The research-practice gap in teacher education: Beliefs, evidence and practice of university-based teacher educators

Dissertation zur Erwerb des Doctor of Philosophy (Ph.D)
am Munich Center of the Learning Sciences
der Ludwig-Maximilians-Universität
München

Vorgelegt von
Despoina Georgiou

17.12.2019

1st Supervisor / Erstgutachter: Prof. Dr. Tina Seidel

2nd Supervisor / Zweitgutachter: Prof. Dr. Frank Fischer

Tag der mündlichen Prüfung: 04.02.2020

Acknowledgements

The work underlying this thesis and the completion of this thesis would not have been possible without the support of a number of people. Below I would like to express my immense gratitude and appreciation to these people.

First, I would like to thank my supervisors. I want to thank Professor Tina Seidel for her guidance, wisdom and continuous inspiration during my research journey. She acted as a role model and a great supporter of my work and she helped me develop as a young researcher. I want to thank Professor Frank Fischer for always asking tricky questions and challenging my thoughts and research status. I want to also thank both of them for their trust and confidence in my work. Additionally, I want to thank Professor Jan Vermunt for his advices and guidance and for sharing his knowledge with me during my visit in Eindhoven. I would also like to thank Dr. Sog Yee Mok for her immense support, generosity and kindness.

Second, I would like to thank my parents, Konstantinos and Katerina, and my siblings Anna and Stavros, for always standing by me and supporting all my efforts and dreams. Without them, I would not be able to be where I am now. Thank you!

Third, I want to thank my REASON colleagues for creating a great working environment, for sharing their ideas, knowledge and sometimes frustrations and for always providing their help and support. In particular, I would like to thank my friend Olga for her continuous support and inspiration during the long journey of our study years. I would like to thank Anastasia for all the psychological and emotional support and Arianne for advancing my knowledge in statistics. Moreover, I would like to thank my TUM colleagues/friends. In particular Adriana, Annika, Ricardo and Meg for being always so kind and supportive.

At last, I want to thank the Elite Network of Bavaria for the opportunities they provided and the international knowledge exchange, which will not be possible without its contribution.

Table of Contents

Abstract

Evidence-based teaching is an important aspect of teacher educators' professionalization, which refers to teaching practices based on robust evidence retrieved from quality research studies. Research on evidence-based practices in medicine has shown that knowledge, beliefs and attitudes play a pivotal role in the acceleration of implementation of Evidence-based practices. In education, this topic has received little attention within the literature despite the high demand by European educational reforms for the use of research evidence into teaching practice. Because teacher educators play a crucial role in the classroom ecology of teacher education, a consistent use of Evidence-based teaching practices in this field is especially important and may accelerate a more rapid shift toward evidence-based teaching practices at large.

The present thesis contributes to research and literature with two studies. The first study focuses on the development of a valid and reliable instrument to measure teacher educators' practical knowledge, self-efficacy beliefs and attitudes toward evidence-based teaching strategies and provides empirical evidence, which support the heterogeneity of the group of teacher educators. The second study sheds light on the relationship between teacher educators' research experience, practical knowledge, self-efficacy beliefs and the frequency of evidence-based teaching implementation and describes the challenges teacher educators face concerning evidence-based teaching.

Given the lack of studies in teacher education and based on existing instruments from the medical field the first study focused on the development of the evidence-based teaching scale (EBTS). Teacher educators (N = 243) from Germany, Switzerland, Austria and the United Kingdom completed the EBTS scale. An exploratory factor analysis (EFA) and a Parallel Analysis (PA) were conducted to reduce the number of items on the scale and to test a three-factor structure for the newly developed instrument. Cronbach's alpha was > .80 for

each sub-scale. The results of the first study provide evidence to support the psychometric structure of the EBTS in teacher education and, in particular, in a heterogeneous sample of teacher educators. Significant differences were also identified between highly research experienced teacher educators and the less research-involved teacher educators. The findings emphasize the need for further professional development tailored to diverse teacher educator groups.

For the second study of this thesis, a set of mediation analysis were run to identify the role of self-efficacy beliefs and practical knowledge in the interplay among teacher educators research experience and frequency of research evidence implementation. Self-efficacy seemed to be a stronger predictor of how frequently one uses evidence-based practices in comparison to practical knowledge. Moreover, the study identified potential challenges, reported from teacher educators, which might undermine evidence implementation in university teaching. Implications about the role of self-efficacy beliefs in teacher educators' professional learning and development along with future steps that are necessary to increase the implementation of Evidence-based teaching practices in teacher education will be discussed as part of study 2 and in the general introduction of this thesis.

1. General Introduction

In the past two decades, quality of teaching in universities has received much criticism (Groccia & Buskist, 2011). This is because, most university instructors, including teacher educators, base their teaching practices on tradition, personal experience, or ideology (Beder & Medina, 2001; Slavin, 2008). Surprisingly, the shift observed in universities from a focus on teaching to increased emphasis on research and publication, has not lead to significant improvements in teaching quality at the university level. On the contrary, it has increased public dissatisfaction and students' frustration caused by teachers' lack of interest in teaching (Bok, 2005). Thus, a considerable gap separates the world of research from the world of practice (Beder & Medina, 2001).

To bridge this gap in the field of education, there is a great need to enhance teaching quality by strengthening the professional profile of teacher educators (European Commission, 2012) and embracing evidence as a crucial component of their teaching practice. As such, being able to incorporate evidence into teaching practice (i.e. evidence-based teaching) is a key requirement of teacher educators' professional learning and development (Livingston, McCall, & Morgado, 2009). Evidence-based teaching (EBT) refers to teaching practices based on robust evidence retrieved from high-quality research studies. Despite its importance, to date, evidence-based teaching has been primarily researched within the field of medicine, yet is significantly lacking in teacher education (e.g. Davies, 1999; Slavin, 2008).

Prior studies in medicine and medical education (e.g. Parrish and Rubin, 2011; Melnyk, Fineout-Overholt, & Mays, 2008) have identified several barriers to the implementation of evidence-based practices across medicine as well as crucial aspects of the use of evidence-based practice. For instance, several important aspects of its use include

practitioners' knowledge, beliefs, and attitudes toward the implementation of research evidence into practice.

Research in teacher education also emphasizes that beliefs, knowledge and attitudes are part of a multi-dimensional construct of teachers' professional competence because they are stored as schemas in teachers minds (Ernest, 1989) and drive their actions (Richardson, 1996), thereby playing a crucial role in teaching and learning (Baumert & Kunter, 2006). Korthagen and Vasalos (2005) and Al-Hinai (2007) also emphasized the pivotal role that these variables play in the professional growth of teacher educators, asserting that the work of teacher educators requires specific knowledge, skills and attitudes.

This thesis contributes to the above-mentioned literature and research by initiating a specialized knowledge base regarding teacher educators' practical knowledge, self-efficacy beliefs and attitudes toward evidence-based teaching practices. It presents two studies that deal with the use of evidence-based practice in teacher education. Study 1 is a validation study of the newly developed evidence-based teaching scale (EBTS) which also investigates the heterogeneous nature of the group of teacher educators. Study 2 explores the interplay between teacher educators' research exposure, practical knowledge, self-efficacy beliefs and frequency of evidence implementation in their teaching practices.

Before the presentation of the two studies, this introduction will provide foundational background information. It begins by describing the theoretical conceptualization and history of evidence-based practice rooted in medicine. Next, the link between evidence-based medicine and evidence-based education will be outlined through the depiction of the similarities between the two disciplines. The theoretical conceptualizations continue with the presentation and discussion of three models relevant to evidence-based teaching. The next section will present important conceptual clarifications regarding teacher educators' practical knowledge, self-efficacy beliefs and attitudes. This section will also introduce the term

personal domain variables, which is an overarching term referring to teachers' knowledge, beliefs and attitudes based on the interconnected model by Clarke and Hollingsworth (2002). The following section continues with the presentation of teacher educators as a professional group. It elaborates on the theoretical considerations concerning teacher educators as professional stakeholders of evidence-based teaching. This section is completed by a brief presentation of teacher educators' role in academia, with reference to the heterogeneous nature of this professional group. The introduction closes with a summary of the research aims and questions, and a brief overview of the two studies of this thesis.

Following the introduction, the two studies of this thesis are presented in the central part of this work. Thereafter, the thesis concludes with a general discussion, which summarizes the results of the two studies, discusses implications and limitations and provides suggestions for further research in the future.

To begin the theoretical foundation, the following section introduces important theoretical conceptualizations about the three variables under investigation, i.e. practical knowledge, self-efficacy beliefs and attitudes. These conceptualizations are specific to teacher educators and to evidence-based teaching.

1.1 Theoretical conceptualization of evidence-based practice

Evidence-based practice is a reform, which has its roots in medicine and medical education. In order to get a better understanding of the reform, the following section will illustrate important information about the history of evidence-based practice and the different understandings of the reform across the literature. The section will also present definitions and terminologies related to evidence-based practice in medicine.

Accordingly, this section will continue with the transition from medicine to education and the relation of evidence-based practice and evidence-based teaching. There, I will present

and discuss the research-gap and the need for evidence-based teaching in teacher education. Next, I will unravel the ambiguity surrounding the term evidence-based teaching, and I will outline the definition used in this thesis. In closing, the holistic approach about what evidence-based teaching entails will be presented and described with the explanation of three relevant models of EBT.

1.1.1 The roots of evidence-based practice

Evidence-based practice (EBP) is the core component of the 20th century scientific revolution that transformed many fields such as agriculture, technology, medicine and economics (Jones, 2009). EBP is a new emerging paradigm for teacher education as well. The concept of EBP has its roots in medicine, a field that was confronted some years ago with the same challenges that education is facing today (Slavin, 2002). There are two main understandings of EBP in medicine. One follows the literature in medicine, where evidence-based practice is seen as a way to support practitioners' decision-making process (Haynes, Devereaux, & Guyatt, 2002; Sackett et al., 1996; Straus, Glasziou, Richardson, & Haynes, 2019). A second refers to effective or empirically tested interventions, such as motivational interviewing or cognitive behavioural theory, which are empirically supported by related research (Thyer & Myers, 2011).

For this thesis, evidence-based practice is associated with the first understanding from medicine, since evidence-based practice in education is largely based on this approach. For practitioners to arrive at informed decisions, evidence-based medicine discusses the integration of relevant research evidence into practitioners' expertise, in combination with clients' values and preferences. Guyatt, Rennie, Meade and Cook (1992) published the first article discussing the importance of evidence-based medicine, suggesting that this new approach can be also implemented in teaching medicine. Later, as one of the pioneers in evidence-based medicine literature, Sackett (1997) defined EBP as the 'conscientious, explicit

and judicious use of current best evidence in making decisions about the care of individual patients' (p.3).

This definition suggests that the practice of evidence-based medicine is rather holistic, emphasizing the integration of medical professionals' clinical expertise with a critical appraisal of the best available research evidence stemming from systematic research (Eddy, 2005). Clinical expertise is defined as the amalgam of medical professionals' judgment and proficiency, which they acquire through their everyday clinical experience and practice (Sackett, 1997). While best available research evidence refers to relevant patient-centred clinical research (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996).

By definition EBP supports evidence-based decision making of clinicians by promoting the marriage of expertise, critical appraisal skills, and research evidence (Sackett, 1997). Good clinicians use the best available evidence in combination with their clinical expertise because neither expertise nor evidence are enough on their own. Without clinical expertise, clinicians are not able to make evidence-based judgements because evidence can be only used as a recipe, which might not be applicable for individual patients (Hemsley-Brown & Sharp, 2003). Evidence-based practice is a lifelong learning process, which requires continuous professional development and improvement of clinicians' knowledge and skills in order to meet their patients' needs.

1.1.2 From evidence-based medicine to evidence-based teaching

The relationship between educational research and teaching practice has been consistently troublesome (Jones, 2009). The long-standing gap between research and practice refers to the mismatch between what is known to be effective and what is actually used in teaching practice (Cook, Smith, & Tankersley, 2011). Practitioners can be rather cynical with regard to the applicability of research to practice, sometimes referring to research findings as

irrelevant, unhelpful for practice, or somehow invasive to their own professional judgment (Kvernbekk, 2019). “Teachers are not machines that can use flawless precision for whatever techniques research has certified” (Zahorik, 1984, p. 34). This rather long-standing sentiment summarizes the criticism that research has faced for the past decades, in many cases from the side of both practitioners and researchers.

However, a shift in support of a research-informed teaching culture has become a matter of interest in and outside Europe (e.g., Biesta, 2007; Slavin, 2002). This shift is increasingly relevant now that the field of education is confronted with the demands of a knowledge society, which requires highly educated teachers who acquire research related knowledge and skills (e.g., Darling-Hammond & Bransford, 2005; European Ministers Responsible for Higher Education, 2009; Organization for Economic Cooperation and Development [OECD]), 2005).

Therefore, debates about the standards of teacher professionalism are focusing on the understanding of teaching as a research or evidence-based profession (Bauer & Prenzel, 2012; Niemi, 2008). In many countries, educational policy makers (e.g. European Comission, 2007; Clearinghouse Unterricht, 2019; What Works Clearinghouse, 2014) discuss the importance of the implementation of research findings into teaching practice, referring to its benefits for teachers’ own professional development on the one hand, and on the other hand to the improvement of students’ learning (e.g., Hattie, 2011; Petty, 2009).

Evidence-based practice in medicine emerged when medicine was in a position similar to that of education today (Davies, 1999); in need of establishing research-based practice to foster practitioners’ professionalization, effectiveness of treatments, and improve patient lives (Slavin, 2002). A characteristic example that summarized the need for evidence-based medicine was the efforts that researchers made to convince tradition-bound physicians to use sterile procedures during operations. A procedure that seems to be common practice

nowadays took 30 years to be established in the field of medicine (e.g., Osborne, Latham, Wen, Cavaignac, Fanning, Foran, & Meunier, 2007; Slavin, 2002). Professional practice does not change overnight, it requires persistence and efforts from both researchers and practitioners to understand the need for change, to embrace change and to implement it into everyday practice.

Like in medicine, evidence-based teaching does not come without controversy. In the literature, many terms describe the notion of evidence-based practice. Hargreaves (1996) uses the term *research-based education*; Hammersley (1997) refers to *literature-based education*, Greenhalgh and Worrall (1997) talk about *context-sensitive practice* while Griffiths (2004) introduces the term *research-oriented or research-informed teaching*. Davies (1999) concludes that all terms can be used interchangeably because the importance lies on the actual implementation of research into practice and the efforts made to bridge the research-practice gap, whether it is called research-informed or research-based education is immaterial. In this study, we use the term *evidence-based teaching*, which we define as a ”set of principles and practices which form the basis upon which practitioners make professional judgments and deploy their expertise” (Davies, 1999, p. 118).

Evidence-based teaching is not a cookbook for practice, a quick fix, or a recipe that provides ready-made solutions to the demands of educators and modern education (Seidel, Mok, Hetmanek, & Knogler, 2017). On the contrary, evidence-based teaching is a holistic approach of teaching which integrates the best available research evidence with educators’ expertise. Based on the definition this research is based upon, evidence-based teaching uses a set of principles and practices, which may change practitioners views about education, and provide a knowledge base that goes hand in hand with their teaching experience.

1.1.3 What counts as evidence?

Before presenting and discussing three influencing models relevant to evidence-based teaching practices in teacher education, it is crucial to present and thoroughly discuss what counts as evidence in education. Since this is one of the most controversial topics in evidence-based literature (Stark, 2017), the authors' main aim is to provide the reader with important clarifications, concluding with the approach that will be adapted within this thesis.

In education, there is an extensive discussion as to what counts as evidence (e.g., Andrews, Brewin, Philpott, & Stewart, 2007; Biesta, 2010; Davies, 1999). Before answering that question, it is necessary to first define the nature of evidence. The Oxford dictionary (Stevenson, 2010) defines evidence as 'the available body of facts or information indicating whether a belief or proposition is true or invalid'. Evidence, therefore, has to do with the question of truth but the question of truth does not directly apply to evidence (Biesta, 2010).

Evidence is considered to be knowledge derived from a range of sources. Knowledge is defined as a 'justified true belief', which means that for someone to know something, it must be true, or to be more precise, believed to be true with the prerequisite that the belief is justified. Thus, evidence is the justification of such beliefs, slightly differing from 'knowledge' per se because it can encompass a broader range (Andrews, 2007).

Evidence in education is not only represented by data that stem from randomised controlled trials or experimental research like in medicine. Research evidence is socially and historically constructed, thus it is not static but dynamic (e.g., Higgs & Titchen, 1995). Because evidence acts as the justification of a certain belief, it can take various forms and it depends on the questions that researchers are asking. For instance, as Davies (1999) states, if one is asking the question 'does educational method x have a better outcome than y in terms of achieving outcome z', then evidence stems from experimental or quasi-experimental research.

If a researcher or a practitioner is interested in examining the field on a particular topic of enquiry, systematic reviews can be seen as evidence (Andrews, 2007). In contrast with Andrews (2007), who claims that anything can be used as evidence (e.g., a photograph, an idea, or a sensation), in this study we recognize that evidence can take different forms but it always has to be scientifically valid and replicable (Slavin, 2008). This is why educational theories which have been replicated and validated can also count as evidence.

1.2 Research evidence in teaching practice: Three models

In order to get a better understanding of evidence-based teaching and its role in practice, we need to visualize it within a model among other relevant pieces of information. Thus, this section presents and discusses three models relevant to evidence-based teaching.

First, it introduces the most recent model from Haynes, Devereaux, and Guyatt (2002), a conceptual model that shaped our understanding of evidence-based practice and inspired evidence utilization in education. Next, it explains the model from Davies (1999), which we adopt in the present work as our starting point for our research. This model is the precursor to the evidence-based teaching approach and the formation of an evidence-based culture in education. Finally, it provides an overview of Toulmin's model (2003), a model rather loosely connected to EBT, which has been widely associated with the teaching of reasoning and argumentation skills in the Learning Sciences community (Fischer, Hmelo-Silver, Goldman, & Reimann, 2018).

1.2.1 The Haynes model

The Haynes model for evidence-based clinical decisions (Haynes, Devereaux, & Guyatt, 2002) is more prescriptive rather than descriptive. This means, that the model does not work as a decision-making schema for practitioners, but rather as a guide for thinking about how decisions should be made. The model is defined as 'the integration of best research

evidence with clinical expertise and patient values' (Sackett, 1997). This model refers to clinicians' decision-making processes, wherein patients' preferences are first considered as the basis for their decisions.

In order for practitioners, (i.e. clinicians) to make evidence-based decisions three different components must be considered (see figure 1). These are patient preferences and actions, research evidence, and clinical state and circumstances. Clinical expertise is replaced in this model by clinical state and circumstances as a key component of clinical decision-making. Clinical state and circumstances refer to the state of patients when they seek medical attention. For instance, a patient with a symptom that is not yet diagnosed cannot be directly moved from a diagnostic decision to a therapeutic decision. Thus, the model urges for the consideration of individual clinical circumstances as an important aspect to always be included in the decision making process by practitioners.

Patients' preferences and actions refer to the differences between clinicians' advice and patients' actions. Unfortunately, , clinicians' estimates for their patients' devotion to 'treatments' have little accuracy better than chance (Stephenson, Rowe, Haynes, Macharia, & Leon, 1993). In education, teachers' estimates for their students' treatment fidelity likely follow in a similar way.

Research evidence is an important component of the model. It refers to applied clinical research such as randomized controlled trials with important implications for patients. However, in evidence-based medicine, researchers provide detailed guides for finding the most suitable evidence to support practitioners in decision-making (Guyatt, Rennie, Meade & Cook, 2015). The 'personalization' of the evidence is considered of great significance for the development of evidence-based medicine because it assists the practitioners who make evidence-based decisions tailored to the needs of their individual patients.

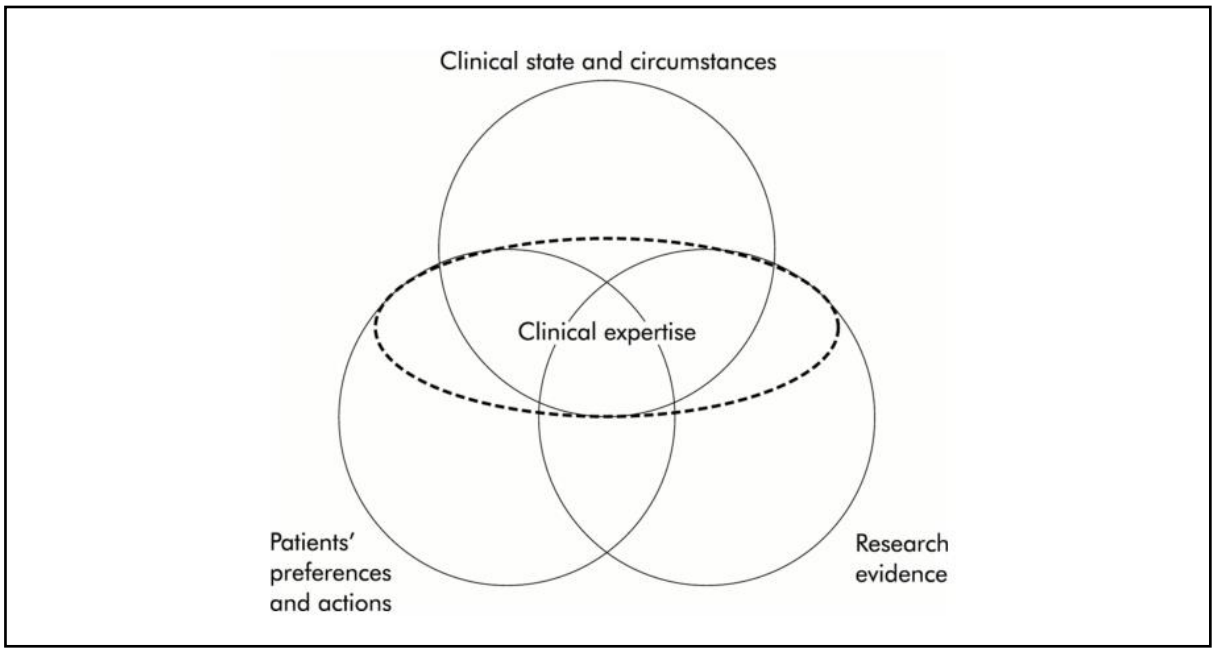

Figure 1. An updated model for evidence-based clinical decisions (Haynes, Devereaux, et al. 2002)

The last component of this model is clinical expertise, which encompasses all aforementioned components. By clinical expertise, the authors mean the ability of practitioners, not only to search and utilise research evidence but also to acquire the skills needed both for the interpretation and application of evidence into clinical practice.

All four components are important to the utilisation of research evidence into clinical practice. However, this model is conceptual rather than practical and it aims to give answers to open issues like the role of expertise, and the needs of patients that have been largely discussed in the EBP literature. This model can be considered as the starting point to the transfer of EBP from medicine to education. Within this study, this model is treated accordingly as the basis upon which Davies (1999) model will be built, wherein issues relevant to education, teaching and teachers' current utilisation of EBT are addressed.

1.2.2 Davies model

Evidence-based education has a twofold role. The first is to employ existing research evidence from educational research and literature. The second is to build sound, new evidence where a lack is observed or where the evidence is weak in nature. Davies (1999) initiates the discussion about what practitioners should be able to do, in order to employ and build new evidence. He proposes the following five steps that practitioners must employ towards already-existing research evidence:

- Be able to pose answerable questions;
- Know where and how to find evidence in a systematic way;
- Retrieve evidence, read evidence, be able to critically appraise and analyse evidence;
- Organize and grade the power of evidence;
- Determine its relevance to their educational needs and environments.

Practitioners should also be able to establish new evidence, thus they need to be able to plan, carry out, and publish scientific evidence of high quality. Davies' also suggests that answers to practitioners' questions can be drawn directly from evidence. Strong emphasis should be placed on the importance of the evidence's quality and relevance for practice, which is sometimes lacking in already-existing literature in teacher education (e.g., Hargreaves, 1996, 1997). This view of evidence-based education, where practitioners are also evidence producers, is based on the problem-solving and self-directed model of adult education (Knowles, 1973). This model has its roots from the 'constructivist' school of learning introduced by Piaget (Ackermann, 2001) and Vygotsky (Jaramillo, 1996). The Evidence-Based Health Care program at the University of Oxford is a great example of the application of the aforementioned learning approach. There, health professionals have the opportunity to develop their professional skills, solve clinical problems, and enhance their practice with research evidence.

The parallelism of evidence-based education and evidence-based medicine has been widely criticized, thus Davies (1999) devotes a whole section in his article discussing the objections to evidence-based education. Briefly, medicine and education have more similarities than differences. Both fields are confronted with complex and context specific problems, measurement issues and major concerns about generalisability. For instance, the difficulty in understanding how patients behave in hospitals and in their own environments has been well documented and runs in parallel with students' performance in classrooms and in the 'real world'.

Hargreaves (1996) and Hillage, Anderson and Pearson (1998) refer to the gap between educational research and teaching practice, which is also present in medicine. This gap in teacher education is related to the fact that there is not a culture of evidence where teachers use research to inform their teaching practice. Teachers are often not involved in research and most times are not included when determining a research agenda. In medicine, practitioners used to face the same difficulties. However, with the introduction of evidence-based practice, they can now more easily identify clinical problems and find solutions in the existing evidence in literature.

An important point that Davies (1999) stresses is that evidence-based practice does not replace practitioners' judgment or experience. On the contrary, it unites these two elements of knowledge to provide a sound basis for practice. Evidence-based teaching enhances the quality of education because it supports practitioners' professional development by fostering their understanding and skills in theoretical and methodological principals.

1.2.3 Toulmin's model

Toulmin's model (2003) is an argumentation model, which discusses the pattern of justification of beliefs or defence claims against challenges. This model is not about directly

putting evidence into practice, but rather more indirectly. It is therefore flexible enough to accommodate different approaches such as evidence-based practice. This model follows a six-factor structure, which every practitioner is expected to follow.

First, it discusses the importance of claims. In detail, it argues that it is important to make the distinction between the claim that the practitioner wishes to establish and the facts that work as the foundation of the claim, which are called grounds or data (Toulmin, 2003).

Then, the question of how one gets from data to conclusion follows. Justification is provided by suggestions for inferring conclusions from data. These suggestions are called warrants. Warrants apply different degrees of strength on claims. This is why, for example, we use qualifiers such as 'necessarily', 'probably' and so forth to express this, as well as 'unless', 'or else' within rebuttals to express this for circumstances that undermine the authority of the warrant.

However, the questions is how trustworthy are warrants, or are warrants trustworthy at all? Toulmin (2003) says, "Standing behind our warrants, […] there will normally be other assurances, without which the warrants themselves would possess neither authority nor currency" (p. 96). This is why backing up one's claims is important. Research evidence can be placed in this model as a backup of one's claims, but also as the data or grounds as aforementioned. Thus, in this model we understand evidence as data that are related to practice. However, the role of these data or the role of research evidence is indirect. Practitioners do not extract conclusions about what to do directly from evidence, but they use evidence to back up and justify their conclusions about what to do. As such, research evidence becomes an explicit part of the chain of practitioners reasoning.

Toulmin's model is an argumentation model, which delineates the power of argumentation theory and answers practical questions, such as 'what should I do if my students phase *x* problem?'. Even though this model has a place for research evidence, as

presented above, its usefulness lies on the analyzation of simple arguments (Ball, 1994), and seems somehow problematic for the description of real-life argumentative texts (Freeman, 2011).

This model has been criticized for various reasons, but because this thesis is concerned with the utilization of evidence into teaching practice, only the criticisms relevant to the context are addressed here. These criticisms involve the difficulty in the practical differentiation between data and warrants, and warrants and backings. The problem lies in the fact that information used as data on some arguments can have the function of a warrant in other arguments, and unsupported claims can sometimes be used as data within practitioners' argumentation patterns (Simosi, 2003). Thus, while the adaptability of the model may be beneficial to the evidence-based practice approach, the difficulties in distinguishing between data, warrants and backings (i.e., evidence), make this model suboptimal for application within our study.

1.3 Teacher educators: the teachers of teachers

The following section will discuss the literature on teacher educators and their role in pre-service teachers learning and development. Alongside, it will also discuss the structure of the German-speaking teacher education field, how teacher educators are hired, how we define the rather broad term teacher educators and what is their role in pre-service teachers learning and development.

