of teachers still assume their learners hold absolutist beliefs about the dimension “control”. According to this epistemic stance, learners’ fixed abilities, not teachers’ professional activities, are accountable for learning success and achievement in learners’ views. It remains to be seen whether these learners would approve of a constructivist and activity-oriented approach towards areas of learning at all. And, how would teachers cope with these kinds of contradictory attitudes of their learners?

With the dimension “source” the minority of teachers (28%) assume their learners have a tendency towards evaluativistic beliefs. However, the majority of teachers (72%) presume their learners hold absolutist beliefs about the dimension “source” – this was especially expressed by the item “when someone in authority tells me what to do, I usually do it”. This view is not in line with the idea of areas of learning. According to this instructional approach learning contents are organized into comprehensive tasks and problems as they are carried out at the workplace or in an everyday situation (Ertl & Sloane, 2004) (compare section “Areas of Learning” in this article). This didactic approach emphasizes that learners need different sources of information and that usually many perspectives have to be taken into account in order to solve problems. Both groups however share a more evaluativistic stance and believe that their learners disapprove of the item “people shouldn’t question authority”. This view may mirror the lower significance of the belief in authority in the participants’ culture. They also agree with the concept of areas of learning in which the teacher obtains the role of a facilitator, and in which learning by individual experiences is encouraged.

Overall, the results of this study show that pre-service teachers’ own epistemic beliefs differ from the beliefs they assume of their learners. With this in mind, a group of pre-service teachers with presumed absolutist views of their learners could be distinguished from a group with less absolutist or even evaluistic views on all four dimensions of epistemic beliefs. Interestingly, these assumed absolutist beliefs are not well aligned with the didactic and curricular approach of areas of learning advocated by the recent school reforms for vocational schools and colleges described above.

In typical German vocational teacher education (and in teacher education in general) little emphasis has so far been placed on supporting pre-service teachers in the development of epistemic beliefs. The current results, however, emphasize the necessity to provide support for teachers. As a first step, it would appear that pre-service teachers would need to identify and analyze their learners’ beliefs in order to adequately address them. They should be encouraged to map out learners’ diverse beliefs early on in courses (Strømsø &

Bråten, 2011). Also, measures should be taken that assist the development of beliefs that are in line with the advocated teaching approach, e.g., by initializing more learning opportunities that support thinking beyond and across single topics, supporting the application of knowledge and skills, and stimulating the acquisition of knowledge applied in interdisciplinary, work-based and daily life-based contexts. Teachers also need to explicitly address learners' beliefs. In teacher education, it seems particularly important to combine the reflection and discussion on personal epistemology with pre-service teachers' activities and their experiences (Strømsø & Bråten, 2011). Such measures are not only a matter of instructor-student interaction. They apply to the organization of teacher education as a whole, spanning from changes in curricula to advocating specific learning and teaching arrangements.

Pre-service teachers' own beliefs and the beliefs they assume of their learners

When looking at the overall results of the Latent Class Analyses, with all dimensions, all pre-service teachers show similar assessments of their own beliefs. Because learners' actual beliefs could not be assessed in this study, it cannot be determined to what extent the pre-service teachers' assessments are accurate descriptions. With this being said, the overall agreement on learners' beliefs might in fact be an indication of an accurate assessment. Even though the identified groups of teachers differ with regard to the presumed beliefs, they largely correspond with their own beliefs.

Only the groups of teachers assuming what tend to be absolutist epistemic beliefs of their learners differed on all four dimensions between their own and their assumed beliefs of their learners. In general, they hold less absolutist or evaluativistic own beliefs than they presume of their learners. With the dimensions "structure" and "source" they hold less absolutist beliefs. With the dimensions "speed/stability" and "control" they have evaluativistic own beliefs. These pre-service teachers probably act and assess using a developmental model in which learners gradually develop their beliefs starting from a generally absolutist stance towards a more and more evaluativistic one. From this kind of developmental point of view, one might assume that teachers with longer teaching experience hold stronger evaluativistic views. In many instances, this kind of model reflects learners' actual epistemic developments over the course of academic education from school to university education all the way to professional training (Baxter-Magolda, 1993; Brownlee, 2004). However, there is a lack of research on this question of the development of epistemic beliefs.

In contrast, pre-service teachers with absolutist views on the dimensions structure, control, and source assume beliefs of their learners similar to or slightly higher than their own ones. These pre-service teachers' beliefs and assumptions appear contradictory when they e.g. expect their learners to be more willing than they themselves to invest time and effort in learning. Also, these beliefs contradict the ideas behind the concept of areas of learning. This instructional approach emphasizes that knowledge is complex and interrelated, that learners need different sources of information, and that usually many perspectives have to be taken into account in order to solve problems. This group of pre-service teachers could especially benefit from supporting and encouraging the development of their own epistemic beliefs and their beliefs about their role as teachers. A good idea would be to give these pre-service teachers opportunities to calibrate their personal epistemologies with teaching knowledge and knowledge on learners. However, according to our research of the literature studies on this question are still missing.

Conclusion

Pre-service teachers' epistemic beliefs and those they presume of their learners were investigated in the setting of German teacher education for vocational colleges and schools. This setting was chosen because vocational schools and colleges have experienced extensive reforms in curricula and school organisation in recent years, shifting instruction towards an activity- and competence-based, cross-curricular approach that concentrates on areas of learning. The results of the study show significant inconsistencies between pre-service teachers' beliefs, the beliefs they assume of their learners, and beliefs that are supportive to teach according to the constructivist, instructional concept of areas of learning. These inconsistencies between pre-service teachers' beliefs, the beliefs they assume of their learners, and the beliefs required for the above instructional approach can be explained by pre-service teachers' learning backgrounds at school and university, making it relatively clear just how important the education of teachers in vocational education is as it aims at supporting pre-service teachers in developing beliefs that are necessary for their future profession. This makes it all the more essential to first support pre-service teachers in developing evaluativistic beliefs that better agree with the idea of learning areas. In order to support pre-service teachers in developing such beliefs teacher educators need to sensitize them for the importance of epistemic beliefs in teaching and learning processes. They could also analyze teaching methods regarding their epistemic basis and how these methods effect in student learning (Kang 2008). Moreover, teacher education programs should be based on a constructivist teaching and learning conception (Brownlee, 2004; Cheng et al. 2009). And secondly, it is important to support pre-service teachers in adequately and correctly recognizing the beliefs their learners hold. Thus, teacher education programs need to improve diagnostic abilities – in general and with respect to own and assumed epistemic beliefs.

This study is not without its limitations, first of which was the sampling of data that was gathered from only one university. Moreover, the study design focused on the domain of business and economics. Future studies should enlarge the data set and include more domains. It would also be advisable not to assess only pre-service teachers' assumptions about their learners' beliefs, but actual learners' beliefs as well.

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