Teaching and Teacher Education 63 (2017) 338–345

Contents lists available at ScienceDirect

Teaching and Teacher Education

journal homepage: www.elsevier.com/locate/tate

Special education pre-service teachers' interest, subject knowledge, and teacher efficacy beliefs in mathematics

Ulrika Ekstam [a, *], Johan Korhonen [a], Karin Linnanmäki [a], Pirjo Aunio [b]

[a] Åbo Akademi University, Faculty of Education and Welfare Studies, PB 311, Vasa 65101, Finland
[b] University of Helsinki, Faculty of Educational Sciences, PB 8, Helsinki 00014, Finland

HIGHLIGHTS

- Examined pre-service teachers' teaching efficacy beliefs in mathematics.
- Investigated how subject knowledge and interest in mathematics predict teacher efficacy beliefs.
- Teacher efficacy beliefs were measured for three sub-domains.
- Interest had a large effect on all sub-domains of teacher efficacy beliefs.
- Subject knowledge was only indirect (via interest) related to teacher efficacy beliefs for instruction.

ARTICLE INFO

Article history:
Received 27 May 2016
Received in revised form
25 October 2016
Accepted 9 January 2017

Keywords:
Teacher efficacy beliefs
Mathematics
Motivational beliefs
Pre-service teachers
Special education

ABSTRACT

Teacher efficacy beliefs is an important characteristic to predict instructional quality and the level of cognitive activation and educational support. Since teacher efficacy beliefs are context and domain specific, this study focuses on how special education pre-service teachers' individual interest and subject knowledge in mathematics predict their efficacy beliefs in teaching mathematics. Data were collected from 57 special education pre-service teachers. The results indicated that the individual interest of pre-service teachers has a strong effect on teacher efficacy beliefs, while subject knowledge has only an indirect effect.

Research has clearly shown that quality teaching is of importance to student achievement (Bolyard & Moyer Packenham, 2008; Brownell, Sindelar, Kiely, & Danielson, 2010; Clotfelter, Ladd, & Vigdor, 2007; Kunter et al., 2015) and the teacher has been identified as the most important school-related factor determining student performance (Hattie, 2009; McCaffrey, Lockwood, Koretz, & Hamilton, 2003; Rowan, Correnti, & Miller, 2002), particularly for students in need of support (Levi, Einav, Raskind, Ziv, & Margalit, 2013). It has also been found that the effect of teachers on student achievement is stronger in mathematics than in reading, for students in low socioeconomic areas (Nye, Konstantopoulos, & Hedges, 2004), and for higher grades (Jepsen, 2005). In addition, it is reported that teacher effects on student learning are cumulative and long-lasting (Heck, 2009).

Traditionally, teacher characteristics have been measured on the basis of subject knowledge, certification and experience; however, in the past decade, research has also acknowledged the importance of teachers' attitudes and teaching beliefs in student performance (Bong & Skaalvik, 2003; Bursal, 2010; Evans, 2011; Gresham, 2008; Kim, Sihn, & Mitchell, 2014; Swars, 2015; Swars, Hart, Smith, Smith, & Tolar, 2007; Swars, Smith, Smith, & Hart, 2009; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998; Woodcock & Reupert, 2016). Hattie (2015) for example, noted in his meta-analysis that collective teacher efficacy has one of the largest effects on student performance. Consequently, it is important to investigate which factors contribute in shaping these beliefs (Austin, 2013; Kleinsasser, 2014). Previous research have shown that teacher's interest (Long & Woolfolk Hoy, 2006) and subject knowledge (Bolyard & Moyer

* Corresponding author.
E-mail addresses: ulrika.ekstam@abo.fi (U. Ekstam), johan.korhonen@abo.fi (J. Korhonen), karin.linnanmaki@abo.fi (K. Linnanmäki), pirjo.aunio@helsinki.fi (P. Aunio).

http://dx.doi.org/10.1016/j.tate.2017.01.009
0742-051X/

Packenham, 2008; Clotfelter et al., 2007; Feng & Sass, 2013) predict teaching efficacy beliefs. However, studies focusing on subject knowledge and efficacy beliefs have not controlled for the possible confounding effects of interest and vice-versa. Thus, knowledge on the mutual relationships among teachers' efficacy beliefs, interest, and subject knowledge can increase our understanding of how pre-service special education teachers can be supported in developing their competencies and beliefs about themselves. Teacher efficacy beliefs are context specific, that is, they have meaning only in specific learning environments (Austin, 2013; Siwatu, 2011; Tschannen-Moran et al., 1998). However, most research on the topic refers to general pre- and in-service teachers and few studies address teacher efficacy beliefs in the area of special education and mathematics. As an addition to the literature, this study aims to investigate if and how pre-service teachers' subject knowledge and interest in mathematics have an impact on teacher efficacy beliefs. Implications for teacher education will also be discussed.

Basic competence in mathematics has become increasingly important in managing day-to-day activities. Therefore, it is necessary to identify and remediate students with low achievements in mathematics (Geary, Hoard, Nugent, & Bailey, 2012). According to the Programme for International Student Assessment (PISA) 2012 results, about one in four students in OECD countries reported less than proficient levels in mathematics (Organisation for Economic Co-operation and Development [OECD], 2016). Poor school performance affects not only the individual but also the society and even the national economy in the long run (European Commission, 2013). Low performance is a consequence and accumulation of several individual factors (e.g., cognitive, neuropsychological, and genetic) and disadvantages (e.g., socioeconomic status, single parent family, and immigrant background). Students with low performance tend to be less motivated and skip more classes than better-performing ones and have low self-confidence in mathematics (OECD, 2016). Measures to reduce the incidence of low-performing students include identifying low performers and designing a tailored strategy to provide early remedial support, create supportive learning environments and inspire and motivate students to make the most of education opportunities (OECD, 2016). To fulfil these actions in the context of special education, teachers and especially special education teachers play an important role.

Teaching mathematics to low-performing students can be challenging and requires both in-depth subject knowledge and a strong pedagogical foundation (van Garderen, Thomas, Stormont, & Lembke, 2013). In many countries, special education teachers are certified for grades K-12; however, special education programmes primarily focus on the content for grades 1–6, and thus, teachers must deal with a wide range of topics on a level they are not necessarily familiar with. This is particularly true in the case of mathematics (Faulkner & Cain, 2013; Rosas & Campbell, 2010). Special education teachers are expected to have an interest in and knowledge on how to teach mathematical concepts and rules and discuss and model mathematical reasoning, which is especially important for low-performing students (Boyd & Bargerhuff, 2010; Mevarech & Kramarski, 2014; Neild, Farley Ripple, & Byrnes, 2009). In practice, it will depend on special education teachers' own math skills and interest how well they can teach mathematics for higher grades. Thus, this study aims to investigate how special education pre-service teachers' efficacy beliefs in teaching mathematics are affected by their interest and subject knowledge in mathematics.

1. Conceptual and theoretical framework

1.1. Self-efficacy

The origin of self-efficacy lies in social cognitive theory and it refers to a person's subjective perception of his or her capability to achieve a preferred outcome in a specific context (Bandura, 1977). Self-efficacy beliefs are formed through experiences and account for what individuals believe they can do with their existing skills rather than the actual skill itself (Bandura, 1977; Bong & Skaalvik, 2003). Bandura (1994) argues that people's beliefs in their efficacy are developed through four main sources of influence: mastery experience, physiological factors, vicarious experiences and social persuasion. The most important factor contributing to an increase in self-efficacy is the experience of mastery: success raises self-efficacy, while failure lowers it. Vicarious experience is seeing people similar to oneself successfully manage tasks, while social persuasion generally manifests as direct encouragement or discouragement from another person. The effect of physiological factors is more related to one's belief in implications for physiological responses (e.g., shakes, pains, fatigue, and fear) in a specific situation rather than the physiological response itself (Bandura, 1994). Self-efficacy beliefs are also reported to influence thought processes and emotions that affect an individual's motivation and are noted to be skill-, task-, and domain-specific (Bandura, 1997). People with high beliefs in their capabilities approach difficult tasks as challenges to be mastered rather than threats to be avoided; such an efficacious approach fosters deep interest and involvement in activities (Bandura, 1994).

Teacher efficacy beliefs (i.e., teacher self-efficacy) can be defined as a teacher's beliefs and perceptions about their ability to teach students with varying needs and qualifications (Tschannen-Moran et al., 1998) and bring about desired student engagement and learning outcomes (Bandura, 1977, 1997; Skaalvik & Skaalvik, 2007). It is also connected to a teacher's capability to organize and execute teaching tasks in specific contexts (Skaalvik & Skaalvik, 2007). Tschannen-Moran et al. (1998) introduced a conceptual foundation where teacher efficacy beliefs are based on a two-dimensional model, 'teaching task and its context' and 'self-perception of teaching competence' (p.228). Later Skaalvik and Skaalvik (2007) argue that teacher efficacy beliefs are even more complex and measurements have to be adapted to today's standards, with a focus on inclusiveness and the student-centred context we have in schools today. Teacher efficacy beliefs are also noted to vary between contexts as well as over time (Tschannen-Moran et al., 1998), but there are arguments that it is important for pre-service teachers and novice teachers to establish high teacher efficacy beliefs at an early stage because once established, teacher efficacy beliefs may be hard to change (Bandura, 1997).

Teacher efficacy beliefs are related to teaching strategies, instruction, and motivation (Holzberger, Philipp, & Kunter, 2013; Midgley, Feldlaufer, & Eccles, 1989; Thoonen, Sleegers, Peetsma, & Oort, 2011) as well as student achievement (Austin, 2013). Holzberger et al. (2013) found a strong positive relationship between teachers' efficacy beliefs and instructional quality as well as educational learning support. Teachers with high efficacy beliefs also tend to provide more student-centred instruction; invest more effort into implementing new teaching methods, strategies and personalised learning support (Holzberger et al., 2013); and demonstrate greater flexibility in classroom engagement and lesson design (Temiz & Topeu, 2013). All these factors contribute to student achievement, and are especially important for students in need of support. As a consequence, high teacher efficacy is of great importance for students in need of support (Woodcock & Reupert, 2016). In addition, teacher efficacy beliefs are positively correlated with higher task- and situation-specific mastery experiences (Malmberg, Hagger, & Webster, 2014).

Mathematics teaching efficacy is a teacher's belief in his or her ability to teach mathematics effectively (Enochs, Smith, & Huinker, 2000). Mathematics teaching efficacy is a significant predictor of