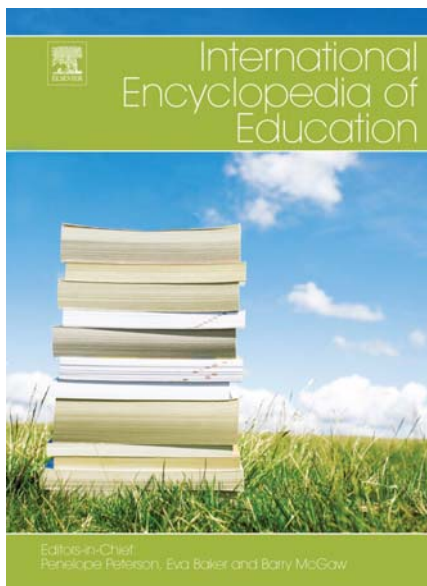


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# Taking Prospective Teachers' Beliefs into Account in Teacher Education

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## Glossary

**Beliefs** – Beliefs are psychological understandings, premises, or propositions that are felt to be true.

**Educational beliefs** – These refer to beliefs about the role of the teacher and/or student in instructional processes. In the literature, a bipolar distinction is made between teacher-centered traditionalistic and more progressive or student-centered educational beliefs.

**Expectancy value theory** – According to this motivation theory, beliefs are a central construct that influences what teachers value and expect, and how this influences their actual teaching behavior.

**Mathematics beliefs** – Beliefs that refer to conceptions about the nature of mathematics, the nature of mathematics teaching, and the process of learning mathematics.

**Teacher beliefs** – These are psychological understandings, premises, or propositions about processes, variables, and actors that are central to learning and instruction settings, such as educational beliefs, epistemological beliefs, beliefs about inclusive education, etc.

## Introduction

Teachers' beliefs have become a crucial variable in studying teaching behavior and teacher education. From the 1980s to the present, researchers have investigated both explicit and implicit knowledge and beliefs of preservice, novice, and experienced teachers to identify these beliefs and to examine how knowledge and beliefs affect learning to teach. Teacher beliefs are central to recent theories about teachers' identity. In their review about teachers' professional identity, [Beijaard et al. \(2004\)](#) state that beliefs are conceived as important constituents of teachers' professional identity formation. This implies that beliefs are of vital importance for teacher education since it determines the way the student teachers develop their meaning making and decision making. This suggests that beliefs are part of a complex set of variables and processes that determine teaching

behavior. The complex nature of teachers' beliefs implies that teacher education is critical to consider the development of a consistent belief system in teachers and student teachers.

## Defining Teacher Beliefs

The concept of beliefs has a long history and has been defined in a variety of ways. Consequently, a conceptual confusion can be observed since authors easily adopt alternative terms. In addition, "some researchers refer instead to teachers' 'principles of practice', 'personal epistemologies', 'perspectives', 'practical knowledge', or 'orientations'" ([Kagan, 1992](#), p. 66). It is therefore not surprising that [Pajares \(1992, p. 307\)](#) considered teacher beliefs as being a "messy construct," noting that "the difficulty in studying teachers' beliefs has been caused by definitional problems, poor conceptualizations, and differing understandings of beliefs and belief structures."

[Richardson \(1996\)](#) defines beliefs as psychological understandings, premises, or propositions that are felt to be true. As such, beliefs can be represented as estimates of the likelihood that the knowledge someone has about a proposition or a subjective experience is correct. Alternatively, beliefs also refer to the likelihood that an event or state of affairs will occur ([Wyer and Albarracín, 2005](#)). Furthermore, as beliefs are clustered as a set of interrelated beliefs in a broader, general belief structure or system, they can vary in strength. The more a belief is interrelated with others in this structure, the more difficult it is to alter the belief in question ([Pajares, 1992](#)).

Since we focus on beliefs in the context of preservice teachers, the question is often raised with reference to the relationship between beliefs, attitudes, and knowledge. With reference to the relationship with attitudes, a distinction is made between an affective, a cognitive, and a conative component (behavioral or action part). Presently, beliefs are considered as representing the cognitive part of attitudes. The difference between beliefs and knowledge is presently also clearer. A differentiation commonly made is that beliefs are based on judgments and evaluations (subjective probability), whereas knowledge refers to objective verifiable facts.

