

Teacher educators as central agents in an evidence-based practice agenda:

An empirical study on their attitudes, professional challenges, and possible solutions

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Abstract

Evidence-based practice (EBP) is an approach that addresses the gap between research and practice in education. The success of this approach depends on whether scientific knowledge finds its way to practitioners. Teacher education and teacher educators play a central role in this endeavor. Teacher educators have the crucial task of promoting EBP among student teachers by selecting and communicating high-quality research evidence. According to the empirical literature, teacher educators need to have positive attitudes toward EBP and possess the necessary knowledge and resources in order to implement and promote EBP successfully. However, previous research on these critical characteristics among teacher educators is scarce. The present research, therefore, aims to examine teacher educators' attitudes toward EBP and the knowledge- and resource-related challenges they encounter and to identify how to best support teacher educators in promoting EBP in teacher education.

The present dissertation summarizes two empirical studies. Data was derived from a newly developed online survey instrument based on self-report measures. Statistical analyses relied on multiple analyses of variance (MANOVAs), as well as on latent profile analyses (LPA). In the first study ($N = 58$), teacher educators' attitudes, knowledge- and resource-related challenges, and usage of research evidence were examined. The results revealed overall positive attitudes toward EBP and, at the same time, the need for more support related to resources and content. Moreover, teacher educators with more experience in teaching and research seemed to struggle less with knowledge- and resource-related challenges related to EBP than those with less experience. Given that teacher educators are a heterogeneous group of professionals, the second study ($N = 484$) sought to identify different subgroups of teacher educators based on their attitudes and perceived challenges. Latent profile analysis resulted in the identification of five distinct subgroups of teacher educators: *high challenges*, *no challenges*, *knowledge & resource challenges*, *resource challenges*, and *skeptical*. The subgroups partly differed in their reported use of evidence in their teaching. Further results revealed that service platforms, such as the Clearing House Unterricht platform, provide a useful and supportive service for all subgroups. Together, the findings of the present research indicate that teacher educators need to be supported in their role as central agents in an EBP agenda. They might also be used to design service initiatives and professional development programs to facilitate the promotion of EBP.

Zusammenfassung

Evidenzbasierte Praxis (EBP) beschreibt einen Ansatz, um Forschung und Praxis im Bildungswesen näher zusammenzubringen. Der Erfolg dieses Ansatzes hängt entscheidend davon ab, ob wissenschaftliche Erkenntnisse ihren Weg in die Unterrichtspraxis von Lehrkräften finden. Der Lehrerbildung und den Lehrerbildner*innen kommen hierbei zentrale Funktionen zu. So haben Lehrerbildner*innen die entscheidende Aufgabe, EBP bei angehenden Lehrkräften zu fördern, indem sie relevante und qualitativ hochwertige Evidenz auswählen und in ihren Lehrveranstaltungen vermitteln. Um dieser Aufgabe nachzukommen, sollten Lehrerbildner*innen eine positive Einstellung zu EBP haben und über das notwendige Wissen und Ressourcen verfügen, um EBP umzusetzen und zu fördern. Bisher existiert allerdings kaum systematische Forschung zu diesen relevanten Merkmalen von Lehrerbildner*innen. In dem vorliegenden Forschungsprojekt wird daher untersucht, welche Einstellungen sowie wissens- und ressourcenbezogenen Herausforderungen Lehrerbildner*innen wahrnehmen und wie sie in ihren Aufgaben unterstützt werden können, um EBP in der Lehrerbildung erfolgreich zu fördern.

Die vorliegende Dissertation umfasst zwei empirische Studien. Die Daten wurden mit einem neu entwickelten Online-Fragebogen erhoben. Für die statistischen Analysen wurden multiple Varianzanalysen (MANOVAs) sowie latente Profilanalysen (LPA) gerechnet. In der ersten Studie ($N = 58$) wurden die Einstellungen, Herausforderungen und Nutzungsformen von Lehrerbildner*innen untersucht. Die Ergebnisse zeigten insgesamt positive Einstellungen zu EBP und gleichzeitig einen Bedarf an mehr ressourcen- und wissensbezogener Unterstützung bei der Förderung von EBP. Zudem zeigte sich, dass Lehrerbildner*innen mit weniger Hintergrunderfahrung die Förderung von EBP herausfordernder empfanden, als Lehrerbildner*innen mit mehr Erfahrung. Angesichts der Tatsache, dass Lehrerbildner*innen eine heterogene Berufsgruppe sind, war das Ziel in der zweiten Studie ($N = 484$), verschiedene Subgruppen von Lehrerbildner*innen basierend auf ihren Einstellungen und wahrgenommenen wissens- und ressourcenbezogenen Herausforderungen in Bezug auf EBP zu identifizieren. Die durchgeführten latenten Profilanalysen resultierten in der Identifizierung von fünf Subgruppen von Lehrerbildner*innen: *high challenges*, *no challenges*, *knowledge & resource challenges*, *resource challenges*, und *skeptical*. Die fünf Subgruppen unterschieden sich zudem in der Nutzung von Evidenz: Lehrerbildner*innen in Subgruppen mit skeptischen Einstellungen und/oder wahrgenommenen Herausforderungen in Bezug auf EBP, berichteten, dass sie Evidenz

seltener für ihre Lehre nutzen. Die weiteren Ergebnisse zeigten, dass Service-Plattformen, wie das vorgestellte Clearing House Unterricht (CHU), für alle Subgruppen eine nützliche und unterstützende Anlaufstelle bieten. Insgesamt deuten die Ergebnisse beider Studien darauf hin, dass Lehrerbildner*innen als die zentralen Akteure in EBP unterstützt werden sollten. Sie zeigen zudem, wie Serviceinitiativen und Weiterbildungsprogrammen gestaltet werden können, um die Implementierung und Unterstützung von EBP in der Lehrerbildung zu unterstützen.