1.3.1 Teacher educators as a professional stakeholder group of EBT

Teacher educators play an important role in the total ecology of teacher education because they support pre-service teachers learning and act as role models through their own teaching (Lunenberg, Korthagen & Swennen, 2007). Because teacher educators promote the professional learning of pre-service teachers, their own professional learning is of great

importance (Mc Gee & Lawrence, 2009). This is why there is a growing awareness regarding the need to enhance teacher educator competences and professional learning about the latest developments in research and teaching (Swennen & van der Klink, 2009).

However, the role of teacher educators has been neglected in research and educational literature for several years, even though researchers agree that quality teacher preparation depends on quality teacher educators (Kosnik, Menna, Dharamshi, Miyata & Beck, 2013). Teacher educators are part of a unique, complex, and multifaceted profession because they not only need to restructure their existing knowledge in order to adapt to changes, but also must be able to acquire and combine it with new empirical research evidence (Bauer & Prenzel, 2012). Accordingly, they must also facilitate and communicate this knowledge to the pre-service teachers they instruct (Vanderlinde, Tuytens, Wever, Bram, & Aelterman, 2016). Using evidence more systematically in the legitimation of teaching requires paradigmatic shifts in teacher education. The shift should start from core structures of teacher education, namely, from higher institutions and specifically from teacher educators (Russell & Korthagen, 2013; Korthagen, Loughran, & Russell, 2006). Educational policy makers such as the European Commission emphasize the importance of such a shift to increase the quality of teacher education and to reach higher standards for all educators (Bauer & Prenzel, 2012; European Commission, 2007).

Recognizing the demanding role for teacher educators in teacher training, some countries (e.g., England, Israel, the Netherlands, Switzerland, and the USA, among others) have started to develop standards for teacher educators so as to represent the ideal collection of competencies that teacher educators must possess to be effective in their profession (Smith, 2003). Based on these standards and on general European frameworks (European Commission, 2013), teacher educators should be able to embrace and use research evidence in their teaching practices (Bauer, Prenzel & Renkl, 2015; Wiseman, 2010).

1.3.2 Teacher educators' roles in academia

Teacher educators are a heterogeneous group with multiple roles. They can be academic staff in higher education with various responsibilities including teaching and research. They can also be teaching practice supervisors, school mentors, or PhD candidates (European Commission, 2013; Dengerink, Lunenberg, & Kools, 2015). In Germany for instance, one of the largest European countries, teacher educators are mainly recruited from two groups: school teachers or researchers. Further prerequisites for becoming a teacher educator differ slightly between countries and within the different German states; however, a completed university degree is usually required (Bayerisches Gesetz- und Verordnungsblatt, [GVBI], S. 230, 2006)**.**

Teacher educators are often classified into different groups based on pay-scale and the type of contract within the employing higher education institution (in initial teacher education, often a university) (Amtsblatt des Bayerischen Staatsministeriums für Bildung und Kultus, Wissenschaft und Kunst, [KWMBI.], 2009). There is a distinct difference between university lecturers and PhD candidates or academic staff. University lecturers either work as freelancers or as civil servants at German universities, and in most cases, have a large amount of teaching and no research obligations.

In comparison, PhD candidates and academic staff represent a group of lecturers who often have limited working contracts and, in most cases, have both teaching and research obligations. School mentors, a third example of the heterogeneous group of teacher educators, are school teachers who mentor pre-service teachers during their internships and practical experiences and, therefore, function as a link between university and school practice. This group of teacher educators might be most challenged with regard to keeping up with the growing research literature in educational science. This assumption stems from previous research that supports the notion that the more research experience of teacher educators, the

higher their scores on their research dispositions (Cochran-Smith, 2005; Tack & Vanderlinde, 2016).

Dengerink et al. (2015) defined teacher educators as ”Higher Education academic staff with a responsibility for teacher education, research or subject studies and didactics, as well as teaching practice supervisors, lecturers, school mentors, induction tutors and supporters of induction networks, and also those in charge of teachers’ continuous professional development” (p. 79). This study follows the aforementioned definition as a basis and focuses particularly on teacher educators who are involved in teaching pre-service teachers in initial university-based teacher education. In detail, its focus lies in university teacher educators ranging from school mentors to professors, because this range reflects a common distribution in university-based teacher education institutions (Zeichner, 2005). The commonality among members of this group is that they are responsible for pre-service teachers’ initial learning and development (Zeichner, 2010).

Teacher educators’ role in teacher education is multifaceted, since it serves different purposes (Korthagen, Loughran, & Lunenberg, 2005; Lunenberg, Korthagen, & Swennen, 2007). For instance, university professors are responsible for communicating basic theories and research findings and providing practical examples of the implementation of these findings in teaching practice. Furthermore, PhD candidates and university lecturers are often the ones who deepen pre-service teachers’ learning by providing courses with a strong focus on the connection between research and teaching practice and by modeling different approaches to teaching through their own practices (Korthagen et al., 2005). School mentors support pre-service teachers directly in their acquisition of teaching skills during their internships at schools. This includes a cycle of planning, teaching, and reflecting (e.g., see Content-focused coaching: Becker, Waldis & Staub, 2019; Staub, 2001).

In this interplay of different roles that teacher educators fill, they must engage themselves in deep reflections of their own beliefs, values, and teaching goals (Korthagen & Vasalos, 2005; Loughran, 2014). When teacher educators want to improve their own professional learning with regard to EBT, they must be familiar with current research activities and, in turn, engage more in learning about such activities (Elstad, 2010; Loughran, 2014; Murray et al. 2009). Both facilitating student teachers' learning and improving their own professionalization requires that teacher educators know about EBT, and that their beliefs and attitudes toward EBT are positive.

Because teacher educators are quite a diverse group, investigating the personal domain variables (practical knowledge, self-efficacy beliefs and attitudes) toward EBT in detail seems to be an important proximal goal for their professional development. Learning more about possible differences between subgroups of teacher educators can provide an important knowledge base as a baseline for further EBT-related professional development.

1.4 Teacher educators practical knowledge, self-efficacy beliefs and attitudes

Change in teacher educators' personal domain variables can lead to instructional changes and adaption of new teaching reforms. In this section, the term personal domain variables will be explained and discussed. Moreover, models representing teacher change will be introduced and briefly discussed. The section refers in detail to the Interconnected Model (Clarke & Hollingsworth, 2002) and the importance of measuring teachers' personal domain variables in teacher education and in particular concerning evidence-based teaching reforms.

Teacher change always had a substantial place in educational literature (see, for example, Clarke & Hollingsworth, 2002; Guskey, 1985; Johnson, 1996). The term change, however, has been described and understood in many different ways. For instance, change as training, where teachers experience change in their teaching after an intervention; change as

personal development, where teachers themselves aspire to change and improve their performance; or change as growth or learning, where teachers change through professional activities that are accomplished in learning communities (Clarke & Hollingsworth, 1994).

Different models have tried to capture teachers' change or better change that will be accomplished through teacher professional development (e.g., Cobb, Wood, & Yackel, 1990; Clarke & Byrne, 1993; Guskey, 1986). Teacher change is represented in most models as a linear process with the following structure: (1) teachers change in knowledge and beliefs will lead to (2) teachers' change of classroom practice, which will lead to (3) change in students' outcomes. However, most models have been criticized for the unidimensional approach to teachers' professional development (Clarke & Byrne, 1993).

The Interconnected Model (Clarke & Hollingsworth, 2002) tries to capture the complexity of teachers' professional growth through the identification of multiple growth pathways between the domains. The model, discusses the presence of four change domains: (1) the external domain, which represents the external source of information or stimulus; (2) the personal domain, which refers to teacher knowledge, beliefs and attitudes; (3) the domain of practice, which refers to teachers professional experimentation; and (4) the domain of consequence, which represents salient outcomes. These domains are interconnected through the mediating processes of 'reflection' and 'enactment', which are represented in the model as arrows linking the domains (see fig. 2).

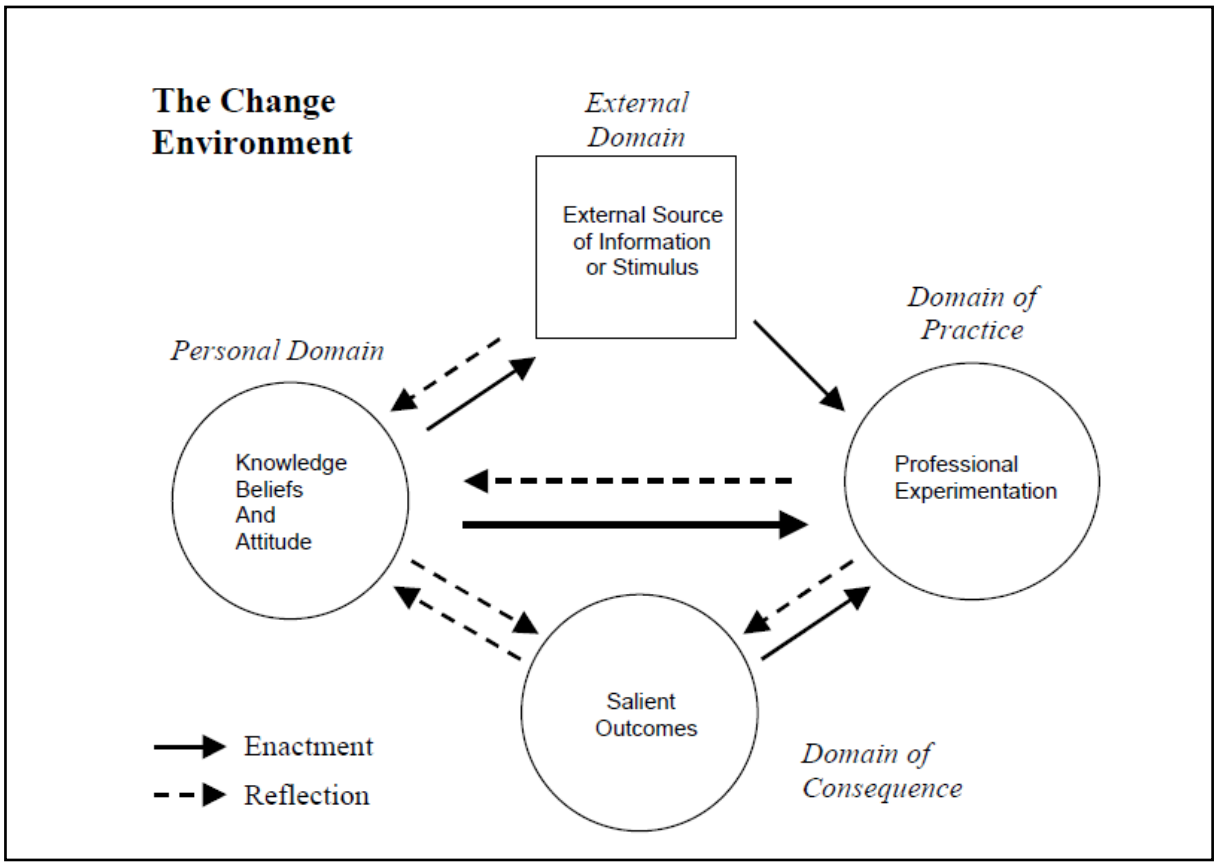

Figure 2. The interconnected model of professional growth (Clarke & Hollingsworth, 2002)

1.4.1 Measuring teacher educators personal domain variables to bridge the research-practice gap

In the present thesis, the focus lies on the investigation of the personal domain variables, and in particular on teacher educators' practical knowledge, self-efficacy beliefs and attitudes toward evidence-based teaching. At the start of a reform, like the evidence-based reform in education, it is essential to first investigate teacher educators' personal domain variables and then those of teachers because these variables constitute the starting point for change (e.g., Haney, Czerniak & Lumpe, 1996; van Driel, Beijaard & Verloop, 2001).

We measure teacher educators' personal domain variables toward evidence-based teaching for various reasons. First, teacher educators are a group of teachers that have been overlooked in the literature. Secondly, the function of teacher educator serves as a link

between research and practice (Malouf & Schiller, 1995). Teacher educators construct and foster pre-service teachers' attitudes that teaching is a profession based on scientific, research-based principles (Greenwood & Mabeady, 2001). Teacher educators must provide in-depth evidence-based information to pre-service teachers, and they are responsible for offering opportunities to apply the research methods and practices that have been taught during their university studies (Simpson, Whelan & Zabel, 1993).

Jones (2009) believes that teacher educators are the ones who can significantly contribute to bridge the gap between research and practice. Because teacher educators are the ones, who are responsible for supporting future teachers learning and development, leading them to recognize that evidence-based teaching refers to positive and significant results. Besides the important role of both teacher educators and personal domain variables in closing the gap between research and practice (Malouf & Schiller, 1995), there are no studies investigating teacher educators' personal domain variables toward evidence-based teaching.

This thesis contributes to the scarce literature and research of teacher educators and evidence-based teaching by first exploring teacher educators' personal domain variables toward EBT. Thus, it is necessary to define and describe the relevant personal domain constructs such as practical knowledge, self-efficacy beliefs and attitudes.

1.4.2 Practical knowledge of teacher educators regarding EBT

In educational literature, with his review study, Fenstermacher (1994) explored the nature of knowledge research that had been conducted until 1994. Based on his review study, two major types of knowledge exist: (1) formal knowledge, which is mainly produced by researchers and can be described as knowledge for teachers; and (2) practical knowledge, which is produced by teachers and is a form of knowledge that teachers generate as a result of their experiences and reflections (Meijer, Verloop & Beijaard, 1999).

Researchers have studied teachers' practical knowledge from different points of view and with various assumptions (e.g., Brown, Collins & Duguid, 1989; Clandinin, 1985; Elbaz, 1991; Leinhardt, 1988; Schön, 1987). Many terms and explanations have been used to define practical knowledge; however, there is no unanimity either about the characteristics or content of this type of knowledge. This section describes some of the basic characteristics of this type of knowledge found in the literature.

Practical knowledge is mostly unexpressed, tacit expertise, because teachers do not often articulate their knowledge (e.g., Calderhead & Robson, 1991; Korthagen, 1993; Wubbels, 1992). It is also personal, which means that teachers' practical knowledge is unique for each individual teacher (Elbaz, 1991). Practical knowledge is defined in and adapted to the classroom situation, thus it can also be described as contextual (Leinhardt, 1988). Moreover, it is guided by teachers' practical experiences and it is based on teachers' reflections (e.g., Grimmett & Mackinnon, 1992; Munby & Russell, 1994).

In research, practical knowledge has been defined in different ways, depending on individual studies. In an investigation from Shulman (1987), pedagogical content knowledge for teaching was seen as the most significant part of teachers' practical knowledge. The research group of Munby and Russell (1993) defines practical knowledge as teachers' implicit theories of knowledge in action. Kagan (1990) and Moore (1990) define practical knowledge as teachers' comprehensive knowledge, beliefs and cognitions.

In this thesis, practical knowledge is understood as the amalgam of personal and professional experience, developed through experiences and concepts, which cannot be easily articulated by teacher educators due to its complexity and integration of knowledge sets (Beijaard, 1990; Verloop, 1989). Practical knowledge consists of procedural knowledge, beliefs, norms, and values (Handal & Lauvas, 1987), which are utilized during teachers actions in practice (Johnston, 1992). Teachers' practical knowledge guides their teaching

practice (Lantz & Kass, 1987; Brickhouse, 1990; van Driel, Verloop, van Werven & Dekkers, 1997) and constitutes the core of teacher's professionality (Van Driel, Beijaard & Verloop, 2001).

In this thesis, the position is taken that this understanding of practical knowledge is also applicable to the professional group of teacher educators and about their practical knowledge regarding EBT. The investigation of teacher educators' practical knowledge toward evidence-based research practices is seen as of great importance for two main reasons. First, due to the mediating role of practical knowledge between theory and practice, and our urge to explore and hear teacher educators' voices. Second, because it is important to understand teacher educators as professionals who enter the teaching profession with a body of knowledge, that changes and flourishes based on their teaching experiences. The investigation of such a knowledge base can be challenging, yet it is necessary before the implementation of an educational reform like evidence-based teaching.

1.4.3 Self-efficacy beliefs of teacher educators regarding EBT

The concept of self-efficacy began to attract researcher's attention after the RAND studies of reading instruction between groups of low-income students and minority students (Armor et al., 1976). In these studies, self-efficacy beliefs positively related to students reading achievement, a finding that fostered the investigation of self-efficacy as a powerful construct that is related to students' outcomes and to teachers' motivation and teaching behaviour (Ross, 1992; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). Bandura (1977) introduced the term self-efficacy as a concept and defined it as the beliefs people hold about their capabilities to accomplish a desired level performance in achieving a certain task. Self-efficacy beliefs drive people's motivation, make them more persistent to pursue their goals and more resilient to their own failures (Tschannen-Moran & Johnson, 2011).

In teacher research, self-efficacy beliefs are shown to be systematically related to student achievement (Ashton & Webb, 1986; Ross, 1992), motivation (Midgley, Feldlaufer & Eccles, 1989), students' own sense of efficacy (Anderson, Greene & Loewen, 1988) and teachers behaviour in their classroom (Tschannen-Moran & Woolfolk Hoy, 2001). Teachers with high self-efficacy invest more time in planning their teaching and organizing their classroom (Allinder, 1994). They are also more open to implementing new teaching approaches and teaching reforms, and to better meet the needs of their students (Guskey, 1988; Stein & Wang, 1988). Thus, the investigation of this construct is important before the implementation of any reform in education.

Bandura (1997) stressed the importance of understanding how self-efficacy beliefs are formed in order to understand human behaviour, and in the case of this research, teachers' behaviour. In most cases, teachers form perceptions about their own capabilities based on experiences they went through during teaching, the views of their peers about their teaching, their supervisors' views, and views of teachers who serve as role models for them (Tschannen-Moran & Woolfolk Hoy, 2001). Self-efficacy is a motivational construct that influences teachers' behaviour, while teachers' behaviour also influences teachers' self-efficacy. This reciprocal relationship between self-efficacy and behaviour reinforces a cycle of either teaching success or failure. Therefore, professional development trainings that target the improvement of teachers' self-efficacy beliefs are of great importance for teachers change and adoption of new instructional strategies and educational reforms (Smylie, 1988).

Guskey (1986) was one of the first researchers who discussed the importance of investigating teachers' self-efficacy beliefs in order to foster teachers' change. He assumed that the failure observed in many teacher training programs stemmed from the fact that researchers were not interested in teachers' motives to change. A study by Scribner (1999) showed that the teachers with the highest self-efficacy where more willing to learn and

acquire new knowledge by involving themselves in new professional development activities. In contrast, the group of low self-efficacy teachers was either unable or unwilling to follow new activities and reforms because of a "perceived disconnection between the purposes of the efforts and their own needs as professionals" (p. 221).

It is clear that teachers must feel able, in order to make changes in their own teaching practices. The interplay between teachers knowledge and their feelings about their abilities to acquire and work with this knowledge is complex, but of crucial importance and must be investigated before the implementation of any reform (Timperley & Phillips, 2003). In order for teachers to implement a new reform or teaching strategy, they first need to know how to implement it and then feel able to implement it (Tschannen-Moran & McMaster, 2009). Teachers may see the need for the implementation of a certain reform or strategy but they may not believe that they have the capacity to implement it (Mesquita & Drake, 1994).

In this thesis, the importance of self-efficacy beliefs is acknowledged and thus teacher educators' self-efficacy beliefs toward evidence-based teaching are investigated. It is important to understand the role that self-efficacy beliefs play regarding educators' resistance or willingness to change in order to enhance the effectiveness of the evidence-based practice implementation in university teaching. Therefore, along with teacher educators' practical knowledge and in order to get a broader overview, this study also investigates teacher educators' self-efficacy beliefs as well as their attitudes, which we will discuss in the following section.

1.4.4 Attitudes of teacher educators regarding EBT

Attitudes such as beliefs and knowledge are central constructs in educational theory and research (Wyer & Albarracin, 2005). Knowledge, beliefs and attitudes are represented in teachers' minds like schemas which drive their actions (Ernest, 1989). The investigation of

teachers' attitudes improves our understanding of teachers' though structures, classroom practices, learning to teach and change in teaching (Richardson, 1996). As described above, similarly to the other two constructs under investigation, teachers' attitudes need to be explored to successfully implement new reforms in education. Teachers and teacher educators must know how to integrate evidence-based teaching practices, must feel able to integrate research evidence and finally they need to have positive attitudes toward evidence-based practices.

Attitudes have been defined differently in educational and psychological literature and there is no general agreement about the meaning of attitudes and how they are expressed (e.g., Halloran, 1967; Wyer & Albarracin, 2005). A classical and rather antiquated definition of the construct refers to a tripartite conception of attitudes, the emotional, cognitive and affective nature of attitudes, without distinguishing between attitudes and other constructs like beliefs and opinions (e.g. Breckler, 1984; Krech & Crutchfield, 1948; Petty & Cacioppo, 2012). Such definitions are one-dimensional and cannot capture the complexity of the construct. In an attempt to define attitudes more clearly, Fishbein (1963) made a distinction between attitudes and beliefs and limited attitudes to each affective component. Attitudes were then defined as the "learned predispositions to respond to an object or class of objects in a favourable or unfavourable way" (Fishbein, 1967, p. 257).

Richardson (1996) also referred to the affective nature of attitudes and made a distinction between attitudes and beliefs. Attitudes and beliefs are thus different because attitudes have an affective nature while beliefs a cognitive nature (Richardson, 1996). More recently, Albarracin and Wyer (2001) also distinguished attitudes and beliefs by conceptualizing attitudes as "expressions of the affective reactions that people experience and attribute to their feelings about this object" (Wyer & Albarracin, 2005, p. 277). Given the affective nature of attitudes, they can predict ones behaviour toward a new reform or teaching

strategy (Bai & Ertmer, 2008). Attitudes can also change, be renegotiated, or recreated (Moreira & Noss, 1995).

Positive teacher attitudes toward new teaching reforms are necessary for effective implementation in practice (Woodrow, 1992). Teachers' enthusiasm and readiness to implement new teaching practices and reforms is important not only for the teachers themselves, but also for the students (Ernest, 1989). Research suggests that affective factors like attitudes can influence teachers' practices and students learning (e.g. Bishop & Nickson, 1983). Teacher attitudes have been investigated particularly in STEM subjects like mathematics (e.g. Leavy, Hourigan, & Carroll, 2017; Maasz, & Schlöglmann, 2019) and physics (Denisova, Bell, & Covaleskie, 2019). However, little attention has been paid towards teacher educators' attitudes about teaching reforms. Richardson (1996) particularly stresses the need for the investigation of teacher educators' attitudes in order to foster and enhance the teacher education practice.

The present thesis adds to research and literature by acknowledging the importance of the three above-mentioned constructs and the role of teacher educators in the adoption and utilization of the evidence-based teaching reform. Thus, before the adaptation of professional developments for teachers and teacher educators, the aim is to get a better understanding of teacher educators' practical knowledge, self-efficacy beliefs and attitudes toward evidence-based practices. It is important to first investigate these three constructs when the goal is to better understand teacher change.

Subsequently, this thesis aims to explore the significance of the two cognitive constructs of self-efficacy beliefs and practical knowledge in the interplay between teacher educators' research experience and the frequency of their evidence-based teaching utilization.

1.5 Research Aims and Questions

There are several reasons why it is important to investigate teacher educators' personal domain variables toward evidence-based teaching practices. As was shown in the introduction to this thesis, there is a great demand from research and society to educate learners in order to acquire analytical and research-oriented skills (e.g. Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci & Rumble, 2011; Griffin, Care & McGaw, 2011). Schools play a pivotal role in cultivating the so-called 21st century skills and teachers are the mediators of change (e.g., Bellanca, & Brandt, 2010; Griffin, Care & McGaw, 2012; Schleicher, 2012; Shapiro, Lauritzen, & Irving, 2011). Teachers in schools and teacher educators in higher education institutions are the key forces to move learning towards these educational goals (Darling-Hammond, 2010; Darling-Hammond & Lieberman 2012; Sherrill, 1999).

The Evidence-based teaching reform originated in medical education in order to foster practitioners' 21st century skills and support their professional learning and development. In teacher education, teachers and educators who embrace evidence-based teaching practices foster their analytical, critical thinking and research-oriented skills. In addition, they support students to embrace such reforms in order to become learners with higher order thinking who meet the demands of the rapidly changing society (Bauer and Prenzel, 2012; Niemi & Nevgi, 2014). However, a key question is how teachers and teacher educators perceive these new reforms, such as the evidence-based teaching reform. In particular, what do teacher educators know and believe about evidence-based teaching, and accordingly, what are their attitudes toward this new reform?

With the importance of evidence-based teaching for both practitioners and leaners, this thesis sets out to learn more about the complex interplay between the three important constructs of practical knowledge, self-efficacy beliefs and attitudes, for teachers' professional development and the adoption of new teaching strategies and reforms. The first

aim of this task was to find a way to measure teacher educators' personal domain variables toward evidence-based teaching strategies. After a thorough investigation of the literature, and finding no existing instruments measuring teacher educators' personal domain variables, scales from the medical field were adapted and further developed. The following research questions are aligned with this goal:

1. What are the psychometric properties of the newly- developed evidence-based teaching scale?
2. What is the factorial structure of the evidence-based teaching scale? Does it follow the factorial structure of the original scales for medicine?
3. How valid and reliable is the evidence-based teaching scale?
4. Are there any differences regarding teacher educators personal domain variables based on their research experience?

The first three questions of this thesis mainly refer to methodological aims, which need to be addressed after the development of a new instrument in order to warrant its quality. Even though the questions are methodological, the answers to these questions will also contribute to theory and perhaps even more so to practice, since both researchers and practitioners will be able to use the instrument. Since there is a lack of research measuring the differences among teacher educators based on their research experience, the fourth question adds insight to both methodological and theoretical domains. In terms of its contribution to methodology, the answer to this question strengthens the validity, and in the long-term, the quality of the developed instrument. For theoretical considerations, since teacher educators belong to a very heterogeneous group of professionals, getting a better understanding of the differences among the different sub-groups will help researchers and policy makers to support their professional development based on the individual group's needs.

The second main goal of the thesis was to explore how personal domain variables, in particular, practical knowledge, and self-efficacy beliefs, contribute to the interplay between teacher educators research exposure and how frequently they implement evidence-based teaching practices. The questions that support the investigation toward these aims are:

1. What practical knowledge, self-efficacy beliefs, and attitudes do teacher educators have toward evidence-based teaching?
2. Is there a model that can foster the utilization of evidence-based teaching?
3. Do practical knowledge and self-efficacy beliefs act as mediators in the interplay between teacher educators' research exposure and the frequency of their evidence-based utilization?

The answers to the abovementioned questions are significant from a practical, theoretical, and methodological perspective. Since the literature specifically targeted toward teacher educators for this topic is scarce, with the knowledge acquired in this investigation, researchers and practitioners can identify which personal domain variable(s) play the most important role(s). This enables researchers to develop professional development trainings that foster the most relevant variables for effective change in teacher educators' adoption of reform. Both studies will significantly contribute to enhance our understanding and support debates around the implementation of the evidence-based teaching reform. Additionally, this thesis will produce recommendations about further research towards the improvement of the developed instrument as well as suggestions for fostering teacher educators' role in the implementation of new reforms like evidence-based teaching.

1.6 Overview of Studies

Study 1 is dedicated to the goal of developing a new instrument measuring teacher educators' practical knowledge, self-efficacy beliefs and attitudes toward evidence-based teaching. To contribute to that goal, we first conducted a review of evidence-based practice instruments. Since no instruments were identified in the teacher education field, we adapted instruments from medicine and medical education. In order to ensure the quality of the instrument, namely the validity and reliability of the scale, the first paper discusses the psychometric properties of the instrument and its usability in the field in depth. The study also looks at potential differences among teacher educators based on their research experience, with the aim of enhancing the validity of the instrument and adding to the literature concerning teacher educators' individual needs for professionalization.

Study 2 aims to deepen our understanding regarding the role of personal domain variables, and in particular, of practical knowledge and self-efficacy beliefs in the interplay between teacher educators' research exposure and frequency of evidence use. Study 2 contributes a basic descriptive analysis to enhance our understanding about these important personal domain variables. After the descriptive analysis, a mediation analysis was conducted to explore the role of practical knowledge and self-efficacy beliefs. This analysis utilized a model where research experience and frequency of evidence implementation were treated as the independent and the depended variable, respectively. Since we wanted to build on the knowledge base about teacher educators professionalization provided from study 1, we additionally investigated the biggest challenges and facilitators to an increase in EBT practices in universities.

2. Study 1 - Measuring teacher educators personal domain variables toward evidence-based teaching

2.1 Introduction

Europe is on its way to putting evidence-based teaching (EBT) into practice. This is why during the last decade the European Commission (2012) has placed an increasing emphasis to support the teacher educator profession by embracing research evidence as the basis of teaching practice (Bauer, Prenzel, & Renkl, 2015; Wiseman, 2010). Communicating about and reflecting upon research evidence are considered to be some of the key requirements for educators' professional learning and development (Livingston, McCall, & Morgado, 2009).

Because teacher educator's role is multifaceted, it requires continuous professional learning and development (Murray, 2010; Swennen, Jones & Volman, 2010). Teacher educators are mediators between academia, schools, local authorities, and communities. They come from various professional backgrounds and diverse national and institutional contexts (Lunenberg, Dengerink, & Korthagen, 2014; MacPhail et al. 2018). They can be academic staff in higher education or researchers at universities, but they can also be school teachers or former school teachers (Vanassche et al., 2015).

Teacher educators can be professors, post-doctoral researchers, university lecturers, PhD candidates, and school mentors. Consequently, their task perceptions, identities, work, and need for professional development are influenced by these diverse backgrounds and contexts. This may mean that, on the one hand, former and current school teachers may lack research skills and, thus, may find it difficult to understand scientific evidence and to implement EBT practices, but, on the other hand, researchers may lack practical teaching skills (Goodwin et al., 2014).

Given the complexity of the profession, the lack of clarity regarding entry requirements into the profession, and the lack of pre-service preparation, professional development specifically targeting EBT is needed to improve teacher education. Therefore, in order to develop appropriate training and to support the various needs of the different teacher educators groups, we first need to focus on what they already know about EBT and their beliefs and attitudes toward evidence implementation (Fleckenstein, Zimmermann, Köller, & Möller, 2015). The relevance of the interplay between knowledge, beliefs, and attitudes has been already pointed out in other fields like medicine and social work, fields which also deal with complex professional requirements and integrating practical competencies with rapid advances in research (Bauer & Prenzel, 2012).

2.1.1 Evidence-Based Practice in Teacher Education

Evidence-based practice is becoming more important in the field of teacher education not only because of the demands of today's knowledge society but also because of its critical role in teachers' professional learning and development (Bauer & Prenzel, 2012; Wiseman, 2010). Evidence-based practice (EBP) was introduced in medicine in an attempt to bridge the research-practice gap (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). Similar to medicine, the introduction of EBP in education was the result of criticisms teaching has long faced as a profession. First, for its resistance to change, and second, for the discrepancy between scientific research findings and what actually occurs as classroom practice (Slavin, 2002).

Defining EBT is a critical issue in teacher education and is not without controversy. Since EBT was introduced to the field of education, numerous, sometimes conflicting, definitions have been provided (Bromme, Prenzel & Jäger, 2014; Groccia & Buskist, 2011; Stark, 2017; Wrigley, 2015). The main disagreement refers to the role that experience and professional judgment play in implementing evidence into teaching practice. Based on Davies

(1999), one of the pioneers in the field of EBT in education, EBT is not a "cookbook" but a guiding resource that goes hand in hand with practitioners' experience. Both evidence and experience have the goal of improving teaching practice. Thus, in this study, we define EBT as "a set of principles and practices which form the basis upon which practitioners make professional judgments and deploy their expertise" (Davies, 1999, p. 118).

2.1.2 Teacher Educators: A Unique Group of Teachers

Teacher educators are part of a unique, complex, and multifaceted profession because they do not only need to restructure their existing knowledge but they also must be able to acquire and combine it with new empirical research evidence (Bauer & Prenzel, 2012). They must also, accordingly, facilitate and communicate this knowledge to the pre-service teachers they instruct (Vanderlinde, Tuytens, Wever, Bram, & Aelterman, 2016). Teacher educators are a heterogeneous group with multiple roles. They can be academic staff in higher education with various responsibilities including teaching and research. They can also be teaching practice supervisors, school mentors, or PhD candidates (Dengerink, Lunenberg, & Kools, 2015).

In Germany for instance, one of the largest European countries, teacher educators are mainly recruited from two groups: school teachers or researchers. Further prerequisites for becoming a teacher educator differ slightly between German-speaking countries and within the different German states; however, a completed university degree is usually required (Bayerisches Gesetz- und Verordnungsblatt, [GVBI], S. 230, 2006)**.** For the purpose of this study, teacher educators are defined as those who are involved in teaching pre-service teachers in initial university-based teacher education. Our focus lies in university teacher educators ranging from school mentors to professors, because this range reflects a common distribution in university-based teacher education institutions (Zeichner, 2005). The

commonality among members of this group is that they are responsible for pre-service teachers' initial learning and development (Zeichner, 2009).

Recognizing the demanding role of teacher educators in teacher education, some countries (England, Israel, the Netherlands, Switzerland, and the USA, among others) have started to develop standards for teacher educators so as to represent the ideal collection of competencies teacher educators must possess to be effective in their profession (Smith, 2003). Based on these standards and on general European frameworks (European Commission, 2013), teacher educators should be able to embrace and use research evidence in their teaching practices (Bauer, Prenzel & Renkl 2015; Wiseman, 2010) in order to increase the quality of teacher education and to reach higher standards for all educators (Bauer & Prenzel, 2012; European Commission, 2007).

Because teacher educators are a quite diverse group, investigating the personal domain variables toward EBT in detail seems to be an important proximal goal for their professional development. Learning more about possible differences between subgroups of teacher educators can provide an important knowledge base regarding the starting points for further EBT-related professional development.

2.1.3 Teacher Educators' Personal Domain Variables

In the model of Clarke and Hollingsworth (2002), knowledge, beliefs, and attitudes are summarized under the term personal domain variables. The model describes the complexity of professional development for teachers (or teacher educators) and refers to important components of teachers' professionalization. Four distinct domains that encompass the teaching world are assumed to be responsible for teachers' changes due to professionalization: the personal domain, the domain of practice, the domain of consequence, and the external domain. The present study emphasizes the personal domain variables component because, as

shown in medicine (e.g., Aarons, 2006; Brown, Wickline, Ecoff, & Glaser, 2009), it is particularly relevant as the individual starting point for the enhancement of practitioners' EBT professional development.

2.1.3.1 Practical knowledge

Teachers' professional knowledge is crucial for improving classroom instruction (Hiebert, Gallimore, & Stigler, 2002). Practical knowledge is the mix of experiential knowledge, formal knowledge, and personal beliefs (Cochran-Smith & Lytle, 1999). Teacher educators are expected to know where and how to find relevant research, to be critical readers, and to know how to apply this knowledge to their own higher education teaching practice (Elstad, 2010; Murray et al. 2009). Hence, understanding teacher educators' judgments regarding their practical EBT knowledge seems to be a relevant target for EBT-related learning and professional development. Drawing on the existing literature on practical knowledge, we assume that research-related experience of teacher educators is positively associated with practical EBT knowledge (Fenstermacher, 1994; Zanting, Verloop & Vermunt, 2001).

2.1.3.2 Self-efficacy beliefs

In the broader context of education, teachers' beliefs and, in particular, self-efficacy beliefs impact their perceptions and judgments and guide their actions (Pajares, 1992). Self-efficacy beliefs are closely related to the construct of confidence; however, "confidence refers to the strength of belief but does not necessarily specify what the certainty is about" (Bandura, 1997, p. 382). Self-efficacy beliefs refer to "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific task in a particular context" (Tschannen-Moran, Hoy, & Hoy 1998, p. 233).

Self-efficacy beliefs are assumed to play an important role as mediator between knowledge and action (Bandura, 1997). For instance, self-efficacy beliefs are related to the

way teachers teach, learn how to teach, how much effort they put into their actions (Tschannen-Moran & Woolfolk Hoy, 2001, 2007), and their level of commitment to teaching (Chan, Lau, Nie, Lim, & Hogan, 2008; Somech & Bogler, 2002). Teachers with high self-efficacy are more open to new challenges, eager to find new instructional methods to meet their students' needs (Künsting, Neuber, & Lipowsky, 2016) and generally willing to adopt new ideas and teaching approaches (e.g., Pan et al., 2013; Tschannen-Moran & McMaster, 2009; Tschannen-Moran & Woolfolk Hoy, 2001, 2007).

Thus, highly self-efficacious teachers might be also more willing to learn and reflect on their own abilities regarding EBT. They might also be more motivated to meet the new challenges that come along with the implementation of EBT. At the same time, they might be eager to develop professionally so as to meet the demands of the ever-growing knowledge in the educational field. In other words, we assume that teacher educators' self-efficacy beliefs regarding EBT will be positively associated with the implementation of EBT, and teachers will view EBT as an important aspect of their professional growth (Bromme, 1997).

2.1.3.3 Attitudes

Attitudes and beliefs are central constructs of social psychology and educational psychology. Since the early 1950s, many authors have examined the nature of teachers' attitudes (Richardson, 1996) and how attitudes influence student–teacher interactions (Brophy & Good, 1974). However, there is a surprising lack of consensus about the terminology and the conceptual distinction between the two constructs (Wyer & Albarracín, 2005). Rokeach (1968) provided a clear distinction between attitudes and beliefs, stating that attitudes have an affective nature while beliefs have a cognitive nature. He further claimed that when one has certain beliefs about an object, these beliefs are the determinants of the rational content of an attitude toward the object but are not themselves an attitude. In other words, teachers' beliefs

influence teachers' attitudes, and teachers construct their attitudes on the basis of their beliefs (Wyer & Albarracín, 2005).

Similar patterns are expected in regard to teacher educator beliefs and their effect on teacher educator attitudes. Along with beliefs, attitudes are seen as predictors of behavior (Bai & Ertmer, 2008). Because attitudes are affective, teacher educator attitudes toward research are expected to predict their implementation of research evidence into teaching practice (Ernest, 1989).

In the context of EBT, attitudes toward changes in practice and adoption of new innovative strategies have long been studied in medicine (Aarons, 2004, 2006; Brown, Wickline, Ecoff, & Glaser, 2009). These studies also support the contention that studies on EBT should consider the potential individual differences between professional groups, such as groups differing according to education, working position, professional experience, or training (Ball et al., 2002; Strosahl, 1998). Therefore, we assume that differences in attitudes will also be found between the different groups of teacher educators. We further assume that self-efficacy beliefs are positively related to EBT-related attitudes and, consequently, to intentions to implement EBT in practice.

2.2 Aim of the Study

The present study aims to contribute to teacher education research by focusing on teacher educators' personal domain variables (practical knowledge, self-efficacy beliefs, and attitudes) toward EBT. Our first aim was to design and test a questionnaire that can be applied to teacher education and is appropriate for teacher educators with diverse experience in teaching and research, namely the Evidence Based Teaching Scale (EBTS). Given the lack of instruments in this field, we modified and adapted scales from existing instruments from medical education.

In order to empirically test the instrument, the factorial and psychometric structure of the developed scale was analyzed. Moreover, and to provide further information on the validity of our scale, the assumed positive relationship between the three investigated variables was explored. We hypothesize that stronger relationships are expected between practical EBT knowledge and self-efficacy beliefs than between practical EBT knowledge and attitudes, as well as between self-efficacy beliefs and attitudes.

In order to further validate the EBT questionnaire, relationships to additional variables such as confidence in EBT (as a similar construct for self-efficacy) as well as frequency of EBT use (as an indicator for actual implementation in practice) were explored. Accordingly, positive relationships were expected between self-efficacy beliefs and confidence, since they measure similar constructs. Positive relationships were also expected between attitudes and the frequency of EBT use, as well as between practical EBT knowledge and frequency of EBT use.

The second aim of this study is to explore the personal domain variables with regard to differences between selected groups of teacher educators. Our hypothesis is that teacher educators with stronger involvement in empirical research projects (e.g. professors, post-doctoral researchers) will report higher values regarding practical knowledge, self-efficacy beliefs, and attitudes toward EBT implementation compared to teacher educators with limited research experience (e.g. university lecturers, PhD candidates, and school mentors).

2.3 Method

2.3.1 Participants

A total sample of $N = 210$ teacher educators (60% female) completed the survey (Table 1). The sample included teacher educators from Germany ($n = 149$), the German-speaking part of Switzerland ($n = 39$), and Austria ($n = 21$). One participant did not state her

or his country of origin. Five groups were identified: professors (group 1: *n* = 58), post-doctoral researchers with teaching obligations (group 2; *n* = 20), university lecturers (group 3: *n* = 13), PhD candidates with teaching obligations (group 4: *n* = 87), and school mentors (group 5: *n* = 25). Seven participants did not state their position rank. Participants ranged in age from 23 to 68 years, with a mean of 43 years (*SD* = 11.57). Their teaching experience as teacher educators ranged from one month to 43 years (*M* = 8, *SD* = 18.73).

2.3.2 Procedure

Data were collected from May to September 2018 using an electronic survey platform. Before participants began the survey, the purpose of the scale was explained to them and they were asked to provide their informed consent. Participants were either contacted via email or through their university's newsletter system. A reminder email was sent to all participants six weeks after the first mailing. Participants were eligible to participate in a raffle for completing the survey.

Responses regarding EBT personal domain variables were assessed on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The same Likert scale was used to measure teacher educators' confidence in EBT. A 10-point frequency scale ranging from 0 (no use) to 10 (EBT use 10 or more times a semester) was used to measure teacher educators' frequency of EBT use during a time period of a semester. An explanation about the term EBT was provided in the introduction to the survey. This way, we ensured that all participants had a similar information basis regarding the EBT concept.

Table 1
Demographic Data

Characteristics	Total (*N* = 210)	Percent
Gender		
Male	82	60
Female	125	39
Other	2	1
Working country		
Germany	149	71
Switzerland	39	19
Austria	21	10
Position type		
Research position	6	3
Teaching position	39	20
Both	134	68
Position rank		
Professor	58	28
Post-doctoral researcher	20	10
University lecturer	13	6
PhD candidate	87	41
School mentor	15	7
Other	17	8
Years of teaching experience		
0–10 years	109	55
11–20 years	64	32
21–30 years	19	10
31–40 years	3	2
41–50 years	1	1
Highest degree attained		
Doctorate	111	53
Master's	84	40
Bachelor's	1	1
High school or equivalent	7	3
Other	5	2

2.3.3 Scale Development

2.3.3.1 Literature review

A review of the literature was conducted to identify potential scales that could measure teachers' or teacher educators' knowledge, beliefs, and attitudes toward the use of scientific evidence in their teaching practice. A search was conducted in PsycINFO and Web of Science databases using the keywords "evidence-based practice" or "evidence-based teaching" combined with "knowledge," "beliefs," "attitudes," "measures," or "instruments." Because the first search yielded no scales for teachers or teacher educators, a new search was conducted using the keywords "evidence-based practice" and "measures" or "instruments." This search produced six potential EBP scales and a semi-structured interview guide that have been used in medicine (for an overview see Table 2).

Table 2
Overview of the Evidence-Based Practice Scales

Title	No. of Items	Author	Year
Evidence-based Practice Attitude Scale	15	Aarons	2004
Evidence-based Practice Questionnaire	24	Upton and Upton	2006
Evidence-Based Practice Beliefs Scale	16	Melnyk, Fineout-Overholt, and Mays	2008
Evidence-Based Practice Implementation Scale	18	Melnyk, Fineout-Overholt, Feinstein, Sadler	2008
Trans-Professional EBP Questionnaire	66	Mcevoy, Williams, and Olds	2010
Evidence-Based Practice Process Assessment Scale	27	Parrish and Rubin	2011
Non-skill-based attributes for Evidence-Based Practice Questionnaire	28	Johnston et al.	2003

2.3.3.2 Item selection

A four-step approach was used for the selection of items that might show good psychometric properties for the field of teacher education (Figure 3).

Step 1: The initial draft of the questionnaire was collated from the aforementioned existing questionnaires investigating medical professionals' personal domain variables toward EBP. First, we collected 176 out of 194 items based on the relevance of the items to the educational field. Items that were specific to medical practice were excluded. All selected items were adapted to fit the educational field.

Step 2: A local panel of four experts with experience in teacher education and educational research underwent two rounds of feedback, reviewing the first draft of the questionnaire for content validity and providing suggestions regarding the item fit. After this process, 74 items were selected.

Step 3: The second draft was reviewed by two experts with experience in teacher education and educational research and a panel of three native English speakers. Out of 74 items, 70 items were included in the third draft of the questionnaire.

Step 4: A pilot study was conducted with 30 teacher educators in order to determine usability (wording, clarity, layout, and duration). All participants completed paper-pencil versions of the EBTS questionnaire. After the completion of the questionnaire, retrospective think-aloud interviews were performed. Additionally, and in order to determine usability (wording, clarity, layout, and duration) and content validity, each participant was asked to rate each survey item in three different ways: understandable, scale adequate, and emotionally laden. Moreover, we recorded the duration of the questionnaire (M = 14.4 minutes, SD = 3.8). Based on the qualitative and quantitative preliminarily analysis, the questionnaire instructions and layout were simplified and formatted for clarity and consistency.

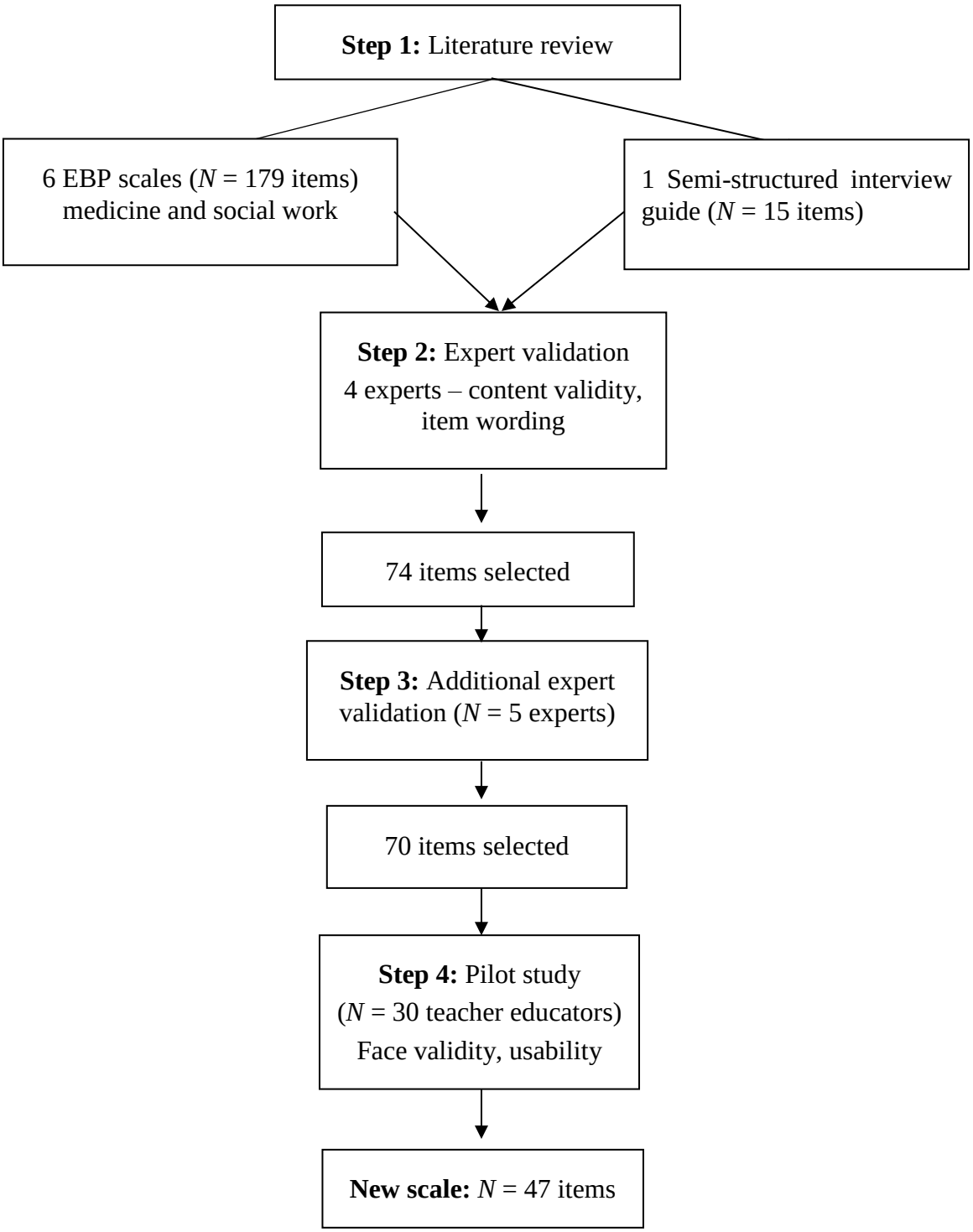

Figure 3. Development of the new instrument and item selection process.

2.3.3.3 EBTS Instrument

After the preliminarily analysis, the questionnaire consisted of 61 items in total. In detail, 47 items aimed to assess teacher educators' practical knowledge, self-efficacy beliefs, and attitudes toward EBT. Sixteen additional items developed for validation purposes investigated teacher educators' frequency of (7 items) and confidence in (7 items) EBT practices. Since the items stemmed from instruments published in English, the 61-item scale was professionally translated from English into German. The German version was then translated back into English by a second translator to ensure the equivalence and accuracy of the translation. Finally, the instrument was pilot tested by a convenience sample of bilingual teacher educators (N = 6; native German-speaking) in order to confirm its comprehensibility and clarity.

2.3.3.4 Data Analysis

First, data cleaning regarding the quality of responses was conducted. Gorsuch (1983) recommends five responses or participants for every measured variable; MacCallum, Widaman, Zhang, and Hong (1999) suggest that with a sample in the range of 100 to 200 and communalities in the range of .5, one has a good recovery of population factors. Therefore, with most communalities over .5 and a sample nearly close to the rule of five suggested by Gorsuch (1983), responses of 210 participants are considered as suitable for the present study.

An exploratory factor analysis[1] (EFA) was conducted utilizing principal axis factoring (PAF) and an oblique rotation. Because many factors within the fields of education and

[1] Performing confirmatory and exploratory factor analysis on the same dataset can lead to overfitting, in particular with smaller datasets; in other words, inflated or "deceivingly optimistic model fit indices" due to capitalization on chance (Fokkema & Greiff, 2017, p. 400; see also Babyak, 2004; Greiff, & Heene, 2017). Thus, and given the exploratory nature of our study, we performed exploratory factor analysis.

psychology are correlated, we proceeded with an oblique approach (Schmitt & Sass, 2011). Eigenvalues, the visual scree test, and the residual correlation matrix were examined during the EFA. Furthermore, a parallel analysis (PA) was conducted (Costello & Osborne, 2005).

The PA is a commonly used method to determine the number of factors to retain in an EFA. It accounts for sampling error that might influence the measured variables (Thompson, 2007). However, PA of adjusted correlation matrices tends to indicate more factors than warranted (Buja & Eyuboglu, 1992). Therefore, in addition to all analyses, a closer inspection of the scree test was considered necessary (Costello & Osborne, 2005).

For reliability analysis, Cronbach's alpha was calculated to determine internal consistency for all three factors. Additionally, Cronbach's alpha was calculated for the confidence in EBT scale as well as the frequency of EBT use scale. The total score for each factor was computed and the convergent validity of the scale was assessed using Pearson's *r*. Specifically, we examined correlations between the factor means and the confidence in EBT scale and the frequency of EBT use scales.

After scale construction and in order to fulfill our second aim, we first ran descriptive statistics for the different groups of teacher educators. To capture any differential effects among teacher educator groups based on their university position, we performed a multivariate analysis of variance (MANOVA) on the three factors as dependent variables, with teacher educators' university position being defined as independent variable. Accordingly, univariate comparisons were calculated in order to explore the differences across the teacher educator groups. Post-hoc tests and effect sizes were also calculated for all groups using Hedge's *g* (Lakens, 2013).

2.4 Results

2.4.1 Testing the Psychometric Structure of the EBTS Instrument

An exploratory factor analysis, using PAF and an oblique rotation (Brown, 2009), was conducted on the 47-item EBTS for 210 respondents to reduce the items for further validation studies and to reveal a parsimonious model. Inspection of the Pearson's correlation matrix revealed the presence of many coefficients of 0.30 or above (Tabachnick, Fidell, & Ullman, 2007). The Kaiser-Meyer-Olin value was 0.84, which exceeded the recommended value of 0.6 (Kaiser, 1970). The Bartlett's Test of Sphericity (Bartlett, 1954) was significant ($p < .001$). Thus, the data is suitable for factor analysis.

A PAF revealed the presence of six factors with eigenvalues above 1 that explained 42% of the total variance, with Factor 1 explaining 21%, Factor 2 explaining 9%, Factor 3 explaining 5%, Factor 4 explaining 3%, and Factors 5 and 6 explaining 2% each. As an additional measure to determine the factor structure, a PA was conducted. For this analysis, 47 variables were entered along with 210 participants and 1,000 replications. Based on the eigenvalues, six factors were retained; however, based on the scree test, only three factors appeared to be significant. A similar competing pattern was also observed between the results provided by the scree test and the eigenvalue tables from both PA and EFA. Thus, it was necessary to re-run the PAF and examine the factor loadings, the variance explained, and the scree tests for both suggested solutions (six-factor and three-factor solution).

In order to reveal optimal results, low loading or freestanding items were dropped. After omitting 21 freestanding and low loading items ($\lambda < .4$), a new PAF, fixed to six factors, was run. This new PAF revealed three significant factors which explained 50% of the total variance. A further inspection of the scree test revealed another clear break between the three factors, indicating that a three-factor solution may be the best fit to produce a parsimonious model.

Next, a new PAF was run with all 47 items. After deleting 22 low loading ($\lambda < .4$) and freestanding items, a final PAF was run. It revealed a three-factor solution explaining 47% of the total variance with Factor 1 explaining 28%, Factor 2 explaining 14%, and Factor 3 explaining 5%. Item 5 loaded on Factor 1 and 3 at a value slightly above .40. The item was kept for further analysis.

Finally, summarizing the results regarding the factor structure, a three-factor solution seems to show the best fit for the analyzed data. The final selection of items includes 25-items representing teacher educators' practical knowledge of the implementation of EBT in teaching practice (Factor 1; 10 items), attitudes toward EBT (Factor 2; 10 items), and self-efficacy beliefs regarding EBT activities (Factor 3; 5 items). Table 3 highlights the factor loadings among the three factors.

Table 3

Three-Factor Solution and Item Factor Loadings

	Factor loadings		
Item	1	2	3
Practical knowledge			
I know how to implement EBT	.74		
I intend to use current research evidence when I teach a class	.70		
I can implement current research findings efficiently	.61		
Teaching should be based on current research evidence	.59		
I have the skills needed to implement current research evidence in my daily teaching practice	.56		
Implementing current research evidence is essential to reach best teaching practice	.54		
I know how to implement current research findings sufficiently enough to make changes in my actual teaching	.53		
Engaging in teaching based on current research evidence will improve one's teaching practice	.51		
I know how to monitor and review my teaching skills	.43		
I know how to identify gaps in my teaching practice	.41	.41	

Self-efficacy beliefs	
I am able to evaluate the quality of a research study I use	.97
I am able to retrieve key messages from research papers	.80
I am able to summarize the main research findings of a research paper	.74
I find it difficult to implement current research evidence into my teaching practice because it is hard for me to evaluate the quality of the evidence	.53
I am able to determine whether research evidence is relevant to my teaching practice	.44
Attitudes	
Previous teaching experience is more important than the use of current research evidence	-.70
Teachers, in general, should not practice teaching based on current evidence because teaching is about people and students, not statistics	-.65
Teachers should decide based on their experience if and how they want to make use of current research findings	-.63
The judgment of esteemed colleagues offers a better basis than current research evidence	-.62
Experienced teachers should disregard research evidence when it conflicts with their intuition	-.61
Teaching based on current research evidence is a waste of time	-.57
There is no reason for me to implement EBT because it is just a fad that will pass with time	-.56
I know what is best for my students without examining the current research evidence	-.57
Teaching based on current research evidence ignores the “art” of teaching	-.55
My teaching experience influences how I judge evidence-based recommendations	-.46

2.4.2 Reliability and Validity

Cronbach's alpha was calculated for all three scales that loaded on the three factors. Cronbach's alpha was also calculated for the two validation scales. The results indicate good internal consistency for all scales (George & Allery, 2003). In detail, α =.84 for the practical knowledge scale, α =.85 for the self-efficacy scale, and α = .83 for the attitudes scale. For the frequency of use scale, α =.84, and for the confidence on implementing EBT scale, α = .81. Additionally, means of each scale were computed (Table 4).

Pearson's *r* was used to determine the degree to which the EBTS scales were interrelated (Table 4). Results showed moderate and significant positive correlations among the scales, supporting the notion that the variables are theoretically highly interrelated but, at the same time, distinct from one another. In particular, the practical knowledge scale and the self-efficacy scale demonstrated the strongest relationship, while the self-efficacy scale and attitudes scale appeared the weakest. With regard to the two validation scales, our findings confirmed our hypothesis that practical knowledge and self-efficacy beliefs would strongly correlate with reported levels of frequency and confidence in the EBT activities.

Table 4
Means, Standard Deviations, and Correlations Among the Factors and the Validation Scales

	M	*SD*	(1)	(2)	(3)
EBT Scales					
(1) Practical Knowledge	4.75	0.63	-	-	-
(2) Self-efficacy Beliefs	5.10	0.73	.57**	-	-
(3) Attitudes	4.66	0.63	.33**	.23**	-
Validation scales					
(4) Research activities confidence	4.52	0.95	.41**	.71**	.18**
(5) Research activities frequency	6.75	2.30	.39**	.54**	.26**

Note. Scale ranges from 1 to 4; 1 = strongly disagree to 6 = strongly agree
Scale range 5: 0 = no use to 10 = use 10 or more than 10 times a semester

2.4.3 Teacher Educator Groups and Their Practical Knowledge, Self-Efficacy Beliefs, and Attitudes

The second aim of the present study was to explore possible differences between distinct groups of teacher educators regarding EBT practical knowledge, beliefs, and attitudes. In general, participating teacher educators reported rather high practical EBT knowledge (M = 4.75, SD = 0.63), positive self-efficacy beliefs (M = 5.10, SD = 0.73), and attitudes toward EBT (M = 4.66, SD = 0.63). For further analyses, we were interested in whether selected teacher educator groups systematically differed regarding EBT practical knowledge, self-efficacy beliefs, and attitudes. The MANOVA showed an overall significant effect regarding group differences on EBT measures, F (12, 519) = 4.79, p =.000; Wilk's $\Lambda = 0.76$, $\eta^2 = .89$.

Univariate comparisons (ANOVA) and follow up Tukey's HSD post-hoc pair comparisons revealed further significant differences across different teacher educator groups in practical EBT knowledge, F (4, 198) = 5.42, p =.000, $\eta^2 = .99$, self-efficacy beliefs, F (4, 198) = 12.17, p = .000, $\eta^2 = .20$, and attitudes, F (4, 198) = 3.39, p = .010, $\eta^2 = .64$. Tukey's HSD post-hoc pair comparisons revealed significant differences for all three personal domain variables between the following three groups: professors (group 1), PhD candidates with teaching obligations (group 4) and school-based mentors (group 5).

Professors reported significantly higher practical EBT knowledge (M = 5.01, SD = 0.50) than PhD candidates with teaching obligations (M = 4.66, SD = 0.72), university lecturers (M = 4.38, SD = 0.40), and school-based mentors (M = 4.52, SD = 0.54). Similarly, professors reported significantly higher EBT self-efficacy beliefs (M = 5.46, SD = 0.51) than PhD candidates with teaching obligations (M = 5.01, SD = 0.76), university lecturers (M = 4.81, SD = 0.71) and school-based mentors (M = 4.40, SD = 0.73). A slightly different pattern was observed regarding EBT attitudes. Professors scored significantly higher (M = 4.89, SD =

0.56) but only in comparison with PhD candidates (M = 4.60, SD = 0.66) and school-based mentors (M = 4.45, SD = 0.57).

Effect sizes were also calculated using Hedges' g for all differences between the groups of teacher educators (Lakens, 2013). A Hedges' $g < 0.5$ was defined as a "small," 0.5 to 0.8 as a "moderate," and > 0.8 as a "large" effect size. The effect sizes for all significant differences ranged from g = 0.3 to 1.8. The largest effect sizes were observed for differences in EBT knowledge between professors and university lecturers (Hedges' g = 1.3, p = .006), between professors and school mentors (Hedges' g = 0.95, p =.007), and between professors and PhD candidates (Hedges' g = 0.54, p = .006).

The same pattern was observed for differences between teacher educators' self-efficacy beliefs. The largest effect size was observed for differences between professors and school mentors (Hedges' g = 0.77, p = .000), between professors and university teachers (Hedges' g = 0.76, p = .017), and between professors and PhD candidates (Hedges' g = 0.46, p = .001). Significant differences with moderate and low effect sizes were also found between post-doctoral researchers and school mentors (Hedges' g = 0.50, p = .001), and PhD candidates and school mentors (Hedges' g = 0.20, p = .001). Regarding EBT attitudes, significant differences with moderate and high effect sizes were observed between professors and school mentors (Hedges' g = 1.8, p = .031), and professors and PhD candidates (Hedges' g = 0.67, p = .046).

2.5 Discussion

This study was an attempt to build and validate the first scale to measure teacher educators' practical knowledge, self-efficacy beliefs, and attitudes toward EBT. The study provides evidence supporting the psychometric structure of the EBTS instrument as well as the relationships between the examined variables. The study also explores the differences

between the personal domain variables toward EBT of a heterogeneous group of educators and adds to previous research and literature on teacher educators' professionalization (Loughran, 2014; Lunenberg, Dengerink, & Korthagen, 2014; Smith, 2003).

A multi-step, multi-method approach was used to develop the EBT survey instrument, as the research basis was scarce. Because there is already a longer tradition of EBP in medicine (Aarons, 2004, 2006; Johnston et al., 2003; McEvoy, Williams & Olds, 2010), we used the existing knowledge base and explored the extent to which a transfer to teacher education is reasonable. Thereto, we reviewed, adapted, and refined existing EBP scales in various rounds with experts in teacher education and educational research.

In addition, we tested the empirical structure and psychometric properties of the EBTS instrument. Exploratory factor analyses revealed a reliable and valid 25-item instrument, which represented teacher educators' practical knowledge about the implementation of EBT (10 items; α = .84), self-efficacy beliefs regarding EBT activities (five items; α = .85), and attitudes toward EBT (10 items; α = .83). Our findings on the validity of the instrument also revealed systematic interrelationships between the confidence in EBT scale and the self-efficacy scale, which supports our initial hypothesis that a general measure of teacher educators' confidence in implementing research activities should be related to a more specific self-efficacy measure.

A strong correlation was also found between the practical knowledge scale and the confidence scale, supporting our initial hypothesis that the more teacher educators know, the more confident they feel about implementing research evidence into their own teaching practice. Medium correlations were identified between attitudes and the self-efficacy scale and between attitudes and the practical knowledge scale.

These findings support the distinct nature between the three constructs, which are interrelated and, therefore, significantly correlated but still different from one another (Cleare,

Gumley, Cleare, & O'Connor, 2018). Therefore, the correlations observed vary. A possible explanation could be the formulation of some of the items in the attitudes scale, which are rather broad and in some cases refer to teachers' experiences and intuitions. These items might have caused a positive tendency in university teacher educators who are aware of the fact that they should not base their teaching practices on their intuitions. Hence, further research regarding the theoretical conceptualizations is required.

Methodologically, the study advances the field by applying theoretical and empirical distinctions between practical knowledge, self-efficacy beliefs, and attitudes to the field of teacher education and EBT (Melnyk, Fineout-Overholt, Feinstein, Sadler, & Green-Hernandez, 2008). A questionnaire instrument is provided that scholars can use to measure teacher educators' personal domain variables toward EBT.

This study also provided insights into the heterogeneous group of teacher educators. Teacher educators belong to an "undiscovered" and "neglected" professional group of teachers (Tack & Vanderlinde, 2016). In the German-speaking teacher education context (Alles, Apel, Seidel, & Stürmer, 2018), teacher educators are considered to be all teachers who educate pre-service teachers, varying from professors to school mentors. German-speaking teacher educators work in higher education institutions and are responsible for the initial pedagogical knowledge, pedagogical content knowledge and for pre-service teachers learning and development. Therefore, investigating the differences among them can not only enhance our empirical understanding of teacher educators' viewpoints toward EBT but also set the ground for developing further evidence-based professional developments tailored to the different needs of teacher educators.

Teacher educators participating in our study reported rather high practical knowledge, self-efficacy beliefs, and attitudes. Significant differences among teacher educators' personal domain variables toward EBT were identified primarily among four groups. As expected,

teacher educators with more research experience (i.e., professors) scored significantly higher on each of the three scales compared to their counterparts with either fewer years of research experience (PhD candidates) or less active research involvement (university teachers, school mentors). University professors reported significantly higher knowledge and self-efficacy beliefs about EBT than PhD candidates and school mentors. A slightly different pattern was observed for the reported attitudes toward EBT. The differences were only significant among professors and the groups of PhD candidates and school mentors but not for the group of university teachers. This finding suggests that the specific needs of teacher educators with limited exposure in research need to be addressed in order to further implement EBT in teacher training (Cochran-Smith & Zeichner, 2005; Lunenberg, Dengerink, & Korthagen, 2014).

Some initiatives exist that focus on dissemination of important instructional research and relevant research findings for a (less) research-active target group of teacher educators. For instance, in the USA, What Works Clearinghouse could provide the research knowledge base for both lecturers and school mentors who have limited research experience. Another example is [blinded for submission] in Germany, which focuses on the heterogeneous groups of teacher educators as a target group. The clearinghouse initiatives in both the USA and Germany provide short overviews of either quantitative primary studies or meta-analyses in an understandable manner and illustrate how teachers can implement the main findings of the reported research in their own practice. Thus, they support teacher educators' evidence-based decision-making (Seidel, Mok, Hetmanek, & Knogler, 2017).

Besides the clearinghouse initiatives, further measures can be taken to encourage university teachers and school mentors to pursue research-oriented professional development. Smith (2003) refers to the importance of team work and collaborative coaching (Wetzel, Svrcek, LeeKeenan, & Daly-Lesch, 2019) among different groups of teacher educators,

including highly experienced teacher educators (i.e., professors). Collaborative coaching can promote mutual learning, support school mentors, foster professional growth, and can be beneficial for the learning and development of pre-service teachers (Alger & Kopcha, 2010; Nguyen, 2009; Wetzel et al., 2018).

In regard to PhD candidates' need for EBT professionalization, university structures may support them by giving them time to become familiar with the local school structures and motivate them to participate in graduate courses that discuss the literature in teacher education and learning how to teach (Zeichner, 2009). Most PhD candidates have the research knowledge base but they often do not identify themselves as teacher educators because they are unaware of the methods provided by the research on how to support pre-service teachers learning and how to transfer the knowledge acquired from research into their own teaching practice (Cochran-Smith & Zeichner, 2005; Smagorinsky, Cook, & Johnson, 2003).

2.6 Limitations

One limitation of this study is that the EBT instrument is a self-reported measure. This might suggest that educators' answers were subject to social desirability, a risk that must be addressed with any form of subjective data collection (Desimone, 2009). However, in the instrument development, piloting, and data collection process, measures were taken to reduce social desirability bias (e.g., assurance of "no right or wrong answers" and absolute confidentiality; exclusion of items including polarizing phrasing). With that said, presence of response biases cannot be excluded. However, and because no ceiling effects were reported, this consideration is rather limited given the high variation expressed in the standard deviation. Therefore, further validation of the new EBTS scale is recommended for future research along with the collection of observational data. With observational data, researchers

may capture how personal domain variables toward EBT affect educators' actual teaching practice.

This study focused on the exploration of the underlying factor structure of the EBTS. Further studies are required to confirm the proposed factor structure. A confirmatory factor analysis could be conducted including different samples of educators from all levels of university and pre-service teacher training (Babyak, 2004; Fokkema & Greiff, 2017). Further validation of the scale must also be considered since the present study refers to convergent and divergent validity results of self-developed measures. However, it is important to mention that the EBTS scale showed systematic differences between teacher educator groups, which can be interpreted as evidence for divergent validity. Future validation studies should supplement this study by collecting further evidence of convergent and divergent validity. While the current instrument was primarily developed for educators, the usefulness of the EBTS questionnaire for all teacher levels (Avalos, 2011; Borko, 2004) warrants further exploration.

2.7 Conclusion

The professional development of teacher educators has been gaining increased research interest (Lunenberg et al., 2014; Smith, 2003). This is particularly relevant when it comes to implementing reform efforts in teacher education (Darling-Hammond, 2006). This study investigated the personal domain variables (practical knowledge, self-efficacy beliefs, and attitudes) of teacher educators regarding the implementation of EBT as one current reform initiative of teacher education in Europe (Bauer & Prenzel, 2012).

Our study contributes to the field by introducing a newly developed instrument and providing information on its measurement quality. Moreover, the findings indicate that teacher educators indeed represent a heterogeneous group with systematic differences in EBT

knowledge, self-efficacy beliefs, and attitudes. Exposure and experience regarding research and the relation of personal domain variables seem to be an important factor that needs to be addressed to further the professional learning and development of teacher educators (Smith, 2011).

3. Study 2 - Evidence-Based Teaching in Teacher Education: The Role of Self-Efficacy Beliefs and Practical Knowledge

3.1 Introduction

The gap between research and practice in teaching has been largely discussed in the teacher education literature (e.g., Broekkamp, & van Hout-Wolters, 2007; Korthagen, 2007). Recent studies in teacher education emphasize the implementation of evidence-based teaching practices as a way to bridge this gap (Bauer, Prenzel, & Renkl, 2015; Wiseman, 2010; Slavin, 2002). Evidence-based teaching (EBT) and in particular research evidence is considered a vital knowledge base for teachers, which can provide a sound basis for action (Davies, 1999).

The necessity for the implementation of EBT practices has been also increasingly fostered by national and international standards, which highlight the need for strengthening the professional profile of all teaching professions (European Commission, 2012). Thus, teachers are expected to use research evidence to inform their everyday school practice and to combine the evidence with their personal judgment and experience (Davies, 1999). Because teacher educators act as 'the teachers of the teachers' (Kelchtermans, Smith, Vanderlinde, 2018), their role in fostering EBT practices in the teaching profession is of great importance (Darling-Hammond, 2016). In this study, we are particularly interested in university based teacher educators.

For teacher educators, research is an important developmental path (Guberman & Mcdossi, 2019) because it is crucial for their professional learning (Livingston, McCall, & Morgado, 2009). While studies on teacher educators professional learning and development show that research plays a significant role in teacher education (Ping, Schellings, & Beijaard, 2018) there is only few research on the personal factors that foster EBT implementation (Tack & Vanderlinde, 2014). The implementation of research evidence into teacher educators

teaching practices requires that they know about research evidence, they know how to use research evidence and at the same time they believe they are able to use it (i.e., self-efficacy).

This study, addresses two main gaps in the literature: First, prior studies only focused on the investigation of teacher educators' attitudes toward research (e.g., Tack & Vanderlinde, 2014), this study adds on previous literature by examining the interplay between teacher educators research exposure and frequency of use of empirical evidence mediated by practical knowledge and self-efficacy beliefs (see Fig.4). In addition, we explore teacher educators' challenges and facilitators to EBT in order to build a knowledge base, which will support EBT professional development initiatives targeted to teacher educators needs.

3.1.1 Evidence-Based Practice in Teacher Education

Evidence-based practice is becoming more and more important in the field of teacher education because of its critical role in teachers' professional learning and development (Bauer & Prenzel, 2012; Wiseman, 2010). Teachers and teacher educators are expected to act upon and apply empirical evidence in their daily teaching practice (Haberfellner & Fenzl, 2017). Evidence-based practice was initially introduced in medicine in an attempt to bridge the research-practice gap (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). Similar to medicine, the introduction of EBP in education was the result of a criticism teaching has long faced as a profession. First, for its resistance to change, and second, for the discrepancy between scientific research findings and actual teaching practice (Slavin, 2002).

Defining EBT is a critical issue in teacher education and is not without controversy. Since EBT was introduced to the field of education, numerous, sometimes conflicting, definitions have been provided (Bromme, Prenzel & Jäger, 2014; Groccia & Buskist, 2011; Stark, 2017; Wrigley, 2015). The main disagreement refers to the role that experience and professional judgment play in implementing evidence into teaching practice. Based on Davies (1999), one

of the pioneers in the field of EBT in education, EBT is not a “cookbook” but a guiding resource that goes hand in hand with practitioners’ experience. Both, evidence and experience have the goal of improving teaching practice. Thus, in this study, we follow the definition of EBT by Davies who described it as “a set of principles and practices which form the basis upon which practitioners make professional judgments and deploy their expertise” (Davies, 1999, p. 118).

3.1.2 Teacher Educators Research Exposure

University-based teacher educators are a professional group who are responsible for the initial and on-going education of pre-service teachers (European commission, 2013; Kelchtermans, Smith, & Vanderlinde, 2018). Identifying the role of teacher educators can be challenging since they work as mediators between the academic world, the world of teacher education and the world of practising teachers (Reynolds, Ferguson-Patrick, & McCormack, 2013). In almost all European countries becoming a teacher educator requires no formal preparation and many times only minimum support from more experienced colleagues (Wilson, 1990).

Teacher educators are hired by universities based on their teaching qualifications and teaching experience (Guberman & Mcdossi, 2019). Because their main task is teaching, the ones who have teaching experience in schools, feel more confident since this is their chosen career and that is the main reason they are recruited as teacher educators. However, teaching pre-service teachers about teaching is different from teaching pupils in school. Teacher educators are expected to familiarize with research in the teacher education field and to engage in research in order to improve their own quality of practice (Cochran-Smith, 2005; Loughran, 2014; Vanassche & Kelchtermans, 2015).

Tack and Vanderlinde (2014) investigated teacher educators' attitudes to research and they found out that active researchers have positive attitudes towards research and because they are involved in research themselves, they contribute to the knowledge base of teacher education. This is because researchers who are also working as teacher educators are able to supervise their students' research projects, to conduct their own research and to publish their findings, and, thus, they actively advance the evidence base in teacher education.

In contrast to the positive attitudes toward teaching, teacher educators' attitudes toward professional development in research are mixed (Griffiths, Thompson & Hryniewicz, 2014). Teacher educators with less exposure in research, especially the ones who come from school rather academia or the ones who are not engaged in research, feel underestimated by their colleagues and the university structures. The lack of motivation and self-efficacy beliefs leads them to neglect participation in research activities for the improvement of their research skills (Meeus, Cools & Placklé, 2018). To summarize, teacher educators with higher research exposure and positive experiences in research might feel more confident about research while their counterparts might have difficulties to cope well with research (Czerniawski, Guberman, & MacPhail, 2017; Zeichner, 2005).

3.2 Building a Framework for Teacher Educators Personal Factors

In the context of the current EBT reforms, we discuss teacher educators' professional development from the perspective of developing teacher educators' practical knowledge and self-efficacy beliefs toward research. Since EBT has its roots in medicine, it is reasonable to build on the knowledge base of the field. Thus, we based our investigation on work that has been done in medical education by Miller (1990). Miller's pyramid has its roots in constructivism and situated learning theories, and is similar to Blooms taxonomy (Constantinou, Papageorgiou, Samoutis & McCrorie, 2018).

This model helps us to match learning outcomes with what we might expect the learner to be able to do at any stage of her or his professional development. The pyramid is usually described, as having four levels: knowing, knowing how, showing, doing. The first two levels are summarized under the cognitive aspects and the second two under the behavioural aspect. In order for professionals to apply in practice, new reforms such as the EBT reform they need to fulfil all four levels stated above. In the present study, we investigate the first two levels or the cognitive aspect by measuring teacher educators' practical knowledge and self-efficacy beliefs. In addition, we investigate the 'doing' level or the behavioural aspect by measuring how often teacher educators implement EBT practices in their classrooms.

3.2.1 Teacher educators' practical knowledge and self-efficacy beliefs

Research on teacher educators' knowledge in practice focuses on various topics. Like school teachers, teacher educators are more in the 'doing' environment than in the 'knowing' environment (Beijaard, Verloop, & Vermunt, 2000), and it is hard for researchers to understand how they interpret, personalize and integrate theory into action. Therefore, it is reasonable to investigate their practical knowledge, which we define as the amalgam of experiential knowledge, formal knowledge, and personal beliefs (Cochran-Smith & Lytle, 1999; van Tartwijk, den Brok, Veldman, & Wubbel, 2009).

Teacher educators are expected to know where and how to find relevant research, to be critical readers, and to know how to apply this knowledge to their own higher education teaching practice (Elstad, 2010; Murray et al. 2009). Thus, understanding teacher educators' judgments regarding their practical EBT knowledge seems to be a relevant target for EBT-related learning and professional development. Drawing on the existing literature on practical knowledge, it can be assumed that research-related experience of teacher educators is positively associated with practical EBT knowledge (Fenstermacher, 1994; Zanting, Verloop & Vermunt, 2001) and frequency of EBT implementation.

We also measure teacher educators' self-efficacy beliefs, which refer to "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific task in a particular context" (Tschannen-Moran, Hoy, & Hoy, 1998, p. 233). Self-efficacy beliefs are assumed to play an important mediating role along with knowledge to one's actions (Bandura, 1997). For instance, self-efficacy beliefs are related to the way teachers teach, learn how to teach, how much effort they put into their actions (Tschannen-Moran & Woolfolk Hoy, 2001, 2007), and their level of commitment to teaching (Chan, Lau, Nie, Lim, & Hogan, 2008; Somech & Bogler, 2002). This is the first study to investigate the role of self-efficacy beliefs in the interplay between teacher educators research exposure and EBT implementation.

Teachers' with high self-efficacy are more open to new challenges, eager to find new methods to meet their students' needs, and generally willing to adopt new ideas and teaching approaches (Tschannen-Moran & McMaster, 2009). Thus, we assume that highly self-efficient teachers are also more willing to learn and reflect on their own abilities regarding EBT. We also assume that self-efficacy beliefs will act as mediator in the interplay between teacher educators' research exposure and frequency of EBT implementation.

3.2.2 The Association between Teacher Educators' Practical Knowledge, Self-Efficacy Beliefs and Teaching Practice

Like teachers, teacher educators' practical knowledge and self-efficacy beliefs have an impact on their teaching practices and behaviours (Hu, Fan, Yang & Neitzel, 2017). Theory suggests that knowledge and beliefs can mediate change in actual teaching practice (Hamre et al., 2012). Fives (2003) mentions that self-efficacy is the main mediator of effort or classroom action. In addition, Ernest (1989) in his descriptive model suggests that knowledge has a direct relationship with teachers' actions in classroom. Both practical knowledge and self-

efficacy beliefs influence teachers' instructional practices, thus, it is reasonable to investigate their mediating role in relation to how frequently one implements EBT practices.

3.3 Aim of the study

Understanding the relationship between teacher educators' research experience, practical knowledge, self-efficacy beliefs and frequency of EBT implementation plays a pivotal role in fostering teacher educators' professional development and improving their teaching quality. In this study, we attempt to understand whether increased research exposure can reinforce and strengthen the frequency of EBT implementation in the university classrooms. We also aim to understand whether teacher educators' practical knowledge and self-efficacy can be the mediators in the interplay between research exposure and EBT use. In addition, we seek to understand teacher educators' views regarding the biggest challenges and facilitators to increase EBT practices in universities. Thus, we propose the following research questions:

1. Are practical knowledge and self-efficacy beliefs mediators of the relationship between teacher educators' research experience and the frequency of EBT use?
2. What are the views of teacher educators about the biggest challenges and incentives to increase the frequency of EBT use in university? Are there any differences based on teacher educators' research exposure?

3.4 Method

We used a correlational design and survey methods to investigate the role of research experience, practical knowledge and self-efficacy beliefs of teacher educators towards the use of evidence-based teaching practice. In addition, we explored teacher educators' views about the challenges and incentives to the use of EBT. As a teacher education context, we chose the example of German-speaking countries (Germany, Austria, and the German speaking part of Switzerland) and the United Kingdom, all with a long history in teacher education. Teacher

educators were recruited into the study via e-mail or through an institutional research subject pool. Teacher educators gave informed consent before participation.

3.4.1 Participants

A total sample of *N* = 243 teacher educators (60% female) completed the study, ages ranging from 23 to 68 (*M* = 44, *SD* = 11.55). The sample included teacher educators from Germany (*n* =152), the German speaking part of Switzerland (*n* = 40), Austria (*n* =22) and the United Kingdom (*n* = 28). One participant did not state her or his country of origin. Research exposure was measured based on teacher educators university position and we identified the five following groups: school mentors (group 1: *n* = 33), teaching associates (group 2: *n* =17), PhD candidates with teaching obligations (group 3: *n* = 80), post-doctoral researchers with teaching obligations (group 4: *n* = 23) and professors (group 5: *n* = 90). Teaching experience ranged from 5 months to 43 years (M = 11, *SD* = 8.80).

3.4.2 Instrument

In order to examine teacher educators' practical knowledge and self-efficacy beliefs toward the use of evidence-based teaching strategies we used a 6-point Likert scale, with 6 being the highest level of agreement. The scale consisted of 2 subscales with 15-items in total (10 items measuring practical knowledge and 5 items measuring self-efficacy beliefs). The two subscales, practical knowledge and self-efficacy beliefs, were taken out of a newly developed and validated scale with 25-items measuring teacher educators practical knowledge, self-efficacy beliefs and attitudes towards EBT (Georgiou, Mok, Wiesbeck, Fischer, & Seidel, 2019). A similar 6-point Likert scale was used to measure challenges and incentives of EBT use. The scale was based on literature on barriers and facilitators published in medical education and social work (e.g. Leasure, Stirlen, & Thompson, 2008; Pagoto et al., 2007). A 10-point frequency scale ranging from 0 (no use) to 10 (EBT use ten or more than ten times a semester)

was used to measure teacher educators' frequency of use of EBT strategies during a time period of a semester. An explanation about the term 'Evidence-based practice' was provided in the introduction to the survey. This way we ensured that all participants had a similar information basis regarding the EBT concept. Finally, research experience was measured based on teacher educators' university position.

3.4.3 Analysis Plan

In this study, we hypothesize that teacher educators' research experience affects their practical knowledge and their self-efficacy beliefs, which, in turn, affect the frequency of EBT implementation in university classrooms (research question 1). As such, we ran a set of mediation analyses. First, we investigated separately the relationships between teacher educators' research experience and frequency of EBT implementation with self-efficacy beliefs as a mediator. Then we run a second model to investigate the relationship between teacher educators' research experience and frequency of EBT implementation with practical knowledge as a mediator. At last, an overall hypothesized model with both mediators added to the model was calculated (figure 4).

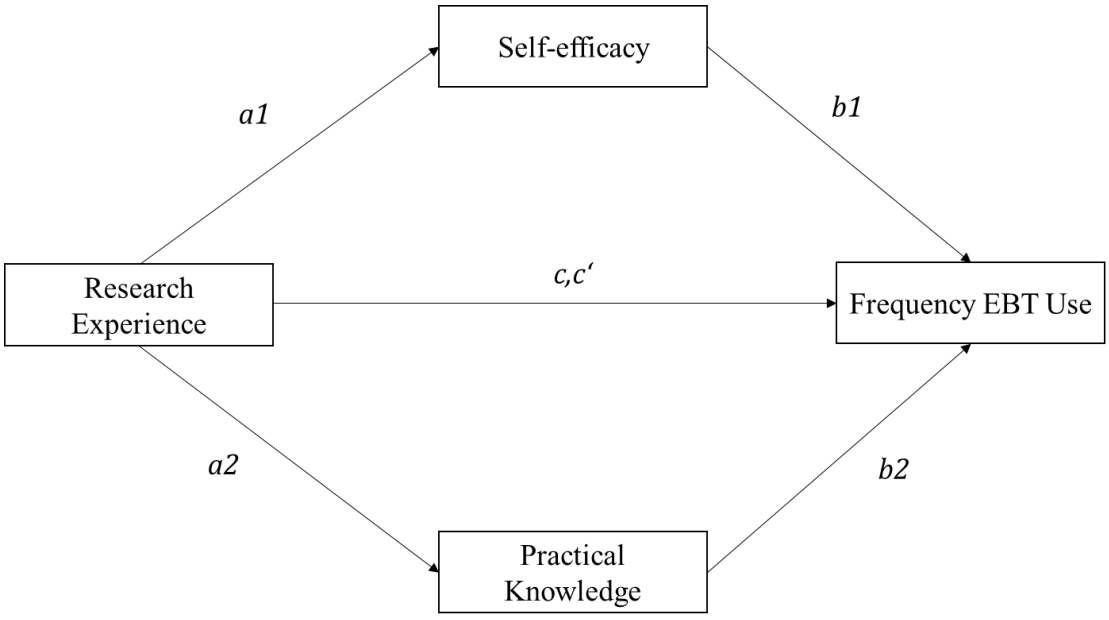

Figure 4. Hypothesized model

In this model, the path *c* is the original direct effect of research experience on frequency of EBT implementation without the mediators (practical knowledge and self-efficacy beliefs), while c' is the direct effect of research experience on frequency of EBT implementation when the mediators are included in the model. Paths a_1, a_2 and b_1, b_2 represent the effect of research experience on practical knowledge and self-efficacy beliefs and that of both mediators on frequency of EBT implementation, respectively. For each of the respective models, the product of *ab* is the indirect effect (Preacher & Hayes, 2004) e.g., in the case of model 1, a_1 and b_1 represent the mediation effect of self-efficacy beliefs to the frequency of EBT implementation. For testing the mediation effect *ab*, we used the bootstrapping procedure in PROCESS model 4 macro Version 3.3 (Hayes, 2018) by obtaining the bias-corrected bootstrapped confidence interval limits.

In order to answer the second research question of the study, we analysed teacher educators' views on challenges and facilitators of EBT use descriptively. To capture any differences between teacher educator groups based on their research exposure, we performed analysis of variance (ANOVA) on all challenges and facilitators as dependent variables, with teacher educators' research exposure defined as independent variable. Then we performed univariate comparisons to explore the differences across the teacher educator groups.

3.5 Results

In the following section, we present descriptive statistics of teacher educators research experience, practical knowledge and self-efficacy beliefs and frequency of EBT use. Next, the results associated with the mediating effect of research experience on the two mediators and the outcome variable are described. Results regarding teacher educators' views about challenges and possible ways to foster EBT use are also provided. Finally, differences between the groups of educators and their views on challenges and facilitators are presented. When

necessary homogeneity of variance was assessed by Levene's Test for Equality of Variances. Results showed homogeneity of variance among the different teacher educator groups.

3.5.1 Descriptive Statistics

Table 5 shows the descriptive statistics of teacher educators' practical knowledge, self-efficacy beliefs and frequency of EBT use for the whole sample and for every group of teacher educators based on their research experience measured by their university position. Overall, teacher educators reported to be relatively knowledgeable about EBT practices. The sample mean for the practical knowledge scale was 4.80 (*SD* = 0.60) out of possible 6 points, with a range of 1 to 6. Accordingly, they also reported rather high self-efficacy beliefs (*M* = 5.10, *SD* = 0.70) about the implementation of EBT practices. Professors reported the highest practical knowledge of the 5 groups, and teaching associates the lowest. Professors reported once more the highest values in self-efficacy beliefs and this time school mentors the lowest. Teacher educators reported moderate use of EBT practices. The sample mean was 7.00 (*SD* = 2.34) out of possible 10 points, with a range of 0 to 10. Professors reported to use EBT practices more often than all other groups of teacher educators with teaching associates being the group with the lowest reported frequency of EBT use. In general, professors who are more exposed to research showed descriptively higher values for all three scales, while teaching associates and school mentors with less exposure to research reported the lowest values.

3.5.2 Practical knowledge and self-efficacy beliefs as mediators between teacher educators` research exposure and frequency of EBT use

The results of the mediation analyses for all three models are reported in Figure 5. The total effect *c* of teacher educators' research experience on the frequency of EBT use was statistically significant for all models. Next, a significant coefficient *a* relating teacher educator's research experience to the hypothesized mediators – practical knowledge and self-

efficacy beliefs was confirmed. The coefficient *b* for both practical knowledge and self-efficacy beliefs was statistically significant. The mediation effect was shown to be statistically significant ($a_1b_1 = 0.149$, $p < 0.05$; $a_2b_2 = 0.073$, $p < 0.05$). Once the mediators were included into the model, the direct effect *c*' was still statistically significant for both models. However, when both mediators included in the same model only self-efficacy beliefs remained a significant mediator.

These findings support the prediction that teacher educators' research experience is related to the frequency of EBT use in university classrooms. Furthermore, teacher educators' practical knowledge and self-efficacy beliefs function as mediators between their research experience and their practice. However, self-efficacy beliefs seem to be a stronger predictor of how frequently one uses EBT practices than practical knowledge. The mediation effect of practical knowledge on the frequency of EBT use accounts for 25% of the total effect, and the mediation effect of self-efficacy beliefs on the frequency of EBT use accounts for 33% of the total effect. Thus, our hypothesis that self-efficacy beliefs act as a mediator between research exposure and frequency of EBT use is confirmed. Concerning practical knowledge, our hypothesis is partially confirmed since practical knowledge does not remain a significant mediator when both mediators are added in the same model.

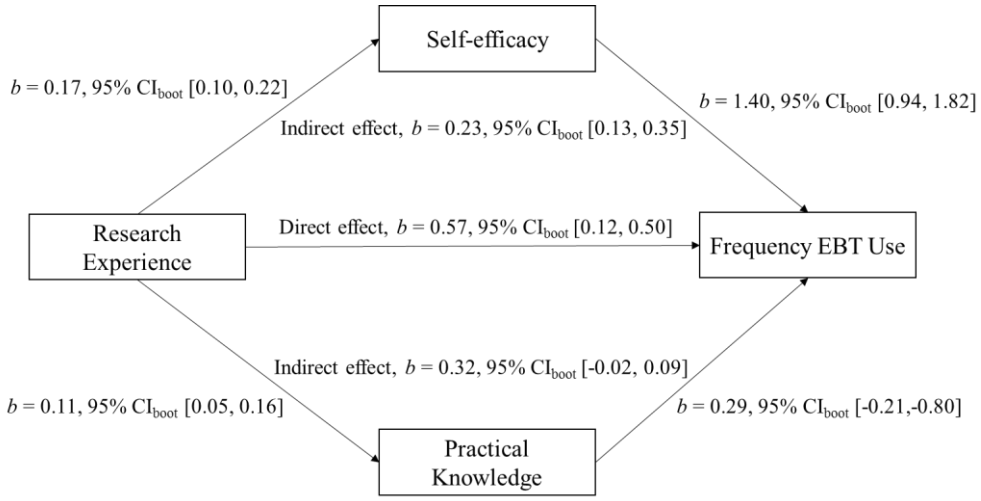

Figure 5. Mediation model

3.5.3 Challenges and facilitators for achieving EBT practices in university classroom

Tables 5 and 6 summarize the mean overall scores in respect to the items referring to challenges and facilitators to EBT implementation. Differences between the groups are depicted also in the tables. The findings indicate that time was perceived as the biggest challenge to the implementation of EBT practices among teacher educators, followed by lack of critical appraisal skills. Significant differences identified between professors, teaching associates and school mentors. Professors reported feeling more time pressured than teaching associates and school mentors. The lack of evidence in the literature and the gap between research and practice were also perceived as challenges to EBT implementation.

Staying up to date with the newest literature, EBT training and evidence evaluation skills were not identified as challenges to changing practice on the basis of best evidence. However, significant differences were identified between professors and teaching associates in regard to the need of EBT training. Significant differences were also identified in regard to the evaluation skills one needs to find the best available evidence between professors, PhD candidates and school mentors.

As for the facilitators, teacher educators reported that access to literature and critical appraisal skills are equally important to the implementation of EBT. Teacher educators' also reported that research experience, teamwork and development of evidence-based databases can facilitate the use of EBT. Concerning teacher educators research experience significant differences were identified between professors and teaching associates, where professors scored significantly higher than their counterparts. Teacher educators did not agree with the idea that the more involved they are in the development of evidence-based databases the more they implement EBT practices.

3.6 Discussion

The aim of the present study was to investigate the relationship between teacher educators' research exposure and frequency of EBT implementation in the university classrooms. In detail, we aimed to understand whether personal factors, such as practical knowledge and self-efficacy beliefs, act as mediators in the interplay between research exposure and EBT use (research question 1). In addition, and in order to provide better support to teacher educators professionalization we investigated the biggest challenges and facilitators to increase EBT practices in universities (research question 2).

Based on the descriptive findings of our study, teacher educators generally reported high practical knowledge and self-efficacy beliefs. Research in medicine (e.g., Johnston et al., 2003) and in teacher education (e.g., Reddy et al., 2017) shows that personal factors such as attitudes are related to professionals' use of evidence in practice. This study expands research by investigating the role of two additional personal factors for teacher educators, namely practical knowledge and self-efficacy beliefs. In order to enrich literature, we further aim to explore the mediating role of both practical knowledge and self-efficacy beliefs in the relationship between teacher educators' research exposure and frequency of EBT implementation.

A significant direct association was found between teacher educators' research exposure and practical knowledge and self-efficacy beliefs, respectively. We also identified a significant indirect relationship between teacher educators' research exposure and frequency of EBT use. In detail, our results suggest a mediating effect of teacher educators' self-efficacy beliefs on the frequency of use of EBT practices. Thus, teacher educators' self-efficacy beliefs may be an important indicator of how frequently teacher educators decide to implement EBT practices in their own teaching practice. This finding is in line with previous findings in teacher education literature where the role of self-efficacy has been widely investigated.

In detail, teacher education literature discusses the relationship of teachers' beliefs to teachers' planning, instructional decisions and teaching practices (Pajares, 1992). Bandura (1993) and Pajares (1996) showed that skills, competence and knowledge are less strong predictors of teachers' behaviours and actions while beliefs and in particular self-efficacy beliefs drive teachers' actions. Self-efficacy is a key construct to understand how teachers make decisions, feel and perform at work (Vera, Salanova & Martin-del-Rio, 2011). It also plays an important role because it works as a predictor of teachers' teaching practice and motivation to teach (Bandura, 1997). Self-efficacy is also useful for shaping cognitive judgments like job satisfaction. Knowing how to apply something and being able to apply it in practice does translate into job satisfaction, if one does not feel self-efficient (Moè, Pazzaglia & Ronconi, 2010).

In our study, practical knowledge seemed to be a mediator in the interplay between teacher educators' research exposure and frequency of EBT use. However, when practical knowledge was entered together with self-efficacy beliefs as mediators in the same model, practical knowledge mediating role was not strong enough to be significant. This finding indicates that, in this interplay self-efficacy beliefs play the most important role in the implementation of EBT strategies. Knowledge or practical knowledge may be insufficient, our research suggests that teacher educators need to feel able to apply their knowledge in order to implement EBT in their classrooms. The fact that teacher educators know how to apply basic EBT strategies does not necessarily mean that they feel able to do it. Thus, higher institutions and professional development initiatives should focus on fostering teacher educators' self-efficacy beliefs and not only knowledge related skills.

Regarding the second research question, teacher educators reported struggling with resource-related and not with knowledge-related challenges. Time constraints, poor critical appraisal skills and difficulty to bridge the gap between research and teaching practice were

identified as the biggest challenges. These findings are in line with previous research in medicine (e.g., Sullivan, Wayne, Patey, & Nasr, 2017) and in teacher education (Brown & Zhang, 2016), where time is considered as a major challenge for the implementation of evidence-based practices. Time pressure seemed to be significantly more prevalent for professors than for teaching associates and school mentors. This is because, professors have a multifaceted role in academia since they have to work as researchers, they have to publish their work and teach at the same time. In addition, they can spend a great amount of time working on administrative tasks and thus they do not have enough time for teaching (Lunenberg, Korthagen, & Swennen, 2007).

A recent study about teacher educators' learning needs (Czerniawski et al., 2017) also emphasized the need for time availability and the development of further research skills, such as critical appraisal skills. Recent initiatives that offer summaries of current findings in educational research such as the 'What Works Clearing House' in the US, the Educational Endowment Foundation in the UK, or the [blinded for submission] (Seidel, Mok, Hetmanek, & Knogler, 2017) can be of great help for teacher educators. These initiatives minimize the time one needs to search, select, rate and decide about the best available evidence e.g. for using a certain teaching strategy. Thus, they offer an easy to access knowledge base for teacher educators' professional development (Tack, Valcke, Rots, Struyven, & Vanderlinde, 2017).

In order to tackle teacher educators' needs for EBT professional development, we also asked them about the potential facilitators, which could support them to use EBT practices more frequently. Our findings show that access to evidence based databases, research exposure, critical appraisal skills and better communication among teacher educators of all levels could facilitate the use of EBT and bridge the gap between research and practice.

Similar results reported in previous research in the health professions (Pagoto et al., 2007) and in teacher education (Langley, Nadeem, Kataoka, Stein, & Jaycox, 2010).

Another major finding of our study concerns the differences between teacher educators with different levels of research exposure. Descriptive differences were identified among the different groups of teacher educators. Teacher educators with higher research exposure in general reported higher practical knowledge and self-efficacy beliefs and higher frequency of use of evidence into their teaching practice. This is because teacher educators who are already involved in both research and teaching are required to know how to use evidence and how to interpret it in their daily practice. On the contrary, teacher educators who only teach at the university are less exposed to research and thus, they report lower practical knowledge and self-efficacy beliefs as well as lower use of EBT practices.

Teaching associates, young researchers and school mentors would benefit from professional development trainings, which would foster their research skills, such as trainings on evaluation of research studies and understanding of basic statistical methods (Lunenberg & Willemse, 2006). University structures should also foster collaborations between low and high research exposed teacher educators in order to advance young educators self-efficacy beliefs and EBT implementation (Smith, 2003). Therefore, future research should focus on the development of EBT professional trainings tailored upon the needs of less research exposed teacher educators.

3.7 Limitations

Although important findings were outlined in this study, several limitations must be addressed in future research to better understand, which factors should be the focus of the EBT professional development efforts for the heterogeneous group of teacher educators. This study only measured the mediating role of practical knowledge and self-efficacy beliefs in the

interplay between teacher educators' research exposure and frequency of use of empirical evidence. Teacher knowledge can include pedagogical knowledge, content knowledge, knowledge of the learner (Shulman, 1987). Beliefs can also include self-concept, self-esteem and can be also subject specific (Pajares, 1992). Because the role of personal factors is scarcely investigated in the teacher educators' literature researchers are encouraged to include other mediators in the model.

Additionally, we used self-reported measures, which are prone to social desirability biases. However, and because no ceiling effects were reported, this consideration is rather limited given the high variation expressed in the standard deviation. It is important to mention though that we took measures to address this issue. We first stressed that there are no right or wrong answers in the introduction section of the survey and as a follow up step, we assured confidentiality to the participants.

3.8 Conclusion

Teacher educators belong to a heterogeneous group of teachers with various work duties, which involve either only teaching or teaching and research, thus, there is a variation on how research exposed they are. Because of these differences, teacher educators may also experience differences in their practical knowledge and self-efficacy beliefs, differences that may affect the implementation of evidence in their teaching practice. In the interplay between self-efficacy beliefs and practical knowledge, self-efficacy plays a more important role concerning EBT implementation in practice. The fact that teacher educators know how to apply EBT practices seems to be less significant regarding EBT implementation. Like teachers, teacher educators need to feel able to implement certain practices (in this case EBT practices) in order to do apply them in practice.

Moreover, because teacher educators come from different backgrounds, they have different needs for professional development. In order to design trainings tailored upon their individual needs, it is important to understand the challenges they face and the potential facilitators that could foster EBT use. University structures should consider investing in professional trainings of less research exposed teacher educators in order to boost their self-efficacy. This measure along with possible collaborations between high and low experienced teacher educators could further support teacher educators EBT professional development and EBT implementation. Finally, like in medicine with the Cochrane library (Jadad & Haynes, 1998) successful application of research evidence to teacher education can be fostered with the support of evidence-based databases like the clearinghouse databases in the USA and in other European countries.

4. General Discussion

This section presents an overall discussion about the studies presented in this thesis. The first section provides a summary of the two studies. The general discussion continues with important theoretical, methodological and practical implications for researchers and practitioners in the domain of evidence-based teaching. In detail, it adds to the scarce literature on teacher educators' professional development by highlighting the aspects from the presented studies that are relevant for improving our understanding about evidence-based teaching within the university setting. The section continues with the discussion of relevant aspects to consider for the implementation of evidence-based teaching practices in this context, and discusses the importance of investigating personal domain variables before initiating an educational reform, such as evidence-based practice. This section is followed by a summary of the limitations within the presented studies, and finally, the general discussion closes with suggestions for further research.

The main goal of the discussion, in particular, within the two sections about the implications of the results, is to provide answers to the questions raised in the introduction of this thesis regarding the aims of this investigation. The first goal was to explore the psychometric structure of an evidence-based teaching scale developed based on instruments from the medical field. The second aim was to demonstrate how this instrument works for the investigation of personal domain variables, particularly self-efficacy beliefs and practical knowledge, and their role in the interplay between teacher educators research experience and the frequency of their evidence implementation. The section discussing the theoretical and methodological implications will address the questions regarding the distinct nature of personal domain variables, the need to measure personal domain variables in an evidence-based context, and the differences among university-based teacher educators and their

different needs for professional learning and development. This section will also discuss the role of self-efficacy and practical knowledge in the interplay between educators' research exposure and frequency of evidence implementation. In general, this part reflects on the need for measuring teacher educators' personal domain variables, the need for further professionalization of teacher educators, and it establishes a knowledge-base for further studies on teacher educators' personal domain variables as well as evidence-based teaching in tertiary education.

4.1 Summaries of the presented studies

4.1.1 Study 1

Study 1 explored the contribution of personal domain variables toward the implementation of evidence-based teaching practices. In detail, this study aimed to first develop and empirically test an instrument to investigate teacher educators' practical knowledge, self-efficacy beliefs and attitudes toward evidence-based teaching practices. The first part of the study focused on the psychometrics and validation of the developed instrument. The second part of the study focused on the potential differences among teacher educators based on their research experience, with the aim of enhancing the validity of the instrument and adding to the literature concerning teacher educators' individual needs for professionalization.

In order to fulfil the first aim of this study, first a review of the literature was conducted. The findings from this review did not uncover any applicable instruments within the educational field, thus the search was broadened into other fields such as medical education and medicine. Since evidence-based practice has its roots in medicine, this extended search found various instruments investigating medical professionals' opinions regarding evidence-based practice. Considering this study focuses on personal domain

variables, the review only included instruments measuring practitioners' knowledge, beliefs and attitudes, while all other instruments from our search were excluded. A total of one hundred and seventy-nine items were selected after the literature search. An extensive piloting phase followed with two phases of expert interviews. This concluded, with a pilot study with 30 teacher educators. The result of this extensive piloting reduced the instrument to a 47-item scale. This instrument was then distributed for further analysis to teacher educators in four countries with long history in education (Germany, Austria, Switzerland, and United Kingdom).

The second aim of the first study was to add to the scarce literature on teacher educators' differences as a professional group. Tack and Vanderlinde (2016) presented one of the very few studies investigating teacher educators differences based on their research exposure. However, their sample only included teacher educators who were employed in schools working as mentors, not teacher educators in universities. This study sheds light on the group of teacher educators who are mainly employed by universities and who educate pre-service teachers within the varying contexts, such as professors and school mentors. The investigation of the differences among these heterogeneous groups of educators aims to enhance our empirical and theoretical understanding concerning teacher educators' viewpoints toward EBT. Moreover, it lays the groundwork for developing further evidence-based professional developments tailored to the different needs of teacher educators. Additionally, it strengthens the validity of the developed instrument by discriminating between the sub-groups of teacher educators.

Overall, Study 1 showed that the developed instrument demonstrated good reliability and validity. This study provided the research community and practitioners with a 25-item instrument that can be used for further study of in-service and pre-service teachers' personal domain variables toward evidence-based teaching. Study 1 also established a knowledge base

for further investigation of the differences among different groups of teacher educators from different countries within Europe. In particular, this study included German-speaking countries in the European and international discussion about the role of teacher educators in research, their research exposure, and their needs for further professional development in research. Study 1 is the first study to investigate German-speaking teacher educators' professionalization and include them in the literature which, to date, mainly comes from the Netherlands and the United Kingdom. In short, study 1 sets the knowledge base for the development, validation and reliability of an instrument measuring teacher educators' practical knowledge, self-efficacy beliefs and attitudes toward evidence-based teaching practices which is generalizable to a more international context. The study also provided first insights on teacher educators' differences about their research exposure and needs for professional development.

4.1.2 Study 2

Based on the conclusions and lessons learned from Study 1, with Study 2 we aimed to better understand the role of personal domain variables in the interplay between teacher educators' research exposure and frequency of evidence-based teaching implementation. The focus of Study 2 was on practical knowledge and self-efficacy beliefs because, based on Study 1, these two variables were significant for evidence-based teaching implementation. Furthermore, Study 2 addressed a gap in research and literature, since prior studies (e.g., Tack & Vanderlinde, 2014) only focused on the investigation of teacher educators' attitudes toward research activities. Study 2 explored a hypothesized mediation model with practical knowledge and self-efficacy as potential mediators on the impact teacher educators' research exposure (independent variable) had on the frequency of their evidence-based teaching implementation (dependent variable).

To reach these objectives, the questionnaire developed in Study 1 was administered to 243 teacher educators. As mentioned above, the sample included teacher educators from four different countries, where three of them were German speaking. Like in Study 1, the sample included five teacher educator groups: (1) school mentors, (2) teaching associates, (3) PhD candidates with teaching duties, (4) post-doctoral researchers with teaching duties, and (5) professors. The descriptive findings of Study 2 showed that teacher educators generally report high practical knowledge and self-efficacy beliefs. The mediation analysis revealed that self-efficacy beliefs play a highly significant role in the interplay between teacher educators' research exposure and frequency of evidence implementation. Practical knowledge did not significantly contribute to the mediation model. These findings leads us to believe that higher institutions and professional development initiatives should particularly focus on fostering teacher educators' self-efficacy beliefs about their knowledge related skills.

Overall, Study 2 concluded that self-efficacy beliefs play an important role concerning evidence implementation in teaching practice. The study also highlighted the need for professional development trainings tailored towards teacher educators' needs and to enhance their self-efficacy beliefs. Moreover, Study 2 provides a knowledge base regarding the difficulties teacher educators face concerning the implementation of research in their own practices. This knowledge base can support university structures to gain a better understanding of the improvements they have to make to foster evidence-based teaching practices in university classrooms. Finally, Study 2 proposes different ways to foster evidence-based teaching implementation. It discusses the need for databases that can help educators to successfully apply evidence-based practices, the development of trainings tailored to educators' specific needs, and the need for collaboration between high and low research-experienced groups.

4.2 Theoretical and methodological implications

The introduction of this thesis described the importance of investigating teacher educators' personal domain variables at the start of a reform because knowledge, beliefs and attitudes constitute the starting point for change (e.g., Haney, Czerniak & Lumpe, 1996; van Driel, Beijaard & Verloop, 2001). During the past 20 years, there have been calls in the literature to make teaching and teacher education more respected professions (Darling-Hammond, 2005; Goodlad, 1991, 1990). This development of professionalism starts with changes in teachers' instructional practices and in particular, by adopting evidence-informed teaching practices (Slavin, 2002).

However, teachers and teacher educators (in this thesis) need to know how to implement evidence-informed teaching practices. They also need to feel able to implement them and develop positive attitudes toward the adoption of such reforms (Fleckenstein, Zimmermann, Köller, & Möller, 2015). The studies in this thesis have recognized this gap in the literature and tried to shed light on this issue by investigating the role of teacher educators' personal domain variables regarding evidence-based teaching in higher education. Both studies in this thesis have theoretical and methodological implications, which will be outlined in this section.

As mentioned above, the need to measure teacher educators knowledge, beliefs, and attitudes before the adoption of any reform lead us to first develop and then test the psychometric structure of an instrument stemming from already-validated instruments in medicine and medical education. The first study aimed to bring together the two fields of medicine and education, which had faced similar challenges with the implementation of evidence-based practice (Slavin, 2002).

Methodologically, Study 1 advanced the field by first providing the research and teaching community with an instrument that measured teacher educators' personal domain variables toward evidence-based teaching strategies. It then provided empirical and theoretical distinctions between the three investigated constructs. The study set the knowledge base to help clean up a messy construct, as Pajares (1996) mentions in his review study about knowledge, beliefs and attitudes. Theoretically, the study advanced the literature by providing insights into the heterogeneous group of teacher educators by empirically demonstrating that teacher educators professional development depends on their specific needs and research exposure.

The novelty of both studies lies in the fact that they initiated an investigation of German-speaking teacher educators' personal domain variables toward evidence-based teaching; a group of teacher educators that was not included in any other international study on teacher educators research-informed professionalization. German-speaking teacher educators are of particular interest due to the long history of teacher education in German speaking countries as well as the prevalent debate in Germany on the implementation of evidence-based reforms in education (e.g. Bromme, Prenzel, Jäger, 2014; Stark, 2017).

On an international level, research on teacher educators has mainly been conducted in countries where members belong to an international forum for teacher educator development, and where the discussion for research-informed teaching has its own place (Smith, 2003). In the following sub-section, we will discuss the theoretical and methodological implications of this thesis in further detail.

4.2.1 Implications regarding psychometric properties

Developing and validating an instrument can be a very demanding process since the researcher is responsible for making important decisions which will affect the research project

as a whole (Benson & Clark, 1982). The studies in this thesis, and in particular Study 1, try to shed light on the demanding process of following a multi-step and multi-method approach in the development and validation of the evidence-based teaching instrument. In detail, the developed evidence-based teaching scale was based on already-existing instruments from medicine and medical education. As mentioned in the introduction of this thesis, the knowledge base existing in medical education was used due to the lack of research in the teacher education field, the long tradition of evidence-based practices in medicine, and the need to explore whether such an adaptation would be considered meaningful in the teacher education field.

Study 1 had a strong focus on the development and psychometric testing of the evidence-based teaching scale. This study revealed a three-factor structure similar to the ones presented in the medical studies used as the basis for scale development. A discussion about the correlations identified among the scales provided a better understanding of the three constructs under investigation. Practical knowledge, self-efficacy beliefs and attitudes are complex constructs that are somewhat overlapping, while also maintaining features that make them independent from one another.

Study 1 confirmed the initial hypothesis about the commonalities and differences of the three constructs. Strong correlations were identified between the construct of practical knowledge and self-efficacy beliefs, a finding that supported the initial assumptions about the common variance shared between the two constructs. Medium correlations were identified between self-efficacy beliefs and attitudes, and between attitudes and practical-knowledge. From a methodological point of view, this finding supports the distinct nature between the three constructs.

The constructs significantly correlated with each other, but were not high enough to assume that the same construct was being measured (Cleare, Gumley, Cleare, & O'Connor,

2018). One important finding was the discrepancies in the correlations among attitudes and the other two scales. It is possible that the formulation of the items in the attitudes scale generated a positive tendency in university teacher educators' responses, and thus could have slightly affected the resulting correlations. Further research regarding the item development, especially within the attitude scale, is needed.

A first step towards the development of an attitude scale regarding educators 'dispositions' was made by Tack and Vanderlinde (2016), who investigated school-based teacher educators' research dispositions. The authors provided first insights about the psychometric structure of their scale, and they referred to theoretical distinctions between dispositions and attitudes, distinctions that should not be overlooked. Since dispositions and attitudes are different constructs, and because this thesis focuses on university based teacher educators' personal domain variables (practical knowledge, self-efficacy beliefs and attitudes), it was reasonable to focus on the development and validation of an instrument targeting each investigated variable, rather than confusing constructs such as attitudes and dispositions. This is why Study 1 is the first study focused on the development and psychometric testing of three rather 'messy' constructs (Pajares, 1992). It aimed to help advance the research and literature in teacher education by providing evidence between the distinctions of these constructs in relation to evidence-informed practice.

4.2.2 The complex construct of personal domain variables

The term personal domain variables refers to teachers' knowledge, beliefs and attitudes. In their paper about teachers' professional growth, Clarke and Hollingsworth (2002) propose a new model for teacher change, in which personal domain variables have its own significant place. The model recognizes the complexity of professional growth and the important contribution that personal domain variables have toward teachers' change through

their professional growth. In teacher education, and particularly in the literature on teacher educators, the discussion about educators' change and professional growth is scarce (White, Sakata, Avissar, Kools, & van der Klink, 2015).

Thus, this thesis focused on advancing the research and literature on teacher educators' professional growth regarding evidence-based teaching by investigating teacher educators' personal domain variables. Before discussing important implications about the heterogeneous group of teacher educators in detail, it is valuable to discuss the complexity of personal domain variables and the contribution of the study to cleaning up this messy construct (Pajares, 1992).

Ernest (1989) refers to the importance of investigating teachers' thought processes, such as teachers' knowledge, beliefs and attitudes, because these constructs are stored in teachers' mind as schemata and drive their actions. Knowledge, beliefs and attitudes affect teachers' behaviour in the classroom, and are essential to improve their professional preparation and teaching practices (Fang, 1996). Personal domain variables share similarities but also differ from one another (Pajares, 1992). One aim of the present thesis was to shed light on the complex construct of personal domain variables. Thus, the focus lies on the practical knowledge of teacher educators as a sub-construct of their overall knowledge, on their self-efficacy beliefs as a sub-construct of the teacher educators' general beliefs, and on teacher educators' attitudes towards evidence-based teaching practices.

Studies 1 and 2 support the literature regarding the distinct nature of personal domain variables (e.g. Ernest, 1989; Pajares, 1992; Richardson, 1996) and demonstrate that practical knowledge and self-efficacy beliefs are more influential than attitudes concerning teacher educators professional growth in the context of evidence-based practice. The complicated structure of teacher educators' practical knowledge, self-efficacy beliefs, and attitudes has also been identified in this thesis. Study 1 revealed a three-factor instrument structure,

supporting the distinctions between practical knowledge, self-efficacy beliefs, and attitudes. Additionally, as mentioned above, the exploration of the correlation matrix added to the understanding of the distinct nature of the three constructs under investigation.

While Study 1 focused more on the exploration of the distinctions between the personal domain variables and the establishment of a three-factor scale, Study 2 focused on the importance of personal domain variables regarding educators' professional growth in the evidence-based practice context. Study 2 proposed the exploration of two models, with practical knowledge and self-efficacy beliefs as mediators of the interplay between teacher educators' research exposure and frequency of evidence-based teaching implementation. More specifically, Study 2 enriched both research and theory by establishing a knowledge base about the importance of self-efficacy beliefs in teacher educators' evidence-based professional development. While Study 1 demonstrated that all three variables were significant for educators professional growth, Study 2 especially emphasized the role of self-efficacy in teacher educators' learning and development in the context of evidence-based teaching. Thus, the author encourages further studies to contribute to the investigation of personal domain variables of teacher educators in the context of evidence-based teaching. Research in this regard can support a better understanding of these complex constructs for fostering teacher educators' evidence-based professional learning and development. In turn, these investigations can provide support for the enhancement of teacher educators' practical knowledge, self-efficacy beliefs and attitudes through the development of targeted professional development programs on these skills that support evidence-based teaching.

4.2.3 Further implications about the heterogeneous group of teacher educators

The introductory section of this thesis discussed a detailed account of the differences between teacher educators, the complexity of their role that may change over time

(Kelchtermans, Smith & Vanderlinde, 2018), and the need for further research on this 'neglected' group of teachers (e.g. Guberman & Mcdossi, 2019). The question that arises here is what else can we learn from the presented studies about the heterogeneous group of teacher educators? In particular, this thesis was especially interested in investigating the potential differences among German-speaking teacher educators on their research exposure, and the impact this exposure had to the implementation of evidence-based teaching practices, if any. It is important to mention that the focus of this thesis is mainly on German-speaking teacher educators because of the lack of literature on this particular group of educators and because of the complexity of German teacher educators' positions in higher education.

Study 1 showed that teacher educators' practical knowledge, self-efficacy beliefs and attitudes differ depending on their research exposure. In detail, professors who belong to the most research-exposed group of teacher educators reported the highest scores in comparison to PhD students, teaching associates and school mentors. This finding is in line with previous research targeting teacher educators in Israel, Norway, Belgium and the Netherlands, which points out that high research-exposed teacher educators have strong beliefs about the importance of research and they are more confident about their research skills (Cochran-Smith, 2005; Griffiths, Thompson & Hynigewicz, 2014; Guberman & Mcdossi, 2019). Thus, the findings of Study 1 add to the findings of recent research studies in other European countries indicating that teacher educators indeed represent a heterogeneous group of teachers with systematic differences in the personal domain variables in the context of evidence-based teaching. This finding is of high relevance regarding the implementation of reform efforts in teacher education (Darling-Hammond, 2006).

Based on the findings of Study 1, Study 2 investigated the role of practical knowledge and self-efficacy beliefs in depth, within the interplay among educators research experience and frequency of evidence-based teaching implementation. Study 2 added to the literature by

exploring the biggest challenges teacher educators phase in this context. Differences were also identified between the groups of teacher educators, such as the prevalence of time pressure being more of an issue for professors compared to teaching associates and school mentors. Since there are no studies in teacher education investigating the major challenges educators' face when it comes to research-informed teaching, these findings add knowledge to this research field. Further, these findings show similarities to research in medical education (e.g., Sullivan, Wayne, Patey, & Nasr, 2017). This supports the notion that although teacher education and medical education might be different disciplines, they have many similarities that could be used for learning from one another.

4.3 Practical implications

This section provides important information about the practical implications of the findings of this thesis for both researchers and practitioners. Evidence-based practice or evidence-based teaching in education is a reform that became necessity because of the need to support practitioners work with research evidence to enhance their professionalization and teaching practices (e.g. Hempenstall, 2006; Slavin, 2002). Given that the main aim of evidence-based practice is to support practitioners in action, practical implications are part of the reform itself. Evidence-based practice aims to enable teachers to gain access to evidence-based knowledge in order to improve their students' outcomes and their own teaching practices. It is therefore, self-evident that this reform has strong implications for practitioners.

The findings of this thesis have implications for educational, research and teaching communities. In detail, Study 1 sheds light on the development of an evidence-informed scale measuring teacher educators' personal domain variables, a scale that can be easily implemented to school teachers and pre-service teachers. The psychometric structure of the scale supports the initial efforts to develop and validate an instrument that can be used in

teacher education for all levels of practice. Study 1 also provided empirical support for the heterogeneous group of teacher educators, who have only been observed within a small number of qualitative studies to date. This finding supports the literature (e.g. Czerniawski, Guberman & MacPhail, 2017; Meeus, Cools & Placklé, 2018; Swennen, Jones & Volman, 2010) which discusses the need for further professional development of teacher educators based on their individual needs and interests to improve their research skills and increase their use of evidence.

This notion is further supported from Study 2 where teacher educators referred to the facilitators that increase the use of evidence in practice. Since time is perceived to be a major challenge, especially for the high research-exposed group of educators (i.e., professors), professional development efforts should, for example, emphasize efficiency in searching for evidence which may be particularly useful for this group of educators. Moreover, evidence published in short forms (e.g. Clearinghouse databases) that can be accessed in one simple stop could also be beneficial for teacher educators who experience the lack of time as a major challenge.

Study 2 also showed that research exposure and the enhancement of teacher educators' critical appraisal skills can significantly contribute to evidence-based practice implementation. Another important finding is the need for better and extended communication among teacher educators of all levels, which could facilitate the use of evidence-based teaching and bridge the gap between research and practice. Similar results reported in previous research in the health professions (Pagoto et al., 2007) and in teacher education (Langley, Nadeem, Kataoka, Stein, & Jaycox, 2010).The findings of this thesis are of particular importance, not only for teacher educators, but also for curricula developers in higher education institutions who can reinforce cooperative teaching among educators. Before closing this section, it is important to keep in mind that in order for evidence in literature to

become transferable to practice, it should meet the criteria of validity, high quality, and of course, practical relevance, which is sometimes lacking in educational literature (Hargreaves, 1996, 1997; Tooley & Darby, 1998).

The research-practice gap is a complex and differentiated phenomenon that has been discussed intensively in teacher education (e.g. Vanderlinde & van Braak, 2010). Based on the findings of this thesis, the complexity of the issue is now more clearly understood. Accordingly, it identified the need to bring together the less research-exposed educators with ones who have more research experience. To build bridges between the different groups of teacher educators, and later between school teachers and researchers, new incentives based on the evidence-based practice approach should be established. Professional learning communities (Broekkamp & van Hout-Wolters, 2007) and collaborative coaching among different groups of teacher educators (Wetzel, Svrcek, LeeKeenan, & Daly-Lesch, 2019) can support school mentors who are less research exposed, in order to foster their professional growth, and benefit both educators and pre-service teachers in general (Alger & Kopcha, 2010; Wetzel et al., 2018).

4.4 Limitations

Before discussing the suggestions for further research, it is important to understand the limitations of the presented studies. The evidence-based teaching scale is a self-reported measure that was used to collect data for both Study 1 and 2. Like Desimone (2009) mentions, self-reported data can be subject to social desirability, a risk that must be taken into consideration in every study using subjective forms of data collection. However, during the instrument development process and the extensive piloting phase, measures were taken to overcome the aforementioned bias. In particular, there was an exclusion of items that included polarizing phrasing (e.g. evidence-based practice is a fad). Moreover, participants were

assured absolute confidentiality and before every set of questions, participants were instructed that there were no right or wrong answers. Additionally, the items were randomized. The results of Study 1 showed that even though response biases could not be entirely excluded, its influence was negligible, since no ceiling effects were observed, and a high variation in participants' responses was expressed in the standard deviation. These findings supports the assumption that response bias did not have an impact in both studies.

Study 1 focused on the exploration of the factorial structure of the evidence-based teaching scale. Given the number of participants, this structure was only examined through exploratory factor analysis. Further studies could be conducted to test the proposed factor structure and further validate the scale by collecting evidence on the convergent and divergent validity of the instrument. Study 1 showed systematic differences among the different groups of educators, a finding that supports the divergent validity of the scale. However, this was only a single effort, which could be supported with the replication of findings in further research.

Study 2 measured the mediating role of self-efficacy beliefs and practical knowledge in the interplay among teacher educators research experience and frequency of evidence-based teaching implementation. This study only explored the potential effect of two variables on how frequently teacher educators implement evidence-based teaching strategies. However, beliefs and knowledge are complex, multidimensional constructs, encompassing a great number of sub-constructs. Knowledge, for example, could be broken down into more specific aspects, such as pedagogical knowledge, or content knowledge; while beliefs such as self-concept and self-esteem may be important sub-constructs to consider in future research. Studies on these rarely investigated variables could provide a more nuanced picture about evidence-based teaching implementation in the literature for teacher educators.

Keeping the aforementioned limitations in mind, for the end of this section, it is meaningful to refer to the explorative nature of both studies. This exploration has established a knowledge base for further investigation of personal domain variables concerning evidence-based teaching practices in higher education teaching.

4.5 Suggestions for future research

Acknowledging the lack of literature and particularly, the lack of instruments for measuring evidence-based teaching practices, Study 1 dealt with the development, validation and psychometric structure of the evidence-based teaching scale. Moreover, Study 2 proposed a new model for the interplay between educators' research experience and frequency of evidence implementation, showing that self-efficacy beliefs play a more important role. In the following section, suggestions will be made for future research.

4.5.1 Further development of the evidence-based teaching scale

First, further research is needed to explore the applicability of the evidence-based teaching scale (EBTS) for groups other than university-based teacher educators. Studies investigating other samples, such as primary and secondary school teachers, vocational teachers, and pre-service teachers, can lead to new conceptual insights. Moreover, the investigation of the personal domain variables with respect to evidence-based teaching from college authorities or policymakers can be an additional research direction, providing new perspectives for the evidence-based teaching literature. At last, since the evidence-based teaching scale was developed for a broad range of different groups of teacher educators, it would also be interesting to test its applicability with university teachers in general and not only education-specific professionals.

From a methodological point of view, the evidence-based teaching scale provided information about the internal consistency and the internal structure of the scale.

Measurement invariance depicted within teacher educators' differences was also established. Thus, first steps for the validation of the instrument were taken. However, since the validation process can continue indefinitely, future studies could potentially focus on testing the relationship of the evidence-based teaching scale to other measures of teacher educators' professional qualifications. This way, evidence of the instruments convergent validity can be presented. Further validation of the instrument could also involve the possible focus on response processes or further validation of the items in different languages.

4.5.2 Evidence-based professional development of teacher educators

The overarching aim of the two studies presented in this thesis was to tackle the research-practice gap observed in university teaching, by first exploring and then establishing a knowledge base concerning teacher educators' personal domain variables about evidence-based teaching practices. Moreover, it was the authors aim to add to teacher educators' literature. While research in this field has increased in the last decade, it has mainly come from small-scale qualitative investigations and theoretical papers (Lunenberg et al., 2014). Both studies within this thesis enhanced the empirical understanding about teacher educators, a rather neglected group of teachers.

As mentioned in the introduction of this thesis, change in personal domain variables can potentially lead to change in teacher practices (Clarke & Hollingsworth, 2002). Thus, future investigations may focus on the design and implementation of evidence-based professional development programs tailored to the needs of the different groups of educators. These programs will require teacher educators to participate in professional development activities where they will have to seek and identify research evidence and implement it in their own lectures. The focus of these programs can be the process of collecting, analysing

and reflecting on evidence found in sound research, and how this evidence can be translated in order to transform educators teaching practice.

The extensive literature (e.g., Ball & Cohen, 1999; Kennedy, 1999; Marx, Freeman, Krajcik & Blumenfeld, 1998; Putnam & Borko, 2000; Borko, 2004) on the characteristics of effective professional development programs highlights some important aspects, which need to be considered in future research efforts. Effective professional development needs to: a) engage teachers in long-term collaborations in teaching practice; b) enable teachers to reflect and learn about how new teaching practices and reforms can be evolved and implemented in their existing teaching practice; c) discuss previous teaching experiences, beliefs and knowledge regarding teaching practices; and d) provide opportunities for creation of new evidence-based knowledge, ideally in communities of practice (Lave & Wenger, 1997).

4.5.3 Lesson study as an example of Evidence-based professional development of teacher educators

Lesson study can be an example of a potential form of future evidence-based professional development efforts. This framework encompasses many of the above-mentioned effective characteristics of professional development programs and it focuses on collaborative learning through observations of teachers' lessons (Lewis, Perry & Murata, 2006). Since this section targets future research, a detailed description of lesson study is beyond the scope of this thesis. This section, however will refer to its most important aspects within the context of this study, and then briefly discuss its potential future application in evidence-based professional development studies.

Lesson study is a Japanese form of teacher professional development, which has spread rather quickly in North America, Asia and Europe (Xu & Pedder, 2014). Lesson study is based on collaborative learning from observations of classroom lessons by a group of

teachers who ‘collect data’ on teaching and learning and then collaboratively analyse it (Lewis, 2002). The lessons that the teachers observe are called ‘research lessons’ and act as the starting point to initiate discussions about education and teaching practices at large. Teachers work in groups, where one of the group members agrees to teach the lesson while the others observe and make detailed notes during the ongoing learning and teaching process. After the lesson, the teachers analyse the data collected within their groups, reflect on the lesson, and connect topics related to their observations to teaching and learning practices (Lewis, 2002).

Due to its collaborative nature, lesson study can be implemented in evidence-based professional development of teacher educators. The following steps proposed for future research are based on the lesson study cycle as depicted in Lewis, Perry, and Murata (2006). Before starting the cycle, it is important to consider grouping teacher educators based on their discipline. Research on lesson study focuses on the professional development of science teachers (e.g. Vermunt, Vrikki, van Halem, Warwick & Mercer, 2019; Stigler & Hiebert, 2009), thus grouping teacher educators based on their shared disciplines may prove meaningful. Moreover, based on the findings of this thesis, it is meaningful to create groups of teacher educators with different levels of research exposure.

The cycle starts with the formulation of goals and the study of the curriculum. As an evidence-based professional development, teacher educators in this phase would identify the topic of interest, read and reflect on the newest available evidence, and set teaching goals and long-term goals for their students’ outcomes based on this evidence. While variation is likely achieved in the groups, additionally during this first phase, it might be interesting to include professional coaches coming from clearinghouse initiative centres who could assist teacher educators on the newest available research evidence, and the skills for interpreting and reflecting on findings.

The cycle continues with the planning phase where teacher educators can work on developing and revising their lesson plans. In this phase, teacher educators with the help of research evidence can choose a teaching approach, justify their choice in-group discussions, and create a plan for collecting data during their observations. The third phase refers to the observation and collection of data, where one of the team members teaches while the others observe.

The last phase is the reflection phase, which takes place after the lessons. During this phase, teacher educators share the collected data and reflect on it in order to improve their teaching, and inform their practice for the beginning of a new cycle with research evidence. Teachers document their process in order to understand what was achieved and what need should be further implemented. This is an iterative cycle, which can be learned and practiced during professional development programs implemented within real contexts (teaching practice).

Before closing this section and this thesis, it is important to mention that there are many other forms of teacher professional development that can be implemented to foster teacher educators' evidence-based professional learning. In this thesis, lesson study was only a briefly discussed example. Future research should consider further professional development approaches for teacher educators where the heterogeneity of this group is taken into consideration. This thesis, investigated teacher educators coming from different disciplines. In order for professional development efforts to be successful, focusing on the professionalization of educators coming from the same domain or discipline might prove beneficial.

5. In Closing

About 20 years ago, Davies (1999) emphasized the importance of a new educational reform named evidence-based practice. Evidence-based practice is a reform that initiated and thrived in the medical field when medicine was in need of improving professionals' praxis with the implementation of the best available research evidence. Even though Davies (1999) discussed the need for establishing high-quality educational research for enhancing educational policy and practice, education and in particular, practitioners still face similar challenges. Besides the efforts that have been made internationally during the last decade (e.g. Bromme, Prenzel & Jäger, 2014, 2017; Biesta, 2010; Slavin, 2002, 2008) the evidence-based teaching reform is still a common topic of controversy among practitioners and researchers (Stark, 2017).

As mentioned in the introductory section of this thesis, evidence-based teaching is not panacea, however, its benefits for practitioners' professional learning and development, which then reflect on students' outcomes, cannot be overlooked. The presented studies aim to support the evidence-based teaching reform by investigating teacher educators' personal domain variables toward research-informed practice. Teacher educators are a rather neglected group in educational research and literature, however, they play a pivotal role in pre-service teachers learning and development (Hattie, 2011). Investigating educators' personal domain variables can establish a knowledge base for teacher educators' further professional development targeting evidence-based teaching practices, which can eventually lead to student learning improvements (e.g. Petty, 2009). Thus, both studies of this thesis contribute to understanding the role of personal domain variables in the evidence-based teaching practices of teacher educators, practices that foster teachers' 21st century skills. They furthermore support their professional learning and development in a rapidly changing society (Bauer & Prenzel, 2012; Niemi & Nevgi, 2014).

6. References

Aarons, G. A. (2004). Mental health provider attitudes toward adoption of evidence-based practice: The Evidence-Based Practice Attitude Scale (EBPAS). *Mental health services research*, *6*(2), 61–74.

Aarons, G. A. (2006). Transformational and transactional leadership: Association with attitudes toward evidence-based practice. *Psychiatric services*, *57*(8), 1162–1169.

Ackermann, E. (2001). Piaget's constructivism, Papert's constructionism: What's the difference. *Future of learning group publication*, *5*(3), 438.

Albarracin, D., & Wyer, R. S. (2001). Elaborative and Nonelaborative Processing of a Behavior-Related Communication. *Personality and Social Psychology Bulletin*, *27*(6), 691–705. https://doi.org/10.1177/0146167201276005

Alger, C., & Kopcha, T. J. (2010). Technology supported cognitive apprenticeship transforms the student teaching field experience: Improving the student teaching field experience for all triad members. *The Teacher Educator*, *46*(1), 71–88. https://doi.org/10.1080/08878730.2010.529986

Amtsblatt des Bayerischen Staatsministeriums für Bildung und Kultus, Wissenschaft und Kunst, [KWMBI.]. (2009). Regelungen vom Bayerischen Hochschulgesetz [Regulations for the Bavarian Higher Education]. Retrieved from https://www.studienberatung.uni-bayreuth.de/pool/dokumente/kwmbl-2009-08.pdf

Al-Hinai, A. M. (2007). The Interplay between Culture, Teacher Professionalism and Teachers' Professional Development at Times of Change. In T. Townsend & R. Bates (Eds.), *Handbook of teacher education: Globalization, standards and professionalism in times of change / edited by Tony Townsend and Richard Bates* (Vol. 21, pp. 41–52). Dordrecht: Springer. https://doi.org/10.1007/1-4020-4773-8_3

Alles, M., Apel, J., Seidel, T., & Stürmer, K. (2018). How candidate teachers experience coherence in university education and teacher induction: The influence of perceived professional preparation at university and support during teacher induction. *Vocations and Learning*, 1–26.

Allinder, R. M. (1994). The Relationship Between Efficacy and the Instructional Practices of Special Education Teachers and Consultants. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, *17*(2), 86–95. https://doi.org/10.1177/088840649401700203

Anderson, R. N., Greene, M. L., & Loewen, P. S. (1988). Relationships among teachers' and students' thinking skills, sense of efficacy, and student achievement. *Alberta Journal of Educational Research*, *34*(2), 148–165.

Andrews, B., Brewin, C. R., Philpott, R., & Stewart, L. (2007). Delayed-onset posttraumatic stress disorder: A systematic review of the evidence. *The American Journal of Psychiatry*, *164*(9), 1319–1326. https://doi.org/10.1176/appi.ajp.2007.06091491

Andrews, R. (2007). What counts as evidence in Education. *Editorial and Commissioning Advisory Board (ECAB) of the Teacher Training Resource Bank (TTRB),*. Retrieved from https://www.researchgate.net/publication/242584489_What_counts_as_evidence_in_Education

Stevenson, A. (2010). *Oxford Dictionary of English*: Oxford University Press. https://doi.org/10.1093/acref/9780199571123.001.0001

Armor, J, D., Conry-Oseguera, P, Cox, Millicent, L, G. (1976, January 1). Analysis of the School Preferred Reading Program in Selected Los Angeles Minority Schools. Retrieved from https://www.rand.org/pubs/reports/R2007.html

Ashton, P. T., & Webb, R. B. (1986). *Making a difference: Teachers' sense of efficacy and student achievement*. *Research on teaching monograph series*. New York: Longman.

Avalos, B. (2011). Teacher professional development in teaching and teacher education over ten years. *Teaching and Teacher Education*, *27*(1), 10–20.

Babyak, M. A. (2004). What you see may not be what you get: A brief, nontechnical introduction to overfitting in regression-type models. *Psychosomatic medicine*, *66*(3), 411–421.

Bai, H., & Ertmer, P. (2008). Teacher Educators' Beliefs and Technology Uses as Predictors of Preservice Teachers' Beliefs and Technology Attitudes. *Journal of Technology and Teacher Education*, *16*(1), 93–112.

Ball, D. L., & Cohen, D. K. (1999). Challenges of improving instruction: A view from the classroom. *Washington, DC: Council on Basic Education*.

Ball, S., Bachrach, K., DeCarlo, J., Farentinos, C., Keen, M., McSherry, T., Wrigley, P. (2002). Characteristics, beliefs, and practices of community clinicians trained to provide manual-guided therapy for substance abusers. *Journal of substance abuse treatment*, *23*(4), 309–318.

Ball, W. J. (1994). Using Virgil to Analyze Public Policy Arguments: A System Based on Toulmin's Informal Logic. *Social Science Computer Review*, *12*(1), 26–37. https://doi.org/10.1177/089443939401200102

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*(2), 117–148. https://doi.org/10.1207/s15326985ep2802_3

Bandura, A. (1997). *Self-efficacy: The exercise of control*. *Self-efficacy: The exercise of control*. New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co.

Bartlett, M. S. (1954). A note on the multiplying factors for various χ 2 approximations. *Journal of the Royal Statistical Society. Series B (Methodological)*, 296–298.

Bauer, J., & Prenzel, M. (2012). Science education. European teacher training reforms. *Science (New York, N.Y.)*, *336*(6089), 1642–1643. https://doi.org/10.1126/science.1218387

Bauer, J., Prenzel, M., & Renkl, A. (2015). Evidenzbasierte Praxis - im Lehrerberuf?! Einführung in den Thementeil. *Unterrichtswissenschaft*, *43*(3), 188–192. Retrieved from http://www.beltz.de/fachmedien/erziehungs_und_sozialwissenschaften/zeitschriften/unterrichtswissenschaft/article/Journal.html?tx_beltz_journal[article]=30962&cHash=534db58739fd0fc34f8479554f5ef314; https://www.digizeitschriften.de/dms/img/?PID=PPN513613439_0043%7CLOG_0029

Bauer, J., Prenzel, M., & Renkl, A. (2015). Evidenzbasierte Praxis - im Lehrerberuf?! Einführung in den Thementeil. [Evidence-based practice in teacher education] *Unterrichtswissenschaft*, *43*(3), 188–192. Retrieved from http://www.beltz.de/fachmedien/erziehungs_und_sozialwissenschaften/zeitschriften/unterrichtswissenschaft/article/Journal.html?tx_beltz_journal[article]=30962&cHash=534db58739fd0fc34f8479554f5ef314; https://www.digizeitschriften.de/dms/img/?PID=PPN513613439_0043%7CLOG_0029

Bayerisches Gesetz-und Verordnungsblatt, [GVBI]. (2006). Gesetz zur Änderung des Bayerischen Schulfinanzierungsgesetzes und der Ausführungsverordnung Schulfinanzierungsgesetz [Amending laws for the School Financing and Regulation Bavarian School Financing Act]. Retrieved from: https://www.verkuendung-bayern.de/files/gvbl/2018/03/gvbl-2018-03.pdf

Baumert, J., & Kunter, M. (2006). Stichwort: Professionelle Kompetenz von Lehrkräften. *Zeitschrift für Erziehungswissenschaft*, *9*(4), 469–520. https://doi.org/10.1007/s11618-006-0165-2

Becker, E. S., Waldis, M., & Staub, F. C. (2019). Advancing student teachers' learning in the teaching practicum through Content-Focused Coaching: A field experiment. *Teaching and Teacher Education*, *83*, 12–26. https://doi.org/10.1016/j.tate.2019.03.007

Beder, H., & Medina, P. (2001). Classroom Dynamics in Adult Literacy Education. NCSALL Reports.

Beijaard, D. (1990). *Teaching as acting: A reconstructive study of an action theoretical approach to research and development in the domain of teaching*. Wageningen: Landbouwuniversiteit, Vakgroep Agrarische Onderwijskunde.

Beijaard, D., Verloop, N., & Vermunt, J. D. (2000). Teachers' perceptions of professional identity: An exploratory study from a personal knowledge perspective. *Teaching and Teacher Education*, *16*(7), 749–764. https://doi.org/10.1016/S0742-051X(00)00023-8

Bellanca, J. A., & Brandt, R. S. (2010). *21st century skills: Rethinking how students learn*. *Leading edge: Vol. 5*. Bloomington IN: Solution Tree Press.

Benson, J., & Clark, F. (1982). A guide for instrument development and validation. *The American Journal of Occupational Therapy : Official Publication of the American Occupational Therapy Association*, *36*(12), 789–800. https://doi.org/10.5014/ajot.36.12.789

Biesta, G. (2007). Why 'What Works' Won't Work: Evidence-Based Practice and the Democratic Deficit in Educational Research. *Educational Theory*, *57*(1), 1–22. https://doi.org/10.1111/j.1741-5446.2006.00241.x

Biesta, G. J. J. (2010). Why 'What Works' Still Won't Work: From Evidence-Based Education to Value-Based Education. *Studies in Philosophy and Education*, *29*(5), 491–503. https://doi.org/10.1007/s11217-010-9191-x

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2011). Defining Twenty-First Century Skills. In P. E. Griffin, E. Care, & B. McGaw (Eds.), *Assessment and teaching of 21st century skills* (Vol. 32, pp. 17–66). Dordrecht, London: Springer. https://doi.org/10.1007/978-94-007-2324-5_2

Bishop, A. J., & Nickson, M. (1983). *Review of Research in Mathematical Education. Part B, Research on the Social Context of Mathematics Education*. Windsor Berks: NFER-Nelson.

Bok, D. C. (2005). *Universities in the marketplace: The commercialization of higher education*. Princeton, N.J, Woodstock: Princeton University Press. Retrieved from http://www.jstor.org/stable/10.2307/j.ctt7svxh https://doi.org/10.2307/j.ctt7svxh

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, *33*(8), 3–15. https://doi.org/10.3102/0013189X033008003

Breckler, S. J. (1984). Empirical validation of affect, behavior, and cognition as distinct components of attitude. *Journal of Personality and Social Psychology*, *47*(6), 1191–1205. https://doi.org/10.1037/0022-3514.47.6.1191

Brickhouse, N. W. (1990). Teachers' Beliefs About the Nature of Science and Their Relationship to Classroom Practice. *Journal of Teacher Education*, *41*(3), 53–62. https://doi.org/10.1177/002248719004100307

Broekkamp, H., & van Hout-Wolters, B. (2007). The gap between educational research and practice: A literature review, symposium, and questionnaire. *Educational Research and Evaluation*, *13*(3), 203–220. https://doi.org/10.1080/13803610701626127

Bromme, R. (1997). Kompetenzen, Funktionen und unterrichtliches Handeln des Lehrers. *Psychologie des Unterrichts und der Schule*, *3*, 177–212.

Bromme, R., Prenzel, M., & Jäger, M. (2014). Empirische Bildungsforschung und evidenzbasierte Bildungspolitik. *Zeitschrift für Erziehungswissenschaft*, *17*(S4), 3–54. https://doi.org/10.1007/s11618-014-0514-5

Bromme, R., Prenzel, M., & Jäger, M. (2017). Educational research and evidence based educational policy. In J. Baumert & K.-J. Tillmann (Eds.), *Empirische Bildungsforschung: Der kritische Blick und die Antwort auf die Kritiker* (pp. 129–146). Wiesbaden: Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-13785-4_8

Brophy, J. E., & Good, T. L. (1974). *Teacher-student relationships: Causes and consequences*: Holt, Rinehart & Winston.

Brown, C. E., Wickline, M. A., Ecoff, L., & Glaser, D. (2009). Nursing practice, knowledge, attitudes and perceived barriers to evidence-based practice at an academic medical center. *Journal of advanced nursing*, *65*(2), 371–381.

Brown, C., & Zhang, D. (2016). Is engaging in evidence-informed practice in education rational?: What accounts for discrepancies in teachers' attitudes towards evidence use and actual instances of evidence use in schools? *British Educational Research Journal*, *42*(5), 780–801. https://doi.org/10.1002/berj.3239

Brown, J. (2009). Choosing the right number of components or factors in PCA and EFA. *JALT Testing & Evaluation SIG Newsletter*, *13*(2).

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, *18*(1), 32–42. https://doi.org/10.3102/0013189X018001032

Buja, A., & Eyuboglu, N. (1992). Remarks on parallel analysis. *Multivariate behavioral research*, *27*(4), 509–540.

Calderhead, J., & Robson, M. (1991). Images of teaching: Student teachers' early conceptions of classroom practice. *Teaching and Teacher Education*, *7*(1), 1–8. https://doi.org/10.1016/0742-051X(91)90053-R

Centre for Educational Research and Innovation; Organisation for Economic Co-operation and Development; ebrary, Inc. (2005). *Education at a glance: Oecd indicators 2005*. Paris: Organisation for Economic Co-operation and Development. Retrieved from http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10245175

Chan, W.-Y., Lau, S., Nie, Y., Lim, S., & Hogan, D. (2008). Organizational and Personal Predictors of Teacher Commitment: The Mediating Role of Teacher Efficacy and Identification With School. *American Educational Research Journal*, *45*(3), 597–630. https://doi.org/10.3102/0002831208318259

Clearing House Unterricht (2019). Clearing House Unterricht für die Lehrerbildung. Retrieved from https://www.clearinghouse.edu.tum.de/reviews/

Clandinin, D. J. (1985). Personal Practical Knowledge: A Study of Teachers' Classroom Images. *Curriculum Inquiry*, *15*(4), 361–385. https://doi.org/10.1080/03626784.1985.11075976

Clarke, D. J., & Hollingsworth, H. (1994). Reconceptualising teacher change. In G. Bell, B. Wright, N. Leeson, & J. Geake (Eds.), Challenges in mathematics education: Constraints on construction, Vol. 1. Proceedings of the 17th annual conference of the Mathematics Education Research Group of Australasia (pp. 153–164). Lismore, NSW: Southern Cross University.

Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education*, *18*(8), 947–967. https://doi.org/10.1016/S0742-051X(02)00053-7

Clarke, P. B., & Byrne, P. (1993). *Religion Defined and Explained*. London: Palgrave Macmillan UK. https://doi.org/10.1057/9780230374249

Cleare, S., Gumley, A., Cleare, C. J., & O'Connor, R. C. (2018). An Investigation of the Factor Structure of the Self-Compassion Scale. *Mindfulness*, *9*(2), 618–628. https://doi.org/10.1007/s12671-017-0803-1

Cobb, P., Wood, T., & Yackel, E. (1990). Chapter 9: Classrooms as Learning Environments for Teachers and Researchers. *Journal for Research in Mathematics Education. Monograph*, *4*, 125. https://doi.org/10.2307/749917

Cochran-Smith, M., & Zeichner, K. M. (2005). Executive summary: The report of the AERA panel on research and teacher education. *Studying teacher education: The report of the AERA panel on research and teacher education*, 1–36.

Cochran-Smith, M. (2005). Teacher educators as researchers: multiple perspectives. *Teaching and Teacher Education*, *21*(2), 219–225. https://doi.org/10.1016/j.tate.2004.12.003

Cochran-Smith, M., & Lytle, S. L. (1999). Chapter 8: Relationships of Knowledge and Practice: Teacher Learning in Communities. *Review of Research in Education*, *24*(1), 249–305. https://doi.org/10.3102/0091732X024001249

Commission, E. (2012). *Supporting the teaching professions for better learning outcomes*.

Constantinou, C. S., Papageorgiou, A., Samoutis, G., & McCrorie, P. (2018). Acquire, apply, and activate knowledge: A pyramid model for teaching and integrating cultural competence in medical curricula. *Patient Education and Counseling*, *101*(6), 1147–1151. https://doi.org/10.1016/j.pec.2017.12.016

Cook, B. G., Smith, G. J., & Tankersley, M. (2011). Evidence-based practices in education. In K. R. Harris, S. Graham, & T. C. Urdan (Eds.), *APA handbooks in psychology. APA*

educational psychology handbook (pp. 495–527). Washington, D.C.: American Psychological Association. https://doi.org/10.1037/13273-017

Costello, A. B., & Osborne, J. (2005). Practical assessment, research & evaluation. *The Journal of Consumer Marketing*, *10*(7), 1–9.

Czerniawski, G., Guberman, A., & MacPhail, A. (2017). The professional developmental needs of higher education-based teacher educators: an international comparative needs analysis. *European Journal of Teacher Education*, *40*(1), 127–140. https://doi.org/10.1080/02619768.2016.1246528

Darling-Hammond, L. (2005). The case for university-based teacher education. In *The role of the university in the preparation of teachers* (pp. 19–36). Routledge.

Darling-Hammond, L. (2006). Constructing 21st-Century Teacher Education. *Journal of Teacher Education*, *57*(3), 300–314. https://doi.org/10.1177/0022487105285962

Darling-Hammond, L. (2010). Teacher Education and the American Future. *Journal of Teacher Education*, *61*(1-2), 35–47. https://doi.org/10.1177/0022487109348024

Darling-Hammond, L. (2016). Research on Teaching and Teacher Education and Its Influences on Policy and Practice. *Educational Researcher*, *45*(2), 83–91. https://doi.org/10.3102/0013189X16639597

Darling-Hammond, L., & Lieberman, A. (2012). *Teacher education around the world: Changing policies and practices / edited by Ann Lieberman, Linda Darling-Hammond*. *Teacher quality and school development*. London: Routledge.

Davies, P. (1999). What is Evidence-based Education? *British Journal of Educational Studies*, *47*(2), 108–121. https://doi.org/10.1111/1467-8527.00106

Dengerink, J., Lunenberg, M., & Kools, Q. (2015). What and how teacher educators prefer to learn. *Journal of Education for Teaching*, *41*(1), 78–96. https://doi.org/10.1080/02607476.2014.992635

Denisova, E. K., Bell, C., & Covaleskie, K. (2019). Evolving the Physics Mindset: Changing Perceptions and Attitudes toward the Teaching and Learning of Physical Science. *Science and Children*, *56*(7), 74.

Desimone, L. M. (2009). Improving Impact Studies of Teachers' Professional Development: Toward Better Conceptualizations and Measures. *Educational Researcher*, *38*(3), 181–199. https://doi.org/10.3102/0013189X08331140

Eddy, D. M. (2005). Evidence-based medicine: A unified approach. *Health Affairs (Project Hope)*, *24*(1), 9–17. https://doi.org/10.1377/hlthaff.24.1.9

Elbaz, F. (1991). Research on teacher's knowledge: the evolution of a discourse. *Journal of Curriculum Studies*, *23*(1), 1–19. https://doi.org/10.1080/0022027910230101

Elstad, E. (2010). University-based teacher education in the field of tension between the academic world and practical experience in school: a Norwegian case. *European Journal of Teacher Education*, *33*(4), 361–374. https://doi.org/10.1080/02619768.2010.504948

Ernest, P. (1989). The Knowledge, Beliefs and Attitudes of the Mathematics Teacher: a model. *Journal of Education for Teaching*, *15*(1), 13–33. https://doi.org/10.1080/0260747890150102

European Commission. (2007). *Improving the quality of teacher education*. Brussels, Belgium. Retrieved from https://ec.europa.eu/education/com392_en.pdf

European Commission. (2012). Supporting the teaching professions for better learning outcomes. Commission Staff Working Document 374. Strasbourg: European Commission.

Retrieved from: https://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2012:0374:FIN:EN:PDF

European Commission. (2013). *Building a global future in responsibility and solidarity*. Brussels, Belgium. Retrieved from https://ec.europa.eu/europeaid/sites/devco/files/annual-report-2013-eu-development-external-assistance-policies-implementation-in-2012_en.pdf

European Ministers Responsible for Higher Education. (2009). ‘‘The Bologna Process 2020 – The European Higher Education Area in the new decade: Communiqué of the Conference of European Ministers Responsible for Higher Education’’. Leuven and Louvain-la-Neuve, 28-29 April 2009. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/IP_09_675

Fang, Z. (1996). A review of research on teacher beliefs and practices. *Educational Research*, *38*(1), 47–65. https://doi.org/10.1080/0013188960380104

Fenstermacher, G. D. (1994). Chapter 1: The Knower and the Known: The Nature of Knowledge in Research on Teaching. *Review of Research in Education*, *20*(1), 3–56. https://doi.org/10.2307/1167381

Fischer, F., Hmelo-Silver, C. E., Goldman, S. R., & Reimann, P. (2018). *International handbook of the learning sciences* (1st). London: Routledge.

Fishbein, M. (1963). An Investigation of the Relationships between Beliefs about an Object and the Attitude toward that Object. *Human Relations*, *16*(3), 233–239. https://doi.org/10.1177/001872676301600302

Fishbein, M. (1967). A consideration of beliefs and their role in attitude measurement. *Readings in attitude theory and measurement*, 257–266.

Fives, H. (Ed.) (2003). *What is teacher efficacy and how does it relate to teachers' knowledge? A theoretical review.*

Fleckenstein, J., Zimmermann, F., Köller, O., & Möller, J. (2015). What works in school? Expert and novice teachers' beliefs about school effectiveness. *Frontline Learning Research, 3*(2), 27–46. https://doi.org/10.14786/flr.v3i2.162

Fokkema, M., & Greiff, S. (2017). *How performing PCA and CFA on the same data equals trouble*: Hogrefe Publishing.

Freeman, J. B. (2011). *Argument structure: Representation and theory / James B. Freeman*. *Argumentation library: Vol. 18*. Dordrecht: Springer.

George, D. M., & Allery, M. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update. *SPSS for Windows Step by Step: A Simple Guide and Reference 11.0 Update*.

Georgiou, D., Mok, SY., Wiesbeck, A., Fischer, F., Seidel, T. (2019, August). The Evidence-based teaching knowledge, beliefs and attitudes scale. In M. Daumiller (Chair), *The role of attitudes and epistemic beliefs for learning and instruction.* Symposium conducted at the meeting of the EARLI 2019, Aachen, Germany.

Goodlad, J. I. (1991). *Teachers for our nation's schools* (1st ed.). *Jossey-Bass higher education series*. San Francisco: Jossey-Bass.

Goodwin, A. L., Smith, L., Souto-Manning, M., Cheruvu, R., Tan, M. Y., Reed, R., & Taveras, L. (2014). What Should Teacher Educators Know and Be Able to Do? Perspectives From Practicing Teacher Educators. *Journal of Teacher Education, 65*(4), 284–302. https://doi.org/10.1177/0022487114535266

Gorsuch, R. L. (1983). Factor analysis Lawrence Erlbaum Associates. *Hillsdale, NJ*.

Greenhalgh, T., & Worrall, J. G. (1997). From EBM to CSM: The evolution of context-sensitive medicine. *Journal of Evaluation in Clinical Practice, 3*(2), 105–108. https://doi.org/10.1046/j.1365-2753.1997.00096.x

Greenwood, C. R., & Mabeady, L. (2001). Are Future Teachers Aware of the Gap Between Research and Practice and What Should They Know? *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, *24*(4), 333–347. https://doi.org/10.1177/088840640102400407

Griffin, P., Care, E., & McGaw, B. (2011). The Changing Role of Education and Schools. In P. E. Griffin, E. Care, & B. McGaw (Eds.), *Assessment and teaching of 21st century skills* (Vol. 118, pp. 1–15). Dordrecht, London: Springer. https://doi.org/10.1007/978-94-007-2324-5_1

Griffiths, V., Thompson, S., & Hryniewicz, L. (2014). Landmarks in the professional and academic development of mid-career teacher educators. *European Journal of Teacher Education*, *37*(1), 74–90. https://doi.org/10.1080/02619768.2013.825241

Griffiths, R. (2004). Knowledge production and the research–teaching nexus: the case of the built environment disciplines. *Studies in Higher Education*, *29*(6), 709–726. https://doi.org/10.1080/0307507042000287212

Grimmett, P. P., & Mackinnon, A. M. (1992). Chapter 9: Craft Knowledge and the Education of Teachers. *Review of Research in Education*, *18*(1), 385–456. https://doi.org/10.3102/0091732X018001385

Groccia, J. E., & Buskist, W. (2011). Need for evidence-based teaching. *New Directions for Teaching and Learning*, *2011*(128), 5–11. https://doi.org/10.1002/tl.463

Guberman, A., & Mcdossi, O. (2019). Israeli teacher educators' perceptions of their professional development paths in teaching, research and institutional leadership. *European Journal of Teacher Education*, *42*(4), 507–522. https://doi.org/10.1080/02619768.2019.1628210

Guskey, T. R. (1985). Staff development and teacher change. *Educational leadership*, *42*(7), 57.

Guskey, T. R. (1986). Staff Development and the Process of Teacher Change. *Educational Researcher*, *15*(5), 5–12. https://doi.org/10.3102/0013189X015005005

Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the implementation of instructional innovation. *Teaching and Teacher Education*, *4*(1), 63–69. https://doi.org/10.1016/0742-051X(88)90025-X

Guyatt, G., Rennie, D., Meade, M., & Cook, D. (1992). Evidence-based medicine. A new approach to teaching the practice of medicine. *JAMA*, *268*(17), 2420–2425. https://doi.org/10.1001/jama.1992.03490170092032

Guyatt, G., Rennie, D., Meade, M., & Cook, D. (2015). *Users' guides to the medical literature: A manual for evidence-based clinical practice / editors, Gordon Guyatt, Drummond Rennie, Maureen O. Meade, Deborah J. Cook* (3rd edition). New York: McGraw-Hill Education.

Haberfellner, C., & Fenzl, T. (2017). The utility value of research evidence for educational practice from the perspective of preservice student teachers in Austria - A qualitative exploratory study [Zum Nutzen von Forschungsergebnissen für die schulische Praxis aus der Perspektive von Lehramtsstudierenden in Österreich - Eine qualitative, explorative Studie]. *Journal for educational research online*, *9*(2), 69–87. Retrieved from //www.pedocs.de/volltexte/2017/14897/

Halloran, J. D. (1967). *Attitude formation and change*. *Attitude formation and change*. Oxford, England: Leicester U. Press.

Hammersley, M. (1997). Educational Research and Teaching: a response to David Hargreaves' TTA lecture. *British Educational Research Journal*, *23*(2), 141–161. https://doi.org/10.1080/0141192970230203

Hamre, B. K., Pianta, R. C., Burchinal, M., Field, S., LoCasale-Crouch, J., Downer, J. T., . . . Scott-Little, C. (2012). A Course on Effective Teacher-Child Interactions:Effects on

Teacher Beliefs, Knowledge, and Observed Practice. *American Educational Research Journal*, *49*(1), 88–123. https://doi.org/10.3102/0002831211434596

Handal, G., & Lauvas, P. (1987). *Promoting reflective teaching: Supervision in practice / by Gunnar Handal and Per Lauras*. Milton Keynes: SRHE/Open University Press.

Haney, J. J., Czerniak, C. M., & Lumpe, A. T. (1996). Teacher beliefs and intentions regarding the implementation of science education reform strands. *Journal of Research in Science Teaching*, *33*(9), 971–993. https://doi.org/10.1002/(SICI)1098-2736(199611)33:9<971::AID-TEA2>3.0.CO;2-S

Hargreaves, A. (1997). Cultures of Teaching and Educational Change. In B. J. Biddle, T. L. Good, & I. Goodson (Eds.), *Springer International Handbooks of Education: Vol. 3. International Handbook of Teachers and Teaching* (Vol. 3, pp. 1297–1319). Dordrecht: Springer Netherlands; Imprint; Springer. https://doi.org/10.1007/978-94-011-4942-6_31

Hargreaves, D. H., Teacher Training Agency. (1996). *Teaching as a Research-based Profession: Possibilities and Prospects*: Teacher Training Agency. Retrieved from https://books.google.de/books?id=h1unZwEACAAJ

Hattie, J. (2011). *Visible learning for teachers & students: How to maximise school achievement*. London: Routledge.

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (Second edition). *Methodology in the social sciences*. New York, London: The Guilford Press. Retrieved from https://ebookcentral.proquest.com/lib/potsdamuni/detail.action?docID=5109647

Haynes, R. B., Devereaux, P. J., & Guyatt, G. H. (2002). Clinical expertise in the era of evidence-based medicine and patient choice. *Evidence-Based Medicine*, *7*(2), 36–38. https://doi.org/10.1136/ebm.7.2.36

Hempenstall, K. (2006). What does evidence-based practice in education mean? *Australian Journal of Learning Disabilities*, *11*(2), 83–92. https://doi.org/10.1080/19404150609546811

Hemsley-Brown, J., & Sharp, C. (2003). The Use of Research to Improve Professional Practice: a systematic review of the literature. *Oxford Review of Education*, *29*(4), 449–471. https://doi.org/10.1080/0305498032000153025

Hiebert, J., Gallimore, R., & Stigler, J. W. (2002). A knowledge base for the teaching profession: What would it look like and how can we get one? *Educational Researcher*, *31*(5), 3–15.

Higgs, J., & Titchen, A. (1995). The Nature, Generation and Verification of Knowledge. *Physiotherapy*, *81*(9), 521–530. https://doi.org/10.1016/S0031-9406(05)66683-7

Hillage, J., Anderson, A., & Pearson, R. (1998). *Excellence in research on schools*. *Research report: no RR74.*

Hu, B. Y., Fan, X., Yang, Y., & Neitzel, J. (2017). Chinese preschool teachers' knowledge and practice of teacher-child interactions: The mediating role of teachers' beliefs about children. *Teaching and Teacher Education*, *63*, 137–147. https://doi.org/10.1016/j.tate.2016.12.014

Jadad, A. R., & Haynes, R. B. (1998). The Cochrane Collaboration-Advances and Challenges in Improving Evidence-based Decision Making. *Medical Decision Making*, *18*(1), 2–9. https://doi.org/10.1177/0272989X9801800102

Jaramillo, J. A. (1996). Vygotsky's sociocultural theory and contributions to the development of constructivist curricula. *Education*, *117*, 133+. Retrieved from https://link.gale.com/apps/doc/A18960235/AONE?u=ubtum&sid=AONE&xid=b2639a6e

Johnson, K. E. (1996). The Role of Theory in L2 Teacher Education. *TESOL Quarterly*, *30*(4), 765. https://doi.org/10.2307/3587933

Johnston, J. M., Leung, G. M., Fielding, R., Tin, K. Y. K., & Ho, L.-M. (2003). The development and validation of a knowledge, attitude and behaviour questionnaire to assess undergraduate evidence-based practice teaching and learning. *Medical Education*, *37*(11), 992–1000. https://doi.org/10.1046/j.1365-2923.2003.01678.x

Johnston, S. (1992). Images: A way of understanding the practical knowledge of student teachers. *Teaching and Teacher Education*, *8*(2), 123–136. https://doi.org/10.1016/0742-051X(92)90003-L

Jones, M. L. (2009). A Study of Novice Special Educators' Views of Evidence-Based Practices. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children*, *32*(2), 101–120. https://doi.org/10.1177/0888406409333777

Kagan, D. M. (1990). Ways of Evaluating Teacher Cognition: Inferences Concerning the Goldilocks Principle. *Review of Educational Research*, *60*(3), 419–469. https://doi.org/10.3102/00346543060003419

Kaiser, H. F. (1970). A second generation little jiffy. *Psychometrika*, *35*(4), 401–415.

Kelchtermans, G., Smith, K., & Vanderlinde, R. (2018). Towards an 'international forum for teacher educator development': an agenda for research and action. *European Journal of Teacher Education*, *41*(1), 120–134. https://doi.org/10.1080/02619768.2017.1372743

Kennedy, M. M. (1999). Form and Substance in Mathematics and Science Professional Development. *NISE brief*, *3*(2), n2.

Knowles, M. S. (1973). *Adult learner: A neglected species*. S.l.: Gulf Pub.

Korthagen, F., Loughran, J., & Lunenberg, M. (2005). Teaching teachers: studies into the expertise of teacher educators: an introduction to this theme issue. *Teaching and Teacher Education*, *21*(2), 107–115. https://doi.org/10.1016/j.tate.2004.12.007

Korthagen, F., Loughran, J., & Russell, T. (2006). Developing fundamental principles for teacher education programs and practices. *Teaching and Teacher Education*, *22*(8), 1020–1041.

Korthagen, F., & Vasalos, A. (2005). Levels in reflection: core reflection as a means to enhance professional growth. *Teachers and Teaching*, *11*(1), 47–71. https://doi.org/10.1080/1354060042000337093

Korthagen, F. A. J. (2007). The gap between research and practice revisited. *Educational Research and Evaluation*, *13*(3), 303–310. https://doi.org/10.1080/13803610701640235

Korthagen, F. A.J. (1993). Two modes of reflection. *Teaching and Teacher Education*, *9*(3), 317–326. https://doi.org/10.1016/0742-051X(93)90046-J

Kosnik, C., Menna, L., Dharamshi, P., Miyata, C., & Beck, C. (2013). A foot in many camps: literacy teacher educators acquiring knowledge across many realms and juggling multiple identities. *Journal of Education for Teaching*, *39*(5), 523–540. https://doi.org/10.1080/02607476.2013.844954

Krech, D., & Crutchfield, R. S. (1948). The field and problems of social psychology. In D. Krech & R. S. Crutchfield (Eds.), *Theory and problems of social psychology* (pp. 3–28). New York: McGraw-Hill. https://doi.org/10.1037/10024-001

Künsting, J., Neuber, V., & Lipowsky, F. (2016). Teacher self-efficacy as a long-term predictor of instructional quality in the classroom. *European Journal of Psychology of Education*, *31*(3), 299–322. https://doi.org/10.1007/s10212-015-0272-7

Kvernbekk, T. (2019). Practitioner tales: possible roles for research evidence in practice. *Educational Research and Evaluation*, *25*(1-2), 25–42. https://doi.org/10.1080/13803611.2019.1617988

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: A practical primer for t-tests and ANOVAs. *Frontiers in psychology*, *4*, 863.

Langley, A. K., Nadeem, E., Kataoka, S. H., Stein, B. D., & Jaycox, L. H. (2010). Evidence-Based Mental Health Programs in Schools: Barriers and Facilitators of Successful Implementation. *School Mental Health*, *2*(3), 105–113. https://doi.org/10.1007/s12310-010-9038-1

Lantz, O., & Kass, H. (1987). Chemistry teachers' functional paradigms. *Science Education*, *71*(1), 117–134. https://doi.org/10.1002/sce.3730710114

Lave, J., & Wenger, E. (1997). *Situated learning: Legitimate peripheral participation* (Reprinted.). *Learning in doing*. Cambridge: Univ. Press.

Leasure, A. R., Stirlen, J., & Thompson, C. (2008). Barriers and facilitators to the use of evidence-based best practices. *Dimensions of Critical Care Nursing : DCCN*, *27*(2), 74-82; quiz 83-4.

Leavy, A., Hourigan, M., & Carroll, C. (2017). Exploring the Impact of Reform Mathematics on Entry-Level Pre-service Primary Teachers Attitudes Towards Mathematics. *International Journal of Science and Mathematics Education*, *15*(3), 509–526. https://doi.org/10.1007/s10763-015-9699-1

Leinhardt, G. (1988). Getting to Know: Tracing Students' Mathematical Knowledge From Intuition to Competence. *Educational Psychologist*, *23*(2), 119–144. https://doi.org/10.1207/s15326985ep2302_4

Lewis, C. (2002). Does Lesson Study Have a Future in the United States? *Nagoya journal of education and human development*.

Lewis, C., Perry, R., & Murata, A. (2006). How Should Research Contribute to Instructional Improvement? The Case of Lesson Study. *Educational Researcher*, *35*(3), 3–14. https://doi.org/10.3102/0013189X035003003

Livingston, K., McCall, J., & Morgado, M. (2009). Teacher Educators as Researchers. In A. Swennen & M. van der Klink (Eds.), *Becoming a teacher educator: Theory and practice for teacher educators / Anja Swennen, Marcel van der Klink, editors* (Vol. 31, pp. 191–203). Dordrecht, London: Springer. https://doi.org/10.1007/978-1-4020-8874-2_14

Loughran, J. (2014). Professionally Developing as a Teacher Educator. *Journal of Teacher Education*, *65*(4), 271–283. https://doi.org/10.1177/0022487114533386

Lunenberg, M., Dengerink, J., & Korthagen, F. (2014). *The Professional Teacher Educator: Roles, Behaviour, and Professional Development of Teacher Educators*. *Professional Learning*. Rotterdam: SensePublishers. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=779488 https://doi.org/10.1007/978-94-6209-518-2

Lunenberg, M., Korthagen, F., & Swennen, A. (2007). The teacher educator as a role model. *Teaching and Teacher Education*, *23*(5), 586–601. https://doi.org/10.1016/j.tate.2006.11.001

Lunenberg, M., & Willemse, M. (2006). Research and professional development of teacher educators. *European Journal of Teacher Education*, *29*(1), 81–98. https://doi.org/10.1080/02619760500478621

Maasz, J., & Schlöglmann, W. (2019). *Beliefs and attitudes in mathematics education: New research results / Jürgen Maaß, Wolfgang Schlöglmann*. Rotterdam: Sense Pub.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological methods*, *4*(1), 84.

MacPhail, A., Ulvik, M., Guberman, A., Czerniawski, G., Oolbekkink-Marchand, H., & Bain, Y. (2018). The professional development of higher education-based teacher educators: Needs and realities. *Professional Development in Education*, 1–14.

Malouf, D. B., & Schiller, E. P. (1995). Practice and Research in Special Education. *Exceptional Children*, *61*(5), 414–424. https://doi.org/10.1177/001440299506100502

Marx, R. W., Freeman, J. G., Krajcik, J. S., & Blumenfeld, P. C. (1998). Professional development of science teachers. *International handbook of science education*, *2*, 667–680.

McEvoy, M. P., Williams, M. T., & Olds, T. S. (2010). Development and psychometric testing of a trans-professional evidence-based practice profile questionnaire. *Medical teacher*, *32*(9), e373-e380.

McGee, A., & Lawrence, A. (2009). Teacher educators inquiring into their own practice. *Professional Development in Education*, *35*(1), 139–157. https://doi.org/10.1080/13674580802268994

Meeus, W., Cools, W., & Placklé, I. (2018). Teacher educators developing professional roles: frictions between current and optimal practices. *European Journal of Teacher Education*, *41*(1), 15–31. https://doi.org/10.1080/02619768.2017.1393515

Meijer, P. C., Verloop, N., & Beijaard, D. (1999). Exploring language teachers' practical knowledge about teaching reading comprehension. *Teaching and Teacher Education*, *15*(1), 59–84. https://doi.org/10.1016/S0742-051X(98)00045-6

Melnyk, B. M., Fineout-Overholt, E., Feinstein, N. F., Sadler, L. S., & Green-Hernandez, C. (2008). Nurse practitioner educators' perceived knowledge, beliefs, and teaching strategies regarding evidence-based practice: Implications for accelerating the integration of

evidence-based practice into graduate programs. *Journal of Professional Nursing : Official Journal of the American Association of Colleges of Nursing*, *24*(1), 7–13. https://doi.org/10.1016/j.profnurs.2007.06.023

Melnyk, B. M., Fineout-Overholt, E., & Mays, M. Z. (2008). The evidence-based practice beliefs and implementation scales: Psychometric properties of two new instruments. *Worldviews on Evidence-Based Nursing*, *5*(4), 208–216. https://doi.org/10.1111/j.1741-6787.2008.00126.x

Mesquita, P. B. de, & Drake, J. C. (1994). Educational reform and the self-efficacy beliefs of teachers implementing nongraded primary school programs. *Teaching and Teacher Education*, *10*(3), 291–302. https://doi.org/10.1016/0742-051X(95)97311-9

Midgley, C., Feldlaufer, H., & Eccles, J. S. (1989). Change in teacher efficacy and student self- and task-related beliefs in mathematics during the transition to junior high school. *Journal of Educational Psychology*, *81*(2), 247–258. https://doi.org/10.1037/0022-0663.81.2.247

Miller, G. E. (1990). The assessment of clinical skills/competence/performance. *Academic Medicine : Journal of the Association of American Medical Colleges*, *65*(9 Suppl), S63-7. https://doi.org/10.1097/00001888-199009000-00045

Moè, A., Pazzaglia, F., & Ronconi, L. (2010). When being able is not enough. The combined value of positive affect and self-efficacy for job satisfaction in teaching. *Teaching and Teacher Education*, *26*(5), 1145–1153. https://doi.org/10.1016/j.tate.2010.02.010

Moore, M. T. (1990). Problem Finding and Teacher Experience *The Journal of Creative Behavior*, *24*(1), 39–58. https://doi.org/10.1002/j.2162-6057.1990.tb00527.x

Moreira, C., & Noss, R. (1995). Understanding teachers' attitudes to change in a Logomathematics environment. *Educational Studies in Mathematics*, *28*(2), 155–176. https://doi.org/10.1007/BF01295791

Munby, H., & Russell, T. (1994). The Authority of Experience in Learning to Teach: Messages from a Physics Methods Class. *Journal of Teacher Education*, *45*(2), 86–95. https://doi.org/10.1177/0022487194045002002

Murray, J. (2010). Towards a new language of scholarship in teacher educators' professional learning? *Professional Development in Education*, *36*(1-2), 197–209.

Murray, J., Campbell, A., Hextall, I., Hulme, M., Jones, M., Mahony, P.,Wall, K. (2009). Research and teacher education in the UK: Building capacity. *Teaching and Teacher Education*, *25*(7), 944–950. https://doi.org/10.1016/j.tate.2009.01.011

Murray, S. L., Leder, S., McClellan, J. C. D., Holmes, J. G., Pinkus, R. T., & Harris, B. (2009). Becoming Irreplaceable: How Comparisons to the Partner's Alternatives Differentially Affect Low and High Self-Esteem People. *Journal of Experimental Social Psychology*, *45*(6), 1180–1191. https://doi.org/10.1016/j.jesp.2009.07.001

Nguyen, H. T. (2009). An inquiry-based practicum model: What knowledge, practices, and relationships typify empowering teaching and learning experiences for student teachers, cooperating teachers and college supervisors? *Teaching and Teacher Education*, *25*(5), 655–662.

Niemi, H. (2008). Advancing research into and during teacher education. In B. Hudson & P. Zgaga (Eds.), *Monographs on Journal of Research in Teacher Education. Teacher education policy in Europe: A voice of higher education institutions* (pp. 183–208). Umeå: University of Umeå, Faculty of Teacher Education.

Niemi, H., & Nevgi, A. (2014). Research studies and active learning promoting professional competences in Finnish teacher education. *Teaching and Teacher Education*, *43*, 131–142. https://doi.org/10.1016/j.tate.2014.07.006

Osborne, S. L., Latham, C. F., Wen, P. J., Cavaignac, S., Fanning, J., Foran, P. G., & Meunier, F. A. (2007). The Janus faces of botulinum neurotoxin: Sensational medicine and

deadly biological weapon. *Journal of Neuroscience Research*, *85*(6), 1149–1158. https://doi.org/10.1002/jnr.21171

Pagoto, S. L., Spring, B., Coups, E. J., Mulvaney, S., Coutu, M.-F., & Ozakinci, G. (2007). Barriers and facilitators of evidence-based practice perceived by behavioral science health professionals. *Journal of Clinical Psychology*, *63*(7), 695–705. https://doi.org/10.1002/jclp.20376

Pajares, F. (1996). Self-Efficacy Beliefs in Academic Settings. *Review of Educational Research*, *66*(4), 543–578. https://doi.org/10.3102/00346543066004543

Pajares, M. F. (1992). Teachers' Beliefs and Educational Research: Cleaning Up a Messy Construct. *Review of Educational Research*, *62*(3), 307–332. https://doi.org/10.3102/00346543062003307

Pan, Y.-H., Chou, H.-S., Hsu, W.-T., Li, C.-H., & Hu, Y.-L. (2013). Teacher self-efficacy and teaching practices in the health and physical education curriculum in Taiwan. *Social Behavior and Personality: an international journal*, *41*(2), 241–250.

Parrish, D. E., & Rubin, A. (2011). An Effective Model for Continuing Education Training in Evidence-Based Practice. *Research on Social Work Practice*, *21*(1), 77–87. https://doi.org/10.1177/1049731509359187

Petty, G. (2009). *Evidence-based teaching: A practical approach / Geoff Petty* (2nd ed.). Cheltenham: Nelson Thornes.

Petty, R. E., & Cacioppo, J. T. (2012). The Elaboration Likelihood Model of Persuasion. In R. E. Petty (Ed.), *Communication and persuasion: Central and peripheral routes to attitude change* (pp. 1–24). [Place of publication not identified]: Springer. https://doi.org/10.1007/978-1-4612-4964-1_1

Ping, C., Schellings, G., & Beijaard, D. (2018). Teacher educators' professional learning: A literature review. *Teaching and Teacher Education, 75*, 93–104. https://doi.org/10.1016/j.tate.2018.06.003

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, *36*(4), 717–731. https://doi.org/10.3758/BF03206553

White, S. Sakata, T., Avissar, G., Kools, Q., & van der Klink, M. (2015). An International Exploration on Professional Development of Experienced Teacher Educators: How DO They Keep Up? Retrieved from https://surfsharekit.nl/publiek/fontys/fd98e9b3-0cc5-4211-b302-d570ac6eca9c

Putnam, R. T., & Borko, H. (2000). What Do New Views of Knowledge and Thinking Have to Say About Research on Teacher Learning? *Educational Researcher*, *29*(1), 4–15. https://doi.org/10.3102/0013189X029001004

Reddy, L. A., Forman, S. G., Stoiber, K. C., & Gonzalez, J. E. (2017). A National Investigation of School Psychology Trainers' Attitudes and Beliefs about Evidence-Based Practices. *Psychology in the Schools*, *54*(3), 261–278. https://doi.org/10.1002/pits.21999

Reynolds, R., Ferguson-Patrick, K., & McCormack, A. (2013). Dancing in the ditches: Reflecting on the capacity of a university/school partnership to clarify the role of a teacher educator. *European Journal of Teacher Education*, *36*(3), 307–319. https://doi.org/10.1080/02619768.2012.755514

Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. *Handbook of research on teacher education*, *2*, 102–119.

Rokeach, M. (1968). Beliefs, attitudes and values: A theory of organization and change.

Ross, J. A. (1992). Teacher Efficacy and the Effects of Coaching on Student Achievement. *Canadian Journal of Education / Revue canadienne de l'éducation*, *17*(1), 51. https://doi.org/10.2307/1495395

Russell, T., & Korthagen, F. (2013). *Teachers who teach teachers: Reflections on teacher education*: Routledge.

Sackett, D. L., Rosenberg, W. M., Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: What it is and what it isn't. *BMJ (Clinical Research Ed.)*, *312*(7023), 71–72. https://doi.org/10.1136/bmj.312.7023.71

Sackett, D. L. (1997). Evidence-based medicine. *Seminars in Perinatology*, *21*(1), 3–5. https://doi.org/10.1016/S0146-0005(97)80013-4

Schleicher, A. (2012). *Preparing teachers and developing school leaders for the 21st century: Lessons from around the world / [edited by Andreas Schleicher]*. Paris: OECD.

Schmitt, T. A., & Sass, D. A. (2011). Rotation criteria and hypothesis testing for exploratory factor analysis: Implications for factor pattern loadings and interfactor correlations. *Educational and Psychological Measurement*, *71*(1), 95–113.

Schön, D. A. (1987). *Educating the reflective practitioner* (1st ed.). *Jossey-Bass higher education series*. San Francisco, CA: Jossey-Bass.

Scribner, J. P. (1999). Teacher Efficacy and Teacher Professional Learning: Implications for School Leaders. *Journal of School Leadership*, *9*(3), 209–234. https://doi.org/10.1177/105268469900900302

Seidel, T., Mok, S. Y., Hetmanek, A., & Knogler, M. (2017). Meta-Analysen zur Unterrichtsforschung und ihr Beitrag für die Realisierung eines Clearing House Unterricht für die Lehrerbildung. *Zeitschrift für Bildungsforschung*, *7*(3), 311–325. https://doi.org/10.1007/s35834-017-0191-6

Shapiro, H., Danish Technological Institute, GHK Consulting, Lauritzen, J., & Irving, P. (2011). *Emerging skills and competences: a transatlantic study: EU-US study for the European Commission*. [Place of publication not identified]: European Commission. Retrieved from http://ec.europa.eu/education/more-information/doc/2011/skills_en.pdf

Sherrill, J. A. (1999). Preparing teachers for leadership roles in the 21st century. *Theory Into Practice*, *38*(1), 56–61. https://doi.org/10.1080/00405849909543831

Shulman, L. (1987). Knowledge and Teaching: Foundations of the New Reform. *Harvard Educational Review*, *57*(1), 1–23. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Simosi, M. (2003). *Argumentation*, *17*(2), 185–202. https://doi.org/10.1023/A:1024059024337

Simpson, R. L., Whelan, R. J., & Zabel, R. H. (1993). Special Education Personnel Preparation in the 21st Century. *Remedial and Special Education*, *14*(2), 7–22. https://doi.org/10.1177/074193259301400203

Slavin, R. E. (2002). Evidence-Based Education Policies: Transforming Educational Practice and Research. *Educational Researcher*, *31*(7), 15–21. https://doi.org/10.3102/0013189X031007015

Slavin, R. E. (2008). Perspectives on Evidence-Based Research in Education—What Works? Issues in Synthesizing Educational Program Evaluations. *Educational Researcher*, *37*(1), 5–14. https://doi.org/10.3102/0013189X08314117

Smagorinsky, P., Cook, L. S., & Johnson, T. S. (2003). The twisting path of concept development in learning to teach. *Teachers College Record*, *105*(8), 1399–1436.

Smith, K. (2003). So, What About the Professional Development of Teacher Educators? *European Journal of Teacher Education*, *26*(2), 201–215. https://doi.org/10.1080/0261976032000088738

Smith, K. (2011). The multi-faceted teacher educator: A Norwegian perspective. *Journal of Education for Teaching*, *37*(3), 337–349. https://doi.org/10.1080/02607476.2011.588024

Smylie, M. A. (1988). The Enhancement Function of Staff Development: Organizational and Psychological Antecedents to Individual Teacher Change. *American Educational Research Journal*, *25*(1), 1–30. https://doi.org/10.3102/00028312025001001

Somech, A., & Bogler, R. (2002). Antecedents and Consequences of Teacher Organizational and Professional Commitment. *Educational Administration Quarterly*, *38*(4), 555–577. https://doi.org/10.1177/001316102237672

Stark, R. (2017). Probleme evidenzbasierter bzw. -orientierter pädagogischer Praxis. *Zeitschrift für Pädagogische Psychologie*, *31*(2), 99–110. https://doi.org/10.1024/1010-0652/a000201

Staub, F. (2001). Fachspezifisch-pädagogisches Coaching: Theoriebezogene Unterrichtsentwicklung zur Förderung von Unterrichtsexpertise. *Beiträge zur Lehrerinnen- und Lehrerbildung*, *19*(2), 175–198. Retrieved from //www.pedocs.de/volltexte/2017/13454/

Stein, M. K., & Wang, M. C. (1988). Teacher development and school improvement: The process of teacher change. *Teaching and Teacher Education*, *4*(2), 171–187. https://doi.org/10.1016/0742-051X(88)90016-9

Stephenson, B. J., & Rowe, B. H., Haynes, R. B., Macharia, W. M., & Leon, G. (1993). Is This Patient Taking the Treatment as Prescribed? *JAMA*, *269*(21), 2779. https://doi.org/10.1001/jama.1993.03500210079036

Stevenson, A. (2010). *Oxford dictionary of English* (3rd ed. / edited by Angus Stevenson). Oxford: Oxford University Press.

Stigler, J. W., & Hiebert, J. (2009). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom* (1st Free Press trade pbk. ed.). New York: Free Press.

Straus, S. E., Glasziou, P., Richardson, W. S., & Haynes, R. B. (2019). *Evidence-based medicine: How to practice and teach EBM / Sharon E. Straus, MD, Paul Glasziou, MRCGP, FRACGP, PhD, W. Scott Richardson, MD, R. Brian Haynes, MD ; with contributions by Reena Pattani, MD, MPH, Areti Angeliki Veroniki, PhD* (Fifth edition). Edinburgh, London, New York: Elsevier.

Strosahl, K. (1998). The dissemination of manual-based psychotherapies in managed care: Promises, problems, and prospects. *Clinical Psychology: Science and Practice, 5*(3), 382–386.

Sullivan, K. J., Wayne, C., Patey, A. M., & Nasr, A. (2017). Barriers and facilitators to the implementation of evidence-based practice by pediatric surgeons. *Journal of Pediatric Surgery, 52*(10), 1666–1673. https://doi.org/10.1016/j.jpedsurg.2017.02.001

Swennen, A., Jones, K., & Volman, M. (2010). Teacher educators: their identities, sub-identities and implications for professional development. *Professional Development in Education, 36*(1-2), 131–148. https://doi.org/10.1080/19415250903457893

Swennen, A., & van der Klink, M. (Eds.). (2009). *Becoming a teacher educator: Theory and practice for teacher educators / Anja Swennen, Marcel van der Klink, editors*. Dordrecht, London: Springer. https://doi.org/10.1007/978-1-4020-8874-2

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics*: Pearson Boston, MA.

Tack, H., Valcke, M., Rots, I., Struyven, K., & Vanderlinde, R. (2017). Uncovering a hidden professional agenda for teacher educators: A mixed method study on Flemish teacher

educators and their professional development. *European Journal of Teacher Education*, *41*(1), 86–104. https://doi.org/10.1080/02619768.2017.1393514

Tack, H., & Vanderlinde, R. (2014). Teacher Educators' Professional Development: Towards a Typology of Teacher Educators' Researcherly Disposition. *British Journal of Educational Studies*, *62*(3), 297–315. https://doi.org/10.1080/00071005.2014.957639

Tack, H., & Vanderlinde, R. (2016). Measuring Teacher Educators' Researcherly Disposition: Item Development and Scale Construction. *Vocations and Learning*, *9*(1), 43–62. https://doi.org/10.1007/s12186-016-9148-5

Thompson, B. (2007). Exploratory and confirmatory factor analysis: Understanding concepts and applications. *Applied Psychological Measurement*, *31*(3), 245–248.

Thyer, B. A., & Myers, L. L. (2011). The quest for evidence-based practice: A view from the United States. *Journal of Social Work*, *11*(1), 8–25. https://doi.org/10.1177/1468017310381812

Timperley, H. S., & Phillips, G. (2003). Changing and sustaining teachers' expectations through professional development in literacy. *Teaching and Teacher Education*, *19*(6), 627–641. https://doi.org/10.1016/S0742-051X(03)00058-1

Tooley, J., & Darby, D. (1998). *Educational research: a critique: a survey of published educational research: report presented to OFSTED*. London: Office for Standards in Education.

Toulmin, S. E. (2003). *The Uses of Argument*: Cambridge University Press. https://doi.org/10.1017/CBO9780511840005

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an Elusive Construct. *Teaching and Teacher Education*, *17*(7), 783–805. https://doi.org/10.1016/S0742-051X(01)00036-1

Tschannen-Moran, M., & Hoy, A. W. (2007). The differential antecedents of self-efficacy beliefs of novice and experienced teachers. *Teaching and Teacher Education, 23*(6), 944–956. https://doi.org/10.1016/j.tate.2006.05.003

Tschannen-Moran, M., Hoy, A. W., & Hoy, W. K. (1998). Teacher Efficacy: Its Meaning and Measure. *Review of Educational Research*, *68*(2), 202–248. https://doi.org/10.3102/00346543068002202

Tschannen-Moran, M., & Johnson, D. (2011). Exploring literacy teachers' self-efficacy beliefs: Potential sources at play. *Teaching and Teacher Education, 27*(4), 751–761. https://doi.org/10.1016/j.tate.2010.12.005

Tschannen-Moran, M., & McMaster, P. (2009). Sources of self-efficacy: Four professional development formats and their relationship to self-efficacy and implementation of a new teaching strategy. *The Elementary School Journal*, *110*(2), 228–245.

Upton, D., & Upton, P. (2006). Development of an evidence-based practice questionnaire for nurses. *Journal of advanced nursing*, *53*(4), 454–458.

Van Driel, J. H., Beijaard, D., & Verloop, N. (2001). Professional development and reform in science education: The role of teachers' practical knowledge. *Journal of Research in Science Teaching*, *38*(2), 137–158. https://doi.org/10.1002/1098-2736(200102)38:2<137::AID-TEA1001>3.0.CO;2-U

Van Driel, J. H., Verloop, N., van Inge Werven, H., & Dekkers, H. (1997). *Higher Education*, *34*(1), 105–122. https://doi.org/10.1023/A:1003063317210

Van Driel, J. H., Beijaard, D., & Verloop, N. (2001). Professional development and reform in science education: The role of teachers' practical knowledge. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *38*(2), 137-158.

Van Tartwijk, J., Brok, P. d., Veldman, I., & Wubbels, T. (2009). Teachers' practical knowledge about classroom management in multicultural classrooms. *Teaching and Teacher Education, 25*(3), 453–460. https://doi.org/10.1016/j.tate.2008.09.005

Vanassche, E., & Kelchtermans, G. (2015). The state of the art in Self-Study of Teacher Education Practices: A systematic literature review. *Journal of Curriculum Studies*, *47*(4), 508–528. https://doi.org/10.1080/00220272.2014.995712

Vanassche, E., Rust, F., Conway, P. F., Smith, K., Tack, H., & Vanderlinde, R. (2015). InFo-TED: Bringing policy, research, and practice together around teacher educator development. In *International teacher education: Promising pedagogies (part C)* (pp. 341–364). Emerald Group Publishing Limited.

Vanderlinde, R., Tuytens, M., Wever, B. de, & Aelterman, A. (2016). Professional learning of teacher educators, teachers, and student teachers. In *Professional learning in education: challenges for teacher educators, teachers and student teachers* (pp. 9–20). Academia Press.

Vanderlinde, R., & van Braak, J. (2010). The gap between educational research and practice: views of teachers, school leaders, intermediaries and researchers. *British Educational Research Journal, 36*(2), 299–316. https://doi.org/10.1080/01411920902919257

Vera, M., Salanova, M., & Martín-del-Río, B. (2011). Self-efficacy among university faculty: How to develop an adjusted scale. *Anales de Psicología, 27*(3), 800–807.

Verloop, N. (1989). *Interactive cognitions of student-teachers: An intervention study*. Arnhem: CITO.

Vermunt, J. D., Vrikki, M., van Halem, N., Warwick, P., & Mercer, N. (2019). The impact of Lesson Study professional development on the quality of teacher learning. *Teaching and Teacher Education, 81*, 61–73. https://doi.org/10.1016/j.tate.2019.02.009

Wetzel, M., Hoffman, J. V., Maloch, B., Vlach, S. K., Taylor, L. A., Svrcek, N. S., Lavender, H. (2018). Coaching elementary preservice teachers: Hybrid spaces for cooperating teachers and university field supervisors to collaborate. *International Journal of Mentoring and Coaching in Education*, *7*(4), 357–372.

Wetzel, M. M., Hoffman, J. V., Roach, A. K., & Russell, K. (2018). Practical Knowledge and Teacher Reflection from a Practice-Based Literacy Teacher Education Program in the First Years: A Longitudinal Study. *Teacher Education Quarterly*, *45*(1), 87–111.

Wetzel, M. M., Svrcek, N. S., LeeKeenan, K., & Daly-Lesch, A. (2019). Coaching through the hard parts: Addressing tensions in teaching with one preservice teacher learning to teach literacy in a fifth-grade classroom. *Teaching and Teacher Education*, *82*, 43–54. https://doi.org/10.1016/j.tate.2019.02.006

What Works Clearinghouse (2014). WWC intervention report: Repeated Reading. Retrieved from http://ies.ed.gov/ncee/wwc/pdf/intervention_reports/wwc_repeatedreading_051314.pdf.

Wilson, S. M. (1990). *The secret garden of teacher education* (72, 204-206): Phi Delta Kappan.

Wiseman, A. W. (2010). The Uses of Evidence for Educational Policymaking: Global Contexts and International Trends. *Review of Research in Education*, *34*(1), 1–24. https://doi.org/10.3102/0091732X09350472

Woodrow, J. E. J. (1992). The Influence of Programming Training on the Computer Literacy and Attitudes of Preservice Teachers. *Journal of Research on Computing in Education*, *25*(2), 200–219. https://doi.org/10.1080/08886504.1992.10782044

Wrigley, T. (2015). Evidence-based teaching: Rhetoric and reality. *Improving Schools*, *18*(3), 277–287. https://doi.org/10.1177/1365480215602983

Wubbels, T. (1992). Taking account of student teachers' preconceptions. *Teaching and Teacher Education, 8*(2), 137–149. https://doi.org/10.1016/0742-051X(92)90004-M

Wyer Jr., R. S., & Albarracín, D. (2005). Belief Formation, Organization, and Change: Cognitive and Motivational Influences. In *The handbook of attitudes* (pp. 273–322). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Xu, H., & Pedder, D. (2014). Lesson Study: An international review of the research. In *Lesson Study* (pp. 29–58). Routledge.

Zahorik, J. A. (1984). Can Teachers Adopt Research Findings? *Journal of Teacher Education, 35*(1), 34–36. https://doi.org/10.1177/002248718403500110

Zanting, A., Verloop, N., & Vermunt, J. D. (2001). Student teachers eliciting mentors' practical knowledge and comparing it to their own beliefs. *Teaching and Teacher Education, 17*(6), 725–740. https://doi.org/10.1016/S0742-051X(01)00026-9

Zeichner, K. (2005). Becoming a teacher educator: a personal perspective. *Teaching and Teacher Education, 21*(2), 117–124. https://doi.org/10.1016/j.tate.2004.12.001

Zeichner, K. (2010). Rethinking the Connections Between Campus Courses and Field Experiences in College- and University-Based Teacher Education. *Journal of Teacher Education, 61*(1-2), 89–99. https://doi.org/10.1177/0022487109347671

Zeichner, K. M. (2009). *Teacher education and the struggle for social justice*. New York: Routledge. Retrieved from http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10296886

7. Appendix

Table 5

Teacher educators perceived challenges to EBT

	Total sample (*N* = 243)	Professor (*n* = 90)	Post-Doc (*n* = 23)	PhD Candidate (*n*= 80)	Teaching associate (*n* = 17)	School Mentor (*n* = 33)
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
1) I face a lot of time constraints that are barriers to the implementation of current research evidence into my teaching practice	3.28 (1.30)	3.62* (1.20)	3.40 (1.10)	3.15 (1.30)	2.65* (1.30)	2.90* (1.50)
2) I am not trained enough to implement current research evidence in my teaching practice	4.80 (1.25)	5.10* (1.20)	4.48 (1.30)	4.70 (1.26)	4.18* (1.30)	4.52 (1.10)
3) Poor critical appraisal skills could be a barrier to the implementation of research evidence in my teaching practice	3.60 (1.60)	3.60 (1.70)	4.13 (1.30)	3.61 (1.60)	2.94(1.40)	3.27 (1.42)
4) The lack of research evidence in the literature is a barrier to the implementation of EBT	3.70 (1.40)	3.80 (1.45)	4.00 (1.20)	3.65 (1.35)	3.60 (1.32)	3.27 (1.50)
5) Having to stay up to date with the literature is a barrier to the implementation of current research evidence in my teaching practice	4.74 (1.20)	4.83 (1.20)	4.43 (1.40)	4.80 (1.13)	4.30 (1.30)	4.80 (1.03)
6) I find it difficult to implement current research evidence into my teaching practice because it is hard for me to evaluate the quality of the evidence	4.90 (1.00)	5.10* (1.00)	4.83 (1.00)	5.00* (1.00)	4.82 (1.20)	4.36* (1.10)

Note. Stars represent significant differences among professors and PhD candidates, professors and teaching associates and professors and school mentors

Table 6

Teacher educators perceived facilitators to foster EBT practices

	Total sample (N = 243)	Professor (n = 90)	Post-Doc (n = 23)	PhD Candidate (n= 80)	Teaching associate (n = 17)	School Mentor (n = 33)
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
1) University teachers who are involved in creating evidence based databases are more likely to implement current research evidence in their teaching practice	2.72 (1.10)	2.64 (1.04)	2.65 (0.71)	2.90 (1.16)	2.71 (1.30)	2.60 (1.10)
2) My teaching experience influences how I judge evidence based recommendations	2.70 (1.00)	2.61 (1.02)	2.90 (0.82)	2.80 (1.02)	2.53 (0.80)	2.60 (1.03)
3) Easy access to evidence based databases (e.g. clearinghouse) fosters the use of research findings in my teaching practice	4.42 (1.13)	4.50 (1.20)	4.35 (1.10)	4.40 (1.20)	3.80 (1.20)	4.64 (1.00)
4) Discussing teaching approaches with colleagues helps me to integrate current research evidence into my teaching practice	4.74 (1.10)	4.80 (1.00)	5.00 (0.90)	4.70 (1.30)	4.65 (1.32)	4.73 (0.80)
5) It is essential for me to have access to bibliographic databases and evidence sources	5.16 (1.05)	5.40 (0.93)	5.00 (1.09)	5.03 (1.20)	5.10 (0.90)	5.12 (1.02)
6) In my opinion, EBT requires the use of critical appraisal skills to ensure the quality of all the research papers retrieved	5.16 (0.92)	5.30 (0.92)	5.04 (0.93)	5.20 (0.91)	5.20 (0.90)	4.82 (0.92)
7) Being a researcher myself facilitates the use of evidence in my practice	4.90 (1.34)	5.24* (1.00)	5.00 (1.00)	4.81 (1.21)	4.24* (1.90)	4.21 (1.92)

Note. Stars represent significant differences among professors and teaching associates