## Teacher Beliefs in Interaction with Other Processes and Variables

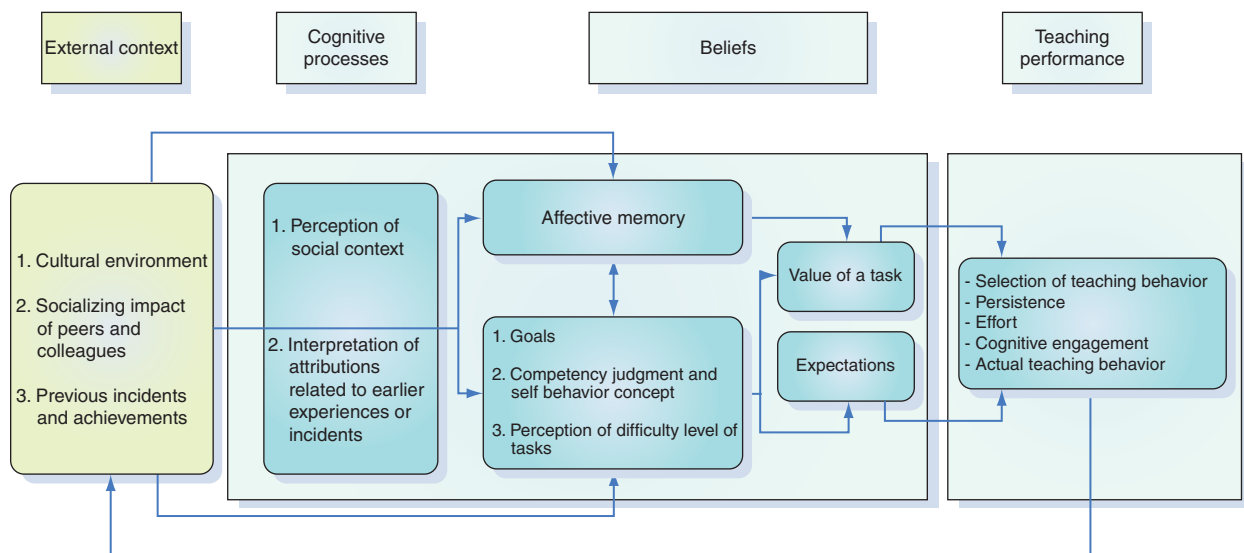
In the literature, the attention paid to teachers' beliefs cannot be isolated from the attention paid to other and clearly related constructs. From the mid-1980s, educational researchers began to focus on nonbehavioral components of teaching behavior, such as: (1) teachers' beliefs about classroom, students, school, and learning; (2) teachers' decisions for designing and presenting a teaching activity; (3) teachers' perceptions on classroom-teaching affairs; and (4) teachers' roles and their self-images (Kagan, 1995). This observation is important since it positions beliefs in the complex overall setting of teachers and their context. It is helpful to study the central position of beliefs as a motivational construct. In this context, it is most useful to reiterate the expectancy-value perspective on motivation as it has been expanded by Wigfield and Eccles (2000) and to rephrase it in terms of teacher-related processes. We stress the importance of this broader orientation toward beliefs in view of the consequences that can be derived for teacher-education practices. The model implies that beliefs consist of affective components, goal orientations, competency judgments, and perceptions about the teaching tasks to be carried out. In addition, the model points out that beliefs influence what students or teachers value. It helps to understand how beliefs are related to teaching expectations and how this results in choices, persistence, duration, and engagement in teaching activities. In addition, the model also stresses the fact that beliefs are influenced by cognitive processes, such as perceptions of the social context and interpretations of attributions related to earlier teaching experiences and

incidents. Moreover, the model stresses the impact of the external context. The relationships depicted in the model help to understand how the outcomes of teaching performance affect the extent to which future behavior will be valued, how beliefs are affected, and what expectations do result from these experiences. The model helps to understand why teacher's beliefs tend to be associated with a congruent style of teaching. The feedback loop in the model is of critical importance. The feedback loop gives teacher educators and trainers the opportunity to influence beliefs. Figure 1 illustrates how the beliefs are part of this complex interplay with other variables and processes.

Positioning teachers' beliefs in this wider setting of mechanisms that influence actual teaching behavior also helps to make clear that beliefs and belief systems serve as personal guides in helping individuals to define and understand the world and themselves (Pajares, 1992). Teachers' educational beliefs are understandings, premises, or propositions about education, established through multitudinous experiences (Pajares, 1992). Teachers' beliefs are considered as relatively stable and act as a filter through which new knowledge and experiences are screened for meaning (Kagan, 1992) and that underlie teachers' planning, decision making, and behavior in the classroom.

### Beliefs about What?

In addition, the model presented above makes it clear that the focus on the beliefs could be as varied as the teaching profession itself and therefore reflects on the issues



**Figure 1** Beliefs in relation to motivational variables and processes. From Wigfield, A. and Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology* 25, 68–81.

related to learners (e.g., beliefs about inclusion and about diversity), knowledge (epistemological beliefs), teaching components (beliefs about the curriculum, beliefs about what learning content is important, beliefs about media (information and communication technology (ICT)), teaching strategies, evaluation, etc.), parents, instructional context, and organizational dimensions. The literature reflects this varied nature of the focus of teachers' beliefs. For example, He and Zhao (2006) state that teachers' beliefs include beliefs about learners, teaching, disciplines, teaching efficiency, and teacher themselves. This is in line with distinctions made by Kagan (1992) who indicates that beliefs are a particularly provocative form of personal knowledge that is generally defined as pre- or in-service teachers' implicit assumptions about student learning, classrooms, and the subject matter to be taught. A major problem in research of teacher beliefs is the wide-ranging nature of beliefs. Often research about educational beliefs is too context-free. Hence, almost 15 years ago, Pajares (1992) considered restricting the object of research study to a particular educational belief or a limited belief system and to clearly define the object under investigation.

### **Measuring Teachers' Beliefs**

The nature of beliefs makes it difficult to measure them straightforwardly. Since beliefs cannot be observed directly, they are measured indirectly. Shavelson *et al.* (1986) presented the first overview of available methods to study beliefs. They refer to analysis of policies, repertory grid technique, and process tracing (e.g., think-aloud, stimulated recall, and journal keeping). Kagan (1992) presents a systematic description of techniques that is still viable. She refers to (1) experimental tasks that ask teachers to think aloud when analyzing classroom vignettes or when viewing their videotaped performances (stimulated recall); (2) semi-structured interviews, during which teachers are asked to recall specific classroom events and decisions; (3) concept maps that teachers draw to depict their understandings of pedagogical issues; (4) a close analysis of the language that teachers use to describe their thoughts and actions; and (5) traditional Likert-type attitude scales. Other approaches embrace case study methodologies, analysis of teachers' concerns, and in-depth interviews.

### **Beliefs as Entry Qualifications of Prospective Teachers**

A result of the growing interest in teachers' beliefs is the conviction that preservice teachers already enter teacher education with a clearly established belief system about

teaching, learning, and themselves as teachers developed over years of life experience and exposure to a wide variety of teaching–learning situations and contexts. It is well documented that these preconceived ideas remain quite stable during teacher training (e.g., Pajares, 1992; Wideen *et al.*, 1998) and have a strong influence on student teachers' understandings of and experiences in their classroom placements (e.g., Kagan, 1992; Richardson, 1996).

Old beliefs must be challenged and proven unsatisfactory in order to assimilate new beliefs into existing conceptions. This is in line with the general findings of Quillen (unpublished PhD thesis) that: “Teacher education researchers have long been aware of the power of beliefs and the resistant-to-change beliefs of many preservice teachers as well as experienced teachers.” This puts teacher educators in a difficult situation since the beliefs:

- are well established by the time student teachers enter their preservice training;
- are already formed at an early stage;
- develop into a belief system that is difficult to change; and
- act as a selective filter to develop new knowledge.

This explains, in part, why student teachers tend to reiterate their personal classroom experiences and also explains why some authors stress the predictive value of beliefs for a successful entry into the teaching profession. The latter explains why it might be important to unlearn and discard some beliefs.

The results of the research about the beliefs of incoming student teachers also clearly point out that, next to stability, in the initial beliefs, changes also could be observed, but this depended largely on the beliefs held by the supervising teachers. The former is not only critical in view of developing sound professional teaching competences, but also to reconsider the nature of the teacher education experience itself. Teacher educators should be aware of the fact that student teachers enter the teacher-education setting with a set of beliefs about teacher education. Preservice teachers tend to think of teaching primarily as a task involving affective, interpersonal relationships rather than a profession requiring a skilled and knowledgeable practitioner. Generally, preservice teachers do not expect to receive much from their education classes and appear to be less interested in what they perceive to be theory and more interested in practical approaches. They feel that they would be good teachers without any preparation, because they believe that the majority of their knowledge about teaching would come from practice in the field or through trial and error when they eventually enter the classroom.

It appears from the findings of these studies that preservice teachers underestimate the complexity of teaching. Yet, student teachers who are guided by these

kind of naïve, idealistic, and unrealistic teaching beliefs have been found to feel overwhelmed, shocked, and disillusioned when confronted with the complexities and responsibilities of a classroom (e.g., Wideen *et al.*, 1998). Student teachers who fail to reconstruct their images of self as teachers appropriately may encounter frustrations sufficiently severe to terminate their teaching career before they really had a chance to begin (Kagan, 1992). Therefore, in order to improve professional preparation and teaching practices, teacher educators cannot neglect the role of beliefs and need to develop specific strategies and approaches to cater to belief systems as an integrated part of the teacher education system. Moreover, teacher educators need to be explicit about their own beliefs about teacher education and training.

### Changing Teachers' Beliefs in Teacher Education

Given the established nature of beliefs, and the fact that the beliefs work as a selective filter in developing professional teaching competences, teacher-education approaches are challenged to consider the pervasive influence of teachers' beliefs. This could result in the implementation of a series of specific activities or teacher-education strategies. However, the processes by which beliefs can be changed are not well understood. In addition, research overall is rather dour about the prospects of changing candidates' beliefs. The simple adoption of a number of strategies, tricks, etc., is insufficient. Teacher educators themselves should, first of all, adopt an updated conception as to how student teachers evolve and how teacher education should take this into consideration. There is clear empirical evidence that shows how teacher education programs are too focused on transmitting pedagogical knowledge that hardly gives consideration to modifying beliefs. In their review, Wideen *et al.* (1998) conclude that successful teacher education programs not only merely change but also build upon student teachers' beliefs by making use of a systematic and consistent support of teacher educators during institutional meetings, as well as of cooperating teachers during teaching-practice periods. Hence, these teacher education programs are characterized by the integration of practical experiences and theoretical study.

The approach of the pedagogy of realistic teacher education (Korthagen *et al.*, 2001) is exemplary in this context. This approach starts from concrete practical problems and the concerns experienced by student teachers in real contexts. It aims at the promotion of systematic reflection of student teachers on their own and their students' wanting, feeling, thinking, and acting on the role of context, and on the relationships between those aspects. Furthermore, this realistic approach states that

teacher education should respect the three consecutive levels along which professional learning develops (gestalt, schema, and theory). Teacher education should help student teachers become aware of their needs, find useful experiences, and reflect on these experiences. At the gestalt level, actions are typically based on unconsciously triggered needs, values, meanings, feelings, and behavioral inclinations. Gestalts refer to the personal conglomerates of needs, concerns, values, meanings, feelings, and behavioral inclinations united into one inseparable whole, which often unconsciously (or only partly consciously) plays a role in shaping teacher behavior. During the process of professional learning, the student teacher may reflect on his or her gestalts and develop a conscious schema of concepts, characteristics, and principles that are helpful in describing practice. The theory level is reached when a logical order is constructed in and between schemata, resulting in a coherent theory.

The above paragraph not only implies a number of potentially successful strategies to influence teachers' beliefs, but also reconsiders the model presented earlier about how beliefs as part of a complex interplay of variables and processes might be helpful when considering the antecedents and consequences of the adoption of specific beliefs. Considering the importance of the external context, the model suggests that teacher education approaches should:

- Present a richer and more varied cultural context where a multitude of beliefs and related teaching and learning approaches are being adopted. Changes in teachers' beliefs are generally not effected by reading and applying the findings of educational research, but, instead, student teachers appear to obtain most of their ideas from actual practice. Therefore, it seems important to put preservice teachers in a sufficient number of real-life situations and oblige them to reappraise their existing beliefs, attitudes, and knowledge. Select a rich variety of learning situations that provides opportunities to reflect on and reconceptualize beliefs about teaching and learning.
- There is plenty of research evidence that points at the critical role of sharing and discussing instructional practices with peers. Hence, we recommend bringing student teachers in contact with peers and cooperating teachers who have adopted a wide variety of beliefs and related instructional approaches. In the context of educational innovations based on the use of ICT, grass-roots projects and good practices have, for example, proven to be successful teacher education projects. However, mere observation of personal practices and instructional models of peers and cooperating teachers is insufficient. Reflection on these experiences and practices should be fostered in order to result in more sophisticated epistemological beliefs.



- Develop a feedback approach that accepts and stimulates varying, dissimilar, and divergent thinking about and the adoption of teaching and learning approaches; and giving the critical impact of cognitive processes that underlie teachers' beliefs, student teachers should be invited to reconsider their perception of the social context and their attributions related to earlier instructional success or failure.
- [Raths \(2001\)](#) presents a list of concrete and more general approaches that are more or less in line with the former statements about changing (student) teachers' beliefs:
- Confronting student teachers with dissonance. Dissonance theory suggests that if we engage teacher candidates in activities that arouse dissonance, beliefs might change. This implies that we arrange for conflicts between new experiences and past experiences. In this context, it is important to raise conflicting beliefs to the surface, and to foster discussion, comparison, examination, and challenge.
- Apprenticeship experiences. This implies that apprenticeship experiences are critical at the start of a teacher education program. This is in sharp contrast to earlier approaches where internships were rather a part of the later phases in teacher education. Of course, the teacher educator should carefully select settings that are helpful in activating specific beliefs.
- – Values clarification involves asking student teachers to reconsider the beliefs they hold. After examination, reacceptance, considering alternatives, anticipating consequences, and trying their implications, the values are expected to develop.
- Case study. In this instructional strategy, student teachers are invited to study cases of instruction through different lenses: the lens of their own beliefs, belief systems derived from constructivism, or direct instruction or the project method. It is hypothesized that this could invoke changes in the belief systems.
- his/her view or conception of the nature of mathematics,
- his/her model or view of the nature of mathematics teaching, and
- his/her model or view of the process of learning mathematics.

This belief structure can be partly related to the earlier general description of beliefs and points at epistemic issues, beliefs about how peoples learn, and how we teach. [Quillen](#) (unpublished PhD thesis) reviewed the literature about mathematics beliefs of preservice teachers. She studied in detail the way the student teachers adopted relational beliefs or instrumental beliefs. Relational beliefs about teaching and learning mathematics refer to the inclination to provide opportunities for students to explore, investigate, use a variety of problem-solving strategies, and use prior knowledge to solve problems involving concepts that have not been previously taught. Instrumental beliefs about teaching and learning mathematics mirrors direct instruction, teaching by telling, and using memorization of rules, formulas, and procedures to solve problems.

There is abundant literature about attempts to change teacher beliefs related to mathematics. Most attempts share the basic characteristic that challenging these beliefs is done in an explicit way in order to transform the beliefs from nonevidential to evidential ([Green, 1971](#)) and exposing them to the individual preservice teacher in view of a critical analysis and discussion with student peers. Strategies to make beliefs explicit build on involving preservice teachers in doing mathematics and learning through talking mathematics. Making beliefs explicit is also the basis of intervention studies that research the extent to which preservice teachers adopt the constructivist base of the new mathematics curriculum, introduced by the National Council of Teachers of Mathematics (NCTM) in the USA in 2000. Researchers have pointed out that most teachers' past experiences with mathematics are/were rather in conflict with the NCTM model that embraces constructivist pedagogical beliefs. Most teachers reflect beliefs that build on their experiences with traditional, behaviorist methods of mathematics instruction that mainly build on transmission and absorption. This creates a tension between teachers' beliefs and the ambitions of the mathematics curriculum innovation. The study of [Swars et al. \(2006\)](#) is an attempt to influence the related teachers' beliefs. The study clearly shows that it required a long-lasting intervention (2 years) and a wide variety of instructional strategies to successfully change the teachers' beliefs about the teaching of mathematics. Strategies comprised: thorough reading of the basic assumptions of the new curriculum, classroom discussions and learning activities focused on social-constructivist pedagogy, analytical viewing of

### Changing Particular Preservice Teachers' Beliefs: Mathematics and Educational Innovations

To exemplify some of the approaches described earlier to change teacher beliefs, we focus on practices and related research that tried to change teacher beliefs related to mathematics and educational innovations (e.g., ICT).

Based on a literature review in relation to teachers' beliefs on mathematics, [Ernest \(1989\)](#) concludes that three components of beliefs have a significant impact on teachers' instructional practices:

classroom videotapes of classrooms, clinical interviews with children (e.g., about the children's understandings of number and operations), report writing about field experiences using the new type of mathematics pedagogy, and analysis of NCTM-based lessons (check of coherence between practices and principles).

Another extensively studied field where attempts to change and influence teacher beliefs is that of educational innovations in general and the implementation of ICTs in particular. In the literature, there is a general agreement that the adoption of an educational innovation can only be explained when the teachers' beliefs are also taken into account. In the research literature, it is, for example, acknowledged that teachers' beliefs tend to be associated with a particular use of ICT in the classroom (e.g., Ertmer, 2005). Studies explain this by hypothesizing that teachers who use computers do so because their conceptions of ICT use fit into their existing teaching belief system. If teachers perceive that computers address important instructional and learning needs, the perceived value will be higher. There is growing evidence that teachers, for example, adopting constructivist beliefs, are more dynamic computer users. Research that focuses on changing teacher beliefs about ICT builds on a variety of strategies. Typical studies stress on the importance of setting up of long-term initiatives. Furthermore, they also build on critical reflection by student teachers on their own video-taped science lessons culminating in a focus group session. This strategy seems to make preservice teachers able to differentiate between their own beliefs and teaching practices that are not or in line with critical assumptions. Research also indicates that changes in beliefs do not imply that earlier beliefs have to disappear. Whereas in the past, authors centered on bipolar and contrasting dimensions in belief structures, for example, the bipolar distinction between teacher-centered traditionalistic and more progressive or student-centered educational beliefs, researchers have shifted their attention toward a multidimensional approach of the structure in belief systems. In newer approaches to influencing and changing preservice teachers' beliefs, teacher educators rather try to promote that student teachers hold both traditionalistic and progressive educational beliefs. Recent research points out that teachers adopting both strong constructivist beliefs and strong traditional beliefs reflect a higher adoption of and more integrated use of ICT.

## Conclusions

Wrapping up the conceptual, theoretical, and empirical base in relation to teachers' beliefs results in a complex and especially challenging agenda for teacher educators. Though current conceptions about teachers' belief are

rooted in a strong research tradition, it is not yet clear how teacher educators can cater to teachers' beliefs in an adequate way. Promising directions for future research and educational practice adopt a comprehensive view toward the education of student teachers and in-service teachers. They consider teachers as active agents with a central personal responsibility in the development of their professional competences.

See also: A Pedagogy of Teacher Education; Mathematics Teacher Education.

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