Included Publications

As part of the present dissertation, two manuscripts have been published in two international journals. The author of this dissertation is the first author of both articles and played a leading role in the development, conceptualization, data collection, writing, statistical data analysis, and publication-based presentation of these journal manuscripts. The supervisor, Prof. Tina Seidel, and the co-authors, Dr. Freydis Vogel and Dr. Maximilian Knogler, guided the development of the online survey with critical reviews, contributed to manuscript revision, and read and approved the submitted versions.

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1 Introduction

Teaching is a complex and multifaceted practice involving a multitude of contextual variables, critical decisions, and student outcomes (Kunter et al., 2013). For good teaching practice, teachers must have the appropriate teaching knowledge, which they can acquire from a variety of sources, ranging from formal knowledge to personal experiences and individual beliefs (Baumert & Kunter, 2006; Shulman, 1987). Another important source that can provide trustworthy and relevant information on effective teaching, but is often ignored, is evidence from empirical educational research (e.g., Bauer et al., 2017). As part of a new paradigm of teacher professionalism, teachers are required to consider research as an additional important source of teaching knowledge that can enrich their professional decision-making and practice (Baumert & Kunter, 2006; Furlong, 2014). According to educational policies and researchers, teachers should be required to develop the capacity to integrate research evidence in order to design and implement appropriate actions to improve student learning and achievement (Bauer & Prenzel, 2012; European Commission, 2007; Hargreaves, 1996). This concept of aligning research and practice more closely is currently reflected in the term “evidence-based practice” (EBP; e.g., Farley-Ripple et al., 2018) and provides the frame for the present research. EBP is based on the idea that research should not only contribute to the growing body of disciplinary knowledge but also help improve professional decision-making and practice, for instance, by increasing the use of practices that lead to desired outcomes (e.g., Rousseau & Gunia, 2016; Shavelson et al., 2013).

For the teaching profession, the concept of EBP may have several benefits. First, it fosters teaching that is informed by the best available, research-generated knowledge. Encouraging and supporting teachers in selecting and implementing research evidence (e.g., to develop effective teaching strategies) contributes to the quality of teaching more generally (Cain et al., 2019; Slavin, 2020). Second, EBP is likely to strengthen the appearance and reputation of the teaching profession. Instead of considering teaching an improvisational, ideological, or tradition-led field, it can be transformed into a more scientific and independent endeavor (Ball & Forzani, 2009; Hiebert & Morris, 2012). Third, by tackling the underutilization of research evidence in teaching, EBP promotes educational research to serve its purpose (Gorard, 2020) and to build usable and accessible knowledge (Burkhardt & Schoenfeld, 2003; Hedges, 2018). This can strengthen the connection between research and teaching practice in the long term.

To date, educational and psychological research has accumulated a rich body of theories, interventions, and designs for teachers to draw and reflect upon in classroom decision-making and teaching practice (e.g., Chi & Wylie, 2014; Engelmann et al., 2016; Slavin et al., 2009). At the same time, the empirical literature regarding EBP reveals an underutilization of research-based knowledge when it comes to teaching and learning due to teachers' lack of motivation, skills, or resources to engage with research evidence (e.g., Bell et al., 2010; Brown & Zhang, 2016; Hemsley-Brown & Sharp, 2003). In this context, teacher education can provide an important transfer mechanism to enable and motivate future teachers to understand and use research evidence in their practice. Within teacher education, teacher educators are responsible for explaining and promoting EBP and act as “transfer agents” or “brokers” between research and teaching practice (Cochran-Smith et al., 2020; Shavelson, 2020). At the university level, teacher educators are a heterogeneous group of professionals with various roles and functions as academic scholars and the teachers of teachers (European Commission, 2013). EBP adds to teacher educators' demanding tasks, as they need to access and survey the ever-increasing amount of research in education and evaluate its practical value for future teachers. In addition, teacher educators need to find ways to integrate and communicate this evidence in their teaching. Despite teacher educators' professional heterogeneity, their great responsibility to future teachers, and the demanding context of teacher education, empirical research on teacher educators is still scarce—particularly with regard to EBP.

The present research addresses this dearth of empirical information and responds to the call for EBP in teacher education. The first objective of the research project presented here was to develop a better understanding of teacher educators and to contribute to the theoretical and empirical literature on this heterogeneous professional group. The second objective was to identify critical professional characteristics in teacher educators that might help or hinder their promotion of EBP. Here, the ultimate goal was to uncover dominant combinations of critical characteristics that co-occur in teacher educators in order to derive tailored support solutions and learning opportunities. Finally, the third objective was to provide empirical information concerning teacher educators' assessment of an exemplary support solution. Together, the present research seeks to enhance theoretical and empirical clarity on teacher educators, their attitudes, their professional challenges, and possible solutions regarding EBP. In this regard, an adapted online survey instrument was developed and applied in two related studies to investigate teacher educators' attitudes toward EBP, knowledge- and resource-related

challenges related to EBP, their usage of EBP, and their assessment of an exemplary support solution.

