



Beyond the dichotomy of teacher- versus student-focused education: A survey study on physics teachers' beliefs about the goals and pedagogy of physics education



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HIGHLIGHTS

- Teachers agreed with the importance of both teacher- and student-regulated learning.
- Beliefs were both learning-/moral-oriented and transmission-/qualification-oriented.
- Teachers had no explicit preference for one of the physics curriculum emphases.
- Transmission-/qualification-oriented beliefs relate to Fundamental Physics-emphasis.
- No clear relations between beliefs about goals of education and types of regulation.

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ABSTRACT

This study explored the content and structure of physics teachers' beliefs on teaching and learning in general in relation to their domain-specific beliefs. A questionnaire was administered to secondary school teachers in physics ($N = 126$) in the Netherlands. The results showed that beliefs about the general and domain-specific goals of physics education formed an interrelated belief system consisting of content-oriented and student-oriented beliefs. Moreover, teachers agreed with the importance of both teacher-regulated and student-regulated learning. Therefore, research on teachers' beliefs should go beyond the often used dichotomy between 'teacher-focused' versus 'student-focused' education by focusing on the rationale behind 'appropriate' teaching behavior.

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1. Introduction

In the daily practice of teaching, beliefs play a significant role in shaping teachers' instructions. Beliefs about teaching and learning in general, as well as their domain-specific beliefs are deemed especially important in this respect (e.g., Richardson, 1996; Stipek, Givvin,

Salmon, & MacGyvers, 2001; Thompson, 1992). For example, decisions about the specific lesson objectives and lesson content, as well as what instructional strategies are most appropriate for providing optimal learning opportunities for students are affected by teachers' beliefs about the goals of education (in general and domain-specific) and their beliefs about learning and the regulation of students' learning processes (cf. Meirink, Meijer, Verloop, & Bergen, 2009). According to Keys and Bryan (2001), teachers hold a complex web of attitudes and beliefs that influence more or less every aspect of teaching, including defining and selecting instructional tasks, knowledge acquisition, choices of assessment, and interpreting course content (cf. Jones & Carter, 2007). For this reason, teacher beliefs are examined with regard to a wide array of topics, such as classroom management (Weinstein, 1998), the nature of knowledge and knowing (Hofer & Pintrich, 1997), and educational reforms (Luttenberg, Van Veen, & Imants, 2011).

Abbreviations: LMO, learning-/moral-oriented; TQO, transmission-/qualification-oriented; SRLCON, student-regulated learning and knowledge construction; REP, knowledge reproduction; TRL, teacher-regulated learning; FP, fundamental physics; PTS, physics, technology and society; KDP, knowledge development in physics.

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According to Pajares (1992), beliefs are organized into a system: “beliefs are prioritized according to their connections or relationship to other beliefs” and “the filtering effect of belief structures ultimately screens, redefines, distorts, or reshapes subsequent thinking and information processing” (p. 325). Thus, in order to understand the specific role of beliefs in shaping teachers’ instructional practices, we need to acquire insight into both content and structure of teachers’ belief systems. Until now, empirical studies of teacher beliefs have mainly focused on one specific type of belief, for example about teaching, learning and instruction in general (e.g., Boulton-Lewis, Smith, McCrindle, Burnett, & Campbell, 2001); epistemological beliefs (e.g., Duell & Schommer-Aikins, 2001); or domain-specific beliefs, such as (in the domain of science education) teachers’ curriculum emphases (e.g., Van Driel, Bulte, & Verloop, 2008).

Some studies focused on belief structures by investigating relationships between different types of beliefs. However, the literature reports on findings that are not always in line with each other. Some studies found consistencies in teachers’ belief systems whereas other studies showed that individual teachers held mixed and divergent beliefs. For example, Tsai (2002) conducted a study on science teachers’ beliefs about teaching, learning, and science in Taiwan ($N = 37$). He found that the majority of teachers held not only ‘traditional’ beliefs about teaching (e.g., “science is best taught by transferring knowledge from teacher to students”) but also ‘traditional’ beliefs about learning (e.g., “learning science is reproducing knowledge from credible sources”). In addition, other teachers held ‘constructivist’ beliefs about both teaching and learning (e.g., “science is best taught by helping students construct knowledge” and “learning science is constructing personal understanding”, respectively). Because many teachers were consistent in their beliefs, Tsai concluded that teachers’ belief systems could be seen as *nested epistemologies*. In another study, Van Driel, Bulte, and Verloop (2007) explored the relationships between Dutch chemistry teachers’ general beliefs about teaching and learning on the one hand and their domain-specific curricular beliefs (i.e., curriculum emphases) on the other. They identified two different belief structures, namely a combination of 1) subject-matter oriented educational beliefs and a ‘fundamental chemistry’ curriculum emphasis (i.e., the opinion that theoretical chemistry concepts should be taught first in order to provide a basis for understanding the natural world and students’ future education) and 2) learner-centred educational beliefs and a ‘chemistry, technology, and society’ curriculum emphasis (i.e., the idea that technological and societal issues should play an explicit role within the chemistry curriculum). A large-scale study by Seung, Park, and Narayan (2011) on elementary pre-service teachers’ beliefs about teaching and learning science in the USA ($N = 106$) showed that many of the participants had both traditional and constructivist views. Furthermore, two teachers in the study of Tsai (2002) held ‘divergent’ beliefs (i.e., ‘process’ beliefs about teaching and ‘constructivist’ beliefs about learning science and vice versa). Finally, Bryan’s (2003) study on one American pre-service elementary teacher’s belief system revealed that this system included ‘foundational’ beliefs (i.e., more central beliefs) and ‘dualistic’ beliefs. The foundational beliefs referred to the value of science and science teaching, the goals of science instruction and the nature of scientific concepts, and control in the science classroom. The dualistic beliefs were about how children learn science, the students’ role in science instruction, and the teacher’s role in science instruction. According to Bryan, these dualistic beliefs formed two sets of compatible and intricately related beliefs.

Until now, however, little is known about the relations between different types of beliefs within a teacher’s belief system. Therefore, the aim of this study is to explore the content and

structure of teachers’ beliefs about teaching and learning in general and their domain-specific beliefs. The present study was conducted in the context of Dutch secondary physics education (students aged 12–18).

2. Theoretical framework

2.1. Research on teacher beliefs

Good education is characterized by high quality learning opportunities for students. In this respect, “the teacher is the most important factor for student learning” (Abell, 2007, p. 1105). Therefore, efforts to improve education are served by efforts to improve teachers’ teaching competences, for instance by providing high quality learning opportunities for teachers in the context of teacher education and professional development programs. In designing these curricula and programs, one of the major challenges is to scaffold teacher learning in a way that it is immediately relevant to practice (Borko, Jacobs, & Koellner, 2010). In this respect, the success of such programs is partly dependent on the extent teachers experience a match or mismatch between the program, their personal routines, and perceptions of the domain or the existing school culture. Thus, in order for teacher education and professional development programs to succeed, teachers’ beliefs about teaching and learning should be taken into account (Verloop, Van Driel, & Meijer, 2001).

Research on teacher beliefs is complicated due to a lack of consensus about appropriate definitions of the construct of ‘beliefs’ as well as different perspectives on the relationship between knowledge and beliefs (Jones & Carter, 2007; Pajares, 1992). In general, scholars agree that teacher beliefs are organized into larger belief systems. In these systems, beliefs are related not only to other beliefs but also to cognitive and affective constructs such as self-efficacy, epistemologies, attitudes, and expectations (Jones & Carter, 2007; Lombaerts, De Backer, Engels, Van Braak, & Athanasou, 2009; Pajares, 1992). Furthermore, some beliefs function as priorities or core beliefs, whereas others are more peripheral (Brownlee, Boulton-Lewis, & Purdie, 2002; Hofer & Pintrich, 1997; Keys, 2003). In the literature teacher beliefs are sometimes distinguished from teacher knowledge (e.g., Den Brok, 2001), but this distinction remains somewhat arbitrary since in the mind of a teacher knowledge and beliefs are intertwined (Keys, 2003; Lombaerts et al., 2009; Meijer & Van Driel, 1999; Pajares, 1992; Verloop et al., 2001).

Another factor that enhances the complexity of research on teacher beliefs is the ‘fact’ that beliefs are often tacit (Pajares, 1992; Thompson, 1992). This means that teacher beliefs must be inferred, for example, by taking into account the congruence of teachers’ belief statements, the intentionality to behave in a predisposed manner, and the actual behavior related to the belief in question (Kagan, 1990; Lombaerts et al., 2009).

2.2. Assumptions about teacher beliefs

In the present study on teachers’ beliefs about teaching and learning physics, we use the reviews of Pajares (1992) and Jones and Carter (2007) together with the work of Richardson (1996) and Calderhead (1996) to formulate some fundamental assumptions about teacher beliefs. These assumptions refer to the *stability*, *organization*, and *functionality* of teacher beliefs:

- Beliefs about teaching and learning (in general) are well established by the time (pre-service) teachers enter teacher education and start their educational careers. As a consequence, teacher beliefs tend to be relatively stable and resistant to change. This is particularly true for teachers with many years of teaching experience. In contrast, pre-service and novice

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