The following sections serve as a frame for the two empirical studies and position them in a broader context. Within the introduction, the call for EBP in education and teaching is discussed based on the theoretical and empirical literature. Then, teacher education is presented as an important context for EBP in terms of research–practice transfer, which crucially depends on teacher educators as central agents. Following this, a conceptualization of professional characteristics in teacher educators relevant to the successful support of EBP is derived from established frameworks. Subsequently, the aim and objectives of the present research, its methodology, and the enclosed studies are presented. Finally, the empirical findings of the studies and their methodological, theoretical, and practical implications are presented. The potential contributions of these findings to EBP in teacher education and, specifically, to tailored support solutions for teacher educators are discussed.

2 The Evidence-based Practice Agenda

2.1 The trend toward evidence-based practice in professional fields

The EBP approach first received attention in medicine in the early 1990s (Guyatt et al., 1992). Reform efforts aimed to increase the application of practices supported by research, thereby ensuring that patients receive the most appropriate treatment with the greatest likelihood of success (Sackett et al., 1996). In this context, EBP was defined as the “conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett, 1997, p 3). In determining the optimal care for a patient, EBP has often been visualized as the three-legged stool or three circles of clinical decision-making, including (1) best research evidence, (2) individual clinical expertise, and (3) patient preferences and circumstances (Spring, 2007), which must be integrated in the decision-making process simultaneously.

Over the years, the medical profession has established a common understanding of EBP, which defines standards for the training and practical work of physicians, as well as mechanisms to promote EBP (Dawes et al., 2005). This movement has been marked by the development of various services and practical resources provided by organizations like the international voluntary Cochrane Collaboration (www.cochrane.org) and the Oxford Centre for Evidence-Based Medicine (www.cebm.ox.ac.uk), which aim to foster evidence-based healthcare. Additionally, the movement has led to a proliferation of randomized control trials, systematic reviews, evidence synthesis, and meta-analyses on effective treatments (Haynes, 2001). In the past decades, EBP has found its way to other health fields (e.g., nursing, dentistry) and a number of different disciplines (e.g., management [Rousseau, 2012], psychology [APA Presidential Task Force on Evidence-Based Practice, 2006; Spring, 2007], and social work [Gambrill, 1999]), with the aim of fostering the implementation of effective, empirically validated practices.

Likewise, the call for evidence-based reform has echoed in education (Bromme et al., 2014; Slavin, 2020). In this context, EBP has been discussed as an approach to aligning educational practice and educational research (Farley-Ripple et al., 2018). In order to improve professional decision-making and practice, professionals in education must be provided with a sound evidence basis and be able to utilize evidence-based knowledge for their (educational) practice

(Davies, 1999). In this context, EBP is often described as having a “what works” agenda (i.e., identifying “what works” in what circumstances and utilizing that knowledge for educational practice). A popular supporter of this approach was Robert Slavin, whose work focused on providing practitioners with evidence from effective educational program evaluations generated by rigorous experimental studies (e.g., Slavin, 2008). Accordingly, EBP in educational practice includes the evaluation, identification, and implementation of effective programs. The focus on evidence gathered from experimental and effectiveness research (with randomized control trials as the gold standard; Sackett et al., 1996) and the top-down terminology of being evidence-“based” have been the subjects of controversial debate (Kvernbekk, 2016; Oancea & Pring, 2008), as they may imply a unidirectional, technical use of evidence (i.e., “cookbook”-style education; Hammersley, 2009; Kvernbekk, 2016) and undermine the educators’ individual expertise (Biesta, 2007).

Consequently, this debate has led to more inclusive approaches to and labels of EBP that acknowledge multiple sources and functions of evidence (Joyce & Cartwright, 2020; Malouf & Taymans, 2016; Simpson, 2019). Instead of rigorous evidence being the sole source for teaching decisions, professional judgment in education should be based on different types of evidence that address a practical problem or question (Brown, 2017; Kvernbekk, 2016; Stark, 2017). Depending on the practical context, this evidence may include research evidence from experimental studies, cross-sectional studies, evaluations, case studies, or descriptive studies. (Ferguson, 2021; Rousseau & Gunia, 2016). Moreover, establishing best practice in education involves not only accessing, critically appraising, and implementing such research evidence but also integrating this evidence with professional judgment and experience (Davies, 1999). Thus, EBP has been defined as “integrating individual teaching and learning expertise with the best available external evidence from systematic research” (Davies, 1999, p. 117). A similar definition is provided by the UK’s Department for Education (2010), which describes EBP as a combination of practitioner expertise and knowledge of the best external research and evaluation-based evidence. Both definitions emphasize how evidence from external research constitutes a complementary resource to individual expertise and experience.

In sum, EBP reflects an approach to professional decision-making and action that has received growing interest in the field of education. In the present research, EBP is understood as the use of research evidence (i.e., peer reviewed and published by academic researchers) to inform and

support teaching practices. In this context, EBP is used as an umbrella term that includes evidence-informed, -oriented, and -aware approaches.

2.2 How research evidence can impact teaching practices

With the call for EBP in education, attention has focused particularly on teachers and their practice (Hargreaves, 1996). Professional standards for teacher education increasingly mention the pivotal role of research evidence in teachers' professionalism, both nationally and internationally (Bauer & Prenzel, 2012; European Commission, 2007). Teachers have the great responsibility of preparing future generations for their participation in a fast-changing and complex society (Organization for Economic Cooperation and Development [OECD], 2005). As teaching should be considered an important and high-quality profession, teachers need the best available knowledge to meet these requirements. The EBP agenda in teaching challenges teachers to constantly engage with new knowledge. Teachers should be able to receive and critically evaluate available research evidence (e.g., from educational and psychological research) and consider it in their professional decision-making and action (Furlong, 2014).

This leads to the question of what and how research evidence can contribute to the development of teachers' professional practice and the quality of teaching. Following Cain et al. (2019), research evidence can have an impact on teaching quality in that it contributes to teachers' professional judgment. The authors identify three ways in which this can happen. First, research can inform teachers' decision-making as it informs their thinking in general, for instance, when they plan and prepare their teaching resources or assess their students. In this process, the contribution of research may vary according to the focus of the decision (i.e., specific versus broad), teachers' research engagement (i.e., superficial reading versus careful review), and their commitment to research-informed change. Second, research evidence can inform teachers' reflections by addressing their professional selves and conceptual frameworks. By engaging with research evidence, teachers can grow their knowledge base, get innovative new ideas, and question their professional self. As a matter of reflection, this might lead to a change of practice (Schön, 1983). Third, it can influence organizational learning within schools in that teachers discuss and exchange ideas about a specific topic informed by research (Cain & Allan, 2017). Such a school environment might then be able to adapt more quickly to changing external environments, embrace innovations in internal organization, and ultimately improve student outcomes (Kools & Stoll, 2016).

In sum, according to Cain et al. (2019), promoting EBP in teaching can contribute to the quality of teaching and learning at the individual and school level. Thus, teachers should be encouraged and enabled to integrate research evidence into all aspects of their work as part of their continual improvement, reflection, and communication (Coldwell et al., 2018).

2.3 Current state of research on evidence-based practice in teaching

Apart from the assumed benefits of teachers' engagement with research evidence on teaching practices (see Cain et al., 2019, for an overview), a few empirical studies have investigated the effects of teachers' use of research on teaching practices and school improvement (e.g., Hemsley-Brown & Sharp, 2003). The CUREE Report, a systematic research review on how practitioners engage in and with research to inform and develop their practice, listed a range of positive teacher outcomes that emerged from EBP, including improvements in their pedagogic knowledge and skills, as well as greater teacher confidence (Bell et al., 2010). Accordingly, Coldwell et al. (2018) reported in their evaluation that research informed teachers' thinking and encouraged them to experiment with, test, and trial new approaches in more systematic ways.

Research has also suggested that EBP is rarely implemented in teachers' everyday practice. A study conducted in Australia investigated teachers' preparedness for EBP (Parr & Timperley, 2008). The findings indicated a low-developed understanding of the principles and processes underlying evidence-based decision-making in teachers. In the study, participants did not consider evidence (specifically, student test data) when thinking about decision-making related to everyday practices of the classroom. An interview study conducted by Hetmanek et al. (2015) with 25 German teachers indicated that they hardly considered research evidence in their classroom decisions. When confronted with problematic classroom situations, teachers more often referred to non-scientific sources (i.e., subjective theories and anecdotal evidence) than to research evidence, as was shown in a study with 202 German student teachers (Kiemer & Kollar, 2021). Additional findings of this study revealed that student teachers' insufficient use of research evidence may be caused by unfavorable beliefs about the utility of educational research evidence. However, other studies have suggested that teachers indeed perceive a general utility value and usefulness of research evidence (Haberfellner & Fenzl, 2017; Thomm et al., 2021) but do not necessarily find it to be relevant to their own practice (Booher et al., 2020). Teachers may feel a lack of alignment between research evidence and their prior knowledge or subjective theory (Borg, 2010).

To conclude, the empirical literature on EBP in teaching reveals insufficient preparedness for EBP among (student) teachers. Despite the expected benefits of EBP regarding the quality of teaching and its outcomes, teachers' use of research evidence is quite often superficial. This issue might be caused by an intertwined set of factors, including the evidence base available to teachers, dissemination strategy (i.e., communication of evidence), and teachers' education and training concerning EBP (Brown & Zhang, 2016; Cain et al., 2019; Farley-Ripple et al., 2018). Consequently, several approaches have evolved to address the underutilization of research evidence in teaching.

2.4 Ways to promote evidence-based practice in teaching

The strong call for EBP in teaching has provoked various approaches to promoting the use and implementation of EBP. Here, a general distinction can be made between (1) approaches that aim to generate more robust evidence of “what works,” (2) approaches that aim to communicate and disseminate robust evidence to (future) teachers in order to make professional decisions informed by evidence, and (3) approaches that aim to enable future teachers to become research-based in their own work in order to generate evidence-based knowledge (Davies, 1999).

The first approach addresses the increasing need for robust evidence from educational research to inform teaching strategies (i.e., instructional practices) in order to improve teaching and learning at schools (Gorard, 2020). This aspiration not only results in an appreciation of educational research as a systematic and useful enterprise (Burkhardt & Schoenfeld, 2003; Hedges, 2018) but also in publicly funded initiatives, such as the Education Endowment Foundation (EEF, www.educationendowmentfoundation.org.uk) and the Institute of Education Science (IES, www.ies.ed.gov), which promote and fund high-quality research in education (Edoald & Nevill, 2020). As such, these initiatives contribute to the quality and range of high-quality, practice-relevant educational research.

The second approach has mainly been addressed by recently established organizations and clearing houses that offer various tools and services, such as synthesis, summaries, guidelines, practice guides, and ready-made material that support practitioner uptake of educational evidence (e.g., Cutspec, 2004; See, 2020). Robert Slavin (2008, 2020), a pioneer of EBP in education, considered the syntheses of research on education programs a key requirement for EBP and sought to make educators and policymakers aware of research-proven interventions.

Numerous initiatives have followed this agenda with the aim of facilitating and supporting the process of establishing EBP by making the output of scientific research publicly available and free of charge. A flagship initiative is the Institute of Education Sciences' What Works Clearinghouse (WWC, www.ies.ed.gov/ncee/wwc/FWW), which reviews research on practical programs in many school-related areas and provides practitioners with systematic summaries of experimental studies based on prescribed quality criteria. Other organizations, reviewing solely experimental studies include the Best Evidence Encyclopedia (BEE, www.bestevidence.org) and the Campbell Collaboration (www.campbellcollaboration.org). The design, content, and material of these organizations and initiatives are targeted primarily at teachers, policymakers, and school leaders to directly implement an evidence-based idea or program.

The third approach is based on the understanding of teaching as a research-based profession (Hargreaves, 1996). In order to support research–practice transfer, teachers must be able to actively engage in and with research evidence. Thus, several concepts of research-based teacher education, including courses, workshops, and training, have been developed to familiarize teachers with the research process, to foster their research skills (by means of an “inquiry stance”; Cochran-Smith & Lytle, 2015), and to engage them in research projects (Böttcher-Oschmann et al., 2021; Niemi, 2008). These concepts are often described in terms of “action research” or “practitioner research.” This third approach illustrates how teacher education provides an important context for research–practice transfer. It offers a research-oriented context that is enriched with various learning opportunities for student teachers. Thus, teacher education constitutes an interface through which to integrate the approaches presented here and to prepare future teachers for EBP. The present research, therefore, introduces teacher education as a promising and complementary route for supporting EBP among student teachers.

3 Teacher Education, Teacher Educators, and Evidence-based Practice

3.1 Fostering evidence-based practice through teacher education

A core task of teacher education is to equip future teachers with the skills and abilities necessary to engage with research evidence in terms of EBP (European Commission, 2007; Niemi, 2008). In most EU countries, initial teacher education is provided by universities or similar tertiary institutions (Bauer & Prenzel, 2012). These institutions of higher education are characterized by a close connection to research and, thus, constitute an important venue for research–practice transfer (European Commission/EACEA/Eurydice, 2018; Newton et al., 2020). Although there are many variations in the organization of teacher education between different countries, the core function of teacher education is to build a foundation for successful classroom teaching and provide student teachers with the scientific basis for their teaching practice (Drahmann, 2020; Flores, 2017). Teacher education should support student teachers in shaping their professional selves as teachers, enhancing their theoretical knowledge base, and gathering first practical experiences (Baumert & Kunter, 2006; Darling-Hammond, 2006).

In Germany, teacher education is organized into two phases. The first phase (i.e., initial or pre-service teacher education) takes place primarily in universities and schools of education and provides the focus for the present research. The second phase (i.e., in-service teacher education) occurs in seminar schools during a 2-year induction phase of teaching in a school. In 2004, the Standing Conference of the Ministers of Education and Cultural Affairs in Germany introduced the *Standards for Teacher Training* for all student teachers (KMK, 2004, 2014). Following these standards, student teachers should be able to apply research in their subject classes to analyze students' knowledge and learning processes and to support individualized learning (Bauer & Prenzel, 2012). Student teachers should learn not only what knowledge to teach but also how to reflect on their teaching and classroom interactions, evaluate their own teaching, and actively participate in shaping school culture (Baumert & Kunter, 2006; KMK, 2004, 2014). Hence, throughout their studies, student teachers should learn how to evaluate research-generated information and its relevancy (i.e., scientific literacy) and where to find such information (i.e., source access). They should become familiar with research methods and learn about current rigorous evidence in their discipline (Niemi, 2008). Consequently, teacher

education is the best place not only to target future teachers' skill and knowledge acquisition regarding EBP but also to help them develop more favorable attitudes and beliefs toward EBP (Fleckenstein et al., 2015; Parr & Timperley, 2008).

Thus, in pursuing an EBP agenda in teacher education, the role of research evidence is to inform the content of teacher education programs and courses (Furlong, 2014). Evidence relevant to teacher education may include theories of teaching and learning, empirical findings of educational processes and interventions, and research in didactics and curriculum studies (Cain et al., 2019). For instance, evidence from studies on students' cognitive processes (Chi & Wylie, 2014) and motivational characteristics (Wentzel & Miele, 2016) can contribute to student teachers' perception of and reflection on teaching that supports classroom learning and student well-being. Evidence from experimental studies on effective teaching strategies (e.g., self-regulated learning [Donker et al., 2014], and inquiry learning [Lazonder & Harmsen, 2016]) and programs (e.g., digital learning tools [Hillmayr et al., 2020]) can facilitate student teachers' decision-making regarding interventions or designs that support students' learning (Slavin, 2020). Additionally, including current and rigorous research evidence can have multiple benefits for the quality of teacher education. Besides enriching student teachers' professional knowledge, thinking, and discourse, it may foster the development of classroom material content (e.g., Niemi, 2008). Consequently, pursuing an EBP agenda in teacher education not only fulfills normative standards (Bauer & Prenzel, 2012) but should be considered a means for future teachers and their educators to adapt to our fast-changing reality in schools by engaging more actively with new knowledge (OECD, 2005; Ozay, 2012; Thiel, 2014).

Within teacher education, teacher educators are key agents in enhancing teacher quality (Cochran-Smith et al., 2020; Liston et al., 2008). The task of promoting EBP rests on their shoulders (Shavelson, 2020). Although various approaches have pursued the goal of promoting teaching as a research-based profession (e.g., through concepts for training in research methods or student research projects; see Böttcher-Oschmann et al., 2021; Kiemer & Kollar, 2021), little attention has been given to teacher educators' role in supporting EBP. Hence, shifting the focus to teacher educators as central agents and their professional contribution to an EBP agenda is highly relevant (Darling-Hammond, 2016).

3.2 Teacher educators as central agents promoting evidence-based practice

At the university level, teacher education takes place across different faculties and departments depending on the chosen subjects (Drahmann, 2020). Hence, there are many teacher educators who are responsible for student teachers. The European Commission (2013) defines teacher educators as a heterogeneous group whose members can differ significantly from one another in several ways—even within the same country—including qualification level (bachelor’s degree, master’s degree, PhD), (subject) area of specialism, work experience (teachers, lecturers, researchers), competence profile, contractual arrangements, and institutional constraints. Despite their great heterogeneity and their responsibility to teach and support student teachers (Liston et al., 2008), interest in who teacher educators are and how they professionally develop has just recently emerged in research and policy literature (e.g., Lunenberg et al., 2014).

University-based teacher educators in Germany are mainly a group of academics, including professors, PhDs, doctoral students, and university lecturers with varying experience in teaching at schools. They are not formally trained in their role as teacher educators and, therefore, acquire the skills and knowledge necessary to fulfill their role while actively working as teacher educators (Guberman et al., 2020). As a result, teacher educators differ greatly in their professional expertise and experience (Tack & Vanderlinde, 2014). Additionally, they perform a variety of functions and tasks in teacher education. They hold multiple identities, such as teachers of teachers, student mentors, researchers, and academic scholars (Goodwin & Kosnik, 2013; Lunenberg et al., 2014). Besides teaching in higher education, teacher educators actively engage in the scientific community by attending conferences and publishing in peer-reviewed journals (Guberman et al., 2020; Reynolds et al., 2013). Moreover, they must contend with a reform-driven environment, and their teaching content depends heavily on local curricula and standards (Kosnik et al., 2020).

Being a teacher educator in higher education is a demanding and highly complex job (European Commission, 2013). Promoting EBP adds to teacher educators’ demanding tasks in that they must select research evidence that is relevant to student teachers as well as to their own teaching practice. Moreover, in their role as academic scholars, teacher educators are required to

contribute to the development and dissemination of research-based knowledge (Livingston et al., 2009).

In order to contribute to high-quality teacher education and promote EBP, teacher educators need to become “active agents” (Tack et al., 2018) in their professional development by continuously updating themselves with new, relevant, and rigorous knowledge on teaching and teacher education to improve their practice. Research that provides such knowledge is seen as a crucial factor in teacher educators’ professional development (Livingston et al., 2009; Loughran, 2014). In a recent model of teacher educators’ professional development, Tack and Vanderlinde (2014) provide a tripartite conception of teacher educators’ professional development toward a “researcherly disposition.” They define researcherly disposition as teacher educators’ tendency to engage in and with research as both producers and consumers. The conception comprises three interrelated aspects: affective, cognitive, and behavioral. Following this approach, teacher educators’ researcherly disposition is determined by their inclination toward research (affective), their ability to engage with research (cognitive), and the research opportunities in their practice (behavioral). Teacher educators should be critical consumers of educational research (Nicholson & Lander, 2020), be able to deal with (fragile) evidence from different sources (Burkhardt & Schoenfeld, 2003), and value the idea and benefits of integrating research evidence into teaching practice (Fleckenstein et al., 2015).

Although the body of research on teacher educators’ professional development (e.g., Ping et al., 2018) and their research engagement (e.g., Tack & Vanderlinde, 2014) is steadily growing, research concerning their professional standpoint in an EBP agenda is still lacking. To strengthen the agenda of EBP in teacher education, it is paramount to develop our understanding of this crucial and diverse group of agents in terms of their professional needs and resources and to offer them appropriate support.

4 Relevant Professional Characteristics for Supporting Evidence-based Practice

4.1 Facilitators and barriers to evidence-based practice

In other disciplines where a common understanding and appreciation of EBP has already been established, such as medicine, nursing, and management, a wealth of research can be found on the potential facilitators and barriers of EBP (e.g., Dawes et al., 2005; Titler, 2008). In addition to the factors associated with research evidence generally (e.g., size, complexity, and ambiguity of the research base; Haynes, 2001), studies in these health fields mention a number of other factors relevant to EBP implementation, including characteristics of the implementer, stakeholders, organization, practice, or intervention (Jette et al., 2003; Reddy et al., 2017; Upton & Upton, 2006). In particular, implementer characteristics toward EBP are essential for high-quality implementation (Forman et al., 2012). These characteristics include affective (e.g., attitudes and beliefs), cognitive (e.g., knowledge), and behavioral (e.g., professional practices) aspects.

In the context of teacher education, teacher educators' important professional role in the implementation and support of EBP has rarely been addressed in empirical research. Only a few studies have investigated teacher educators' perceptions of research (MacPhail & O'Sullivan, 2019) or their "researcherly disposition" (e.g., Tack & Vanderlinde, 2014), which serve as first indicators of what factors might impede or facilitate EBP implementation and support. In order to further conceptualize teacher educators' professional characteristics related to the support of EBP, the empirical literature offers helpful references. Rousseau and Gunia (2016) provide a systematic review of the psychology of EBP implementation in which they integrate approaches of goal-based behavior (e.g., the theory of planned behavior [Ajzen, 1991] and workplace learning/expectancy theory [Vroom, 1992]) and the Ability-Motivation-Opportunity framework (AMO; Hughes, 2007) to shed light on why people do or do not use EBP. A brief description of each theoretical framework is presented below to derive relevant professional characteristics for EBP support in teacher educators.

According to the theory of planned behavior, based in social psychology, the performance of a behavior is strongly determined by one's intention to realize this behavior (Ajzen, 1991). An individual's intention can be predicted by three conceptually independent factors: their attitudes

toward the behavior, their subjective norms, and their perceived behavioral control. Attitudes toward the behavior refer to one's individual evaluation or appraisal of the specific behavior (i.e., favorable or unfavorable). Subjective norms refer to the perceived social pressure or motivation to perform this behavior. Perceived behavioral control describes the perceived ease or difficulty of performing this behavior. In the context of EBP, this means that teacher educators' intention to implement and support EBP depends on their attitudes toward EBP, their motivation, and their perceived difficulty of performing EBP.

Expectancy theory, as presented by Vroom (1992) in the context of workplace behavior, describes how employees' performance is dependent on the expected benefits of their professional actions and behavior. Vroom argues that people's choice of a particular action or behavior (e.g., EBP) is an interactive function of their ability and motivation toward the behavior. Hence, teacher educators must feel able and motivated in order to support EBP successfully among student teachers. Both the expectancy theory and the above-mentioned theory of planned behavior are operationalized in the AMO framework (Hughes, 2007), which connects the basic concepts as important antecedents of a specific behavior: ability (i.e., the skills and capabilities toward the behavior), motivation (i.e., the impetus toward the behavior), and opportunity (i.e., the contextual and situational constraints relevant to the performance of the behavior).

In their systematic review, Rousseau and Gunia (2016) applied the AMO framework to the context of EBP implementation. They describe how the implementation of EBP depends on practitioners' ability (i.e., skills and knowledge related to EBP activities), motivation (i.e., function of individual belief systems toward EBP), and opportunities to practice (i.e., perceived support to engage in EBP). This integrated approach, combining perspectives from psychology (Ajzen, 1991) and organizational behavior (Vroom, 1992), offers a recent and comprehensive conceptualization of teacher educators' professional characteristics relevant to implementing and supporting EBP. Based on this integrative framework, for the present research, the relevant professional characteristics are summarized as attitudes (being motivated), knowledge-related challenges (being able), and resource-related challenges (having opportunities and resources).

4.2 Determining teacher educators' attitudes and challenges related to evidence-based practice

In the social sciences, attitudes are described as an individual's positive or negative evaluation of an object, person, or concept, which is relatively enduring but modifiable (Fishbein & Ajzen, 2010; Guyer & Fabrigar, 2015). Prior research on attitudes supports the idea that an individual's attitude toward a certain concept also determines their intention to act in a certain way (e.g., to implement measures based on a concept; see Lenski et al., 2019). Based on this association of attitudes and proximal actions, it is assumed that attitudes are an important predictor of peoples' behavior (Ajzen, 1991). Implementation research suggests that negative or unfavorable attitudes toward an innovation or new practice might hinder its implementation (Aarons, 2004). Within teacher education, however, little attention has been paid to teacher educators' attitudes toward EBP or research–practice transfer more generally. With regards to teacher educators' research-oriented working environment, it can be assumed that they generally hold favorable attitudes toward EBP in teaching (Cochran-Smith, 2005). This is supported by the results of a large-scale survey study conducted by Tack and Vanderlinde (2016), which found that teacher educators valued research in their teaching role and in the teacher educator profession in general.

Apart from favorable attitudes, the implementation and support of EBP require appropriate knowledge and skills to engage in EBP-related activities (Davies, 1999). These activities include evidence search and critical appraisal (Rousseau & Gunia, 2016). Accordingly, teacher educators should know where and how to find relevant research evidence, how to retrieve, read, and critically appraise evidence, and how to organize and grade the power of the evidence. Therefore, they must be “smart consumers” of research evidence concerning its reception, understanding, and evaluation (Tack & Vanderlinde, 2014). Based on the career paths that lead to teacher education (German university-based teacher educators usually have an academic background; Drahmman, 2020), the majority of teacher educators have formal knowledge about research and its basic principles. In addition to this formal way of acquiring EBP-related knowledge, teacher educators generate practical knowledge through their professional experiences and reflections (Loughran, 2014). Since there are no systematic induction phases for beginning teacher educators and limited continuous professional training (see Ping et al., 2018 for an overview), there might be differences in teacher educators' relevant knowledge regarding EBP. Previous research has shown that teacher educators with more experience in

teacher education feel more confident in dealing with research than those with less experience (Murray & Male, 2005; Tack & Vanderlinde, 2016). Additionally, a study on teacher educators' professional learning needs revealed that academic upskill with regard to research activities, academic writing, and related skills, was one of the most stated needs for further development (Czerniawski et al., 2017). Accordingly, the findings of an interview study conducted by Smith (2005) showed that knowledge about how to conduct and make use of research were the most frequently mentioned aspects of professional practice.

In addition to knowledge-related challenges, the availability of and access to the necessary resources for EBP may constitute further challenges for its implementation and support. For instance, lack of time, institutional support, or appropriate source access are potential barriers to EBP (Jette et al., 2003). The findings of a survey study of 1158 teacher educators revealed that the time demands of academic activities (i.e., EBP-related aspects), such as searching, accessing, and appraising research evidence, were challenging for teacher educators (Czerniawski et al., 2017). Staying up-to-date with the ever-increasing body of empirical literature in education is a time-consuming task. In an in-depth interview study of 10 Irish teacher educators, participants reported a lack of institutional support (i.e., a lack of alignment between their academic and teaching roles), which prevented them from supporting EBP-related activities in their pre-service courses (MacPhail & O'Sullivan, 2019). Another interview study on teacher educators' research engagement conducted in England suggested several resource-related barriers, most pertinently lack of time, insufficient mentoring, and limited opportunities for collaboration (Nicholson & Lander, 2020). It seems that the time required and the growing body of research literature in education present challenges for teacher educators regarding EBP. Additionally, teacher educators are provided with neither sufficient resources nor the necessary professional training to be able to classify the best available knowledge and communicate it competently to student teachers.

Previous research has shown that the successful implementation and support of EBP depends on these three characteristics (Rousseau & Gunia, 2016). Teacher educators need to have a positive attitude toward EBP and possess the knowledge and resources necessary to implement and support EBP. Consequently, empirical investigations into EBP support in teacher education need to consider all three characteristics of teacher educators simultaneously.

5 The Present Research

In the previous chapters, teacher education was introduced as an important context for fostering EBP in teaching. Within teacher education, teacher educators are tasked with promoting EBP. This heterogeneous group of professionals is responsible for preparing future teachers for the fast-changing environment of schools and providing them with the best available knowledge. To date, teacher educators have been an under-researched target group, and what facilitates or hinders them in promoting EBP among student teachers has not yet been investigated systematically. To support teacher educators appropriately in their transfer mission, there is a need for research that examines their professional characteristics related to EBP. The objective of the present research, therefore, is to address this gap and contribute to a more sophisticated understanding of teacher educators as important agents in the EBP agenda. In this regard, the present research aims to explore teacher educators' professional characteristics related to EBP and their self-reported use of research evidence by means of two related online survey studies. Furthermore, it aims to examine how teacher educators evaluate an existing service platform designed to support teacher educators in their EBP mission.

The first study (Manuscript A: "Evidence-based practice in higher education: Teacher educators' attitudes, challenges, and uses") uses a newly developed online survey to examine teacher educators' professional characteristics related to EBP in terms of their attitudes, knowledge- and resource-related challenges, and use of research evidence in teacher education. Apart from describing the professional group of German university-based teacher educators, the study further aims to provide insights into teacher educators' previous experience and whether teacher educators with different background experience differ in their professional characteristics related to EBP. In sum, this study addresses the following research questions:

RQ 1.1: What are university-based teacher educators' (a) attitudes, (b) challenges, and (c) current uses regarding evidence-based practice in teaching?

RQ 1.2: To what extent do university-based teacher educators with different types of experience, such as (a) research experience, (b) higher education teaching experience, and (c) in-school teaching experience, differ in their attitudes, challenges, and uses regarding evidence-based practice in teaching?

The second study (Manuscript B: “Supporting evidence-based practice through teacher education: A profile analysis of teacher educators’ perceived challenges and possible solutions”) extends the research of the first study by closer examining teacher educators’ professional characteristics related to EBP with a bigger and systematic sample. Since teacher educators form a heterogeneous professional group, it is assumed that treating them as one group might be too simplistic and that they could be better described as distinct subgroups characterized by specific profiles in terms of attitudes and perceived challenges. Understanding the challenges encountered by teacher educators in the EBP agenda can help develop and design appropriate and tailored support solutions. Hence, an additional aim of the second study is to examine teacher educators’ evaluations of an existing EBP support solution. This second study addresses the following research questions:

RQ 2.1: What subgroups of university-based teacher educators can be distinguished in terms of their self-reported attitudes and challenges regarding evidence-based practice?

RQ 2.2: Do teacher educators with varying challenge profiles differ in their self-reported forms of use of evidence in university teaching?

RQ 2.3: Do (different subgroups of) teacher educators evaluate a service platform as useful and supportive in addressing their challenges?

The overarching aim of these two empirical studies is to provide empirically supported information from a quantitative survey of German university-based teacher educators regarding their professional characteristics related to EBP, their self-reported use of research evidence, and their perception of a specific support solution. Thus, the studies help advance conceptual and empirical clarity regarding teacher educators as central agents in the EBP agenda in teaching. Additionally, the studies also provide practically relevant information for the professional development of teacher educators, for the design of tailored support solutions, and for those engaged in the support of research–practice transfer.

6 Methodology

6.1 Project context

The present research was conducted as part of the Clearing House Unterricht (CHU, www.clearinghouse.edu.tum.de) project, funded by the German Federal Ministry of Education and Research (01JA1801). In the context of the CHU project, a service platform was designed to provide teacher educators with the latest research evidence on effective teaching in order to promote EBP in teacher education. The material available on the platform includes critical and short reviews, podcasts, and further information material from recent meta-analyses on effective teaching. The meta-analyses were critically analyzed in terms of content and methodology according to standardized criteria in order to determine their quality and relevance (e.g., Meta-Analysis Reporting Standards [MARS] of the American Psychological Association; Cooper, 2018). The content was created and updated by a team of educational researchers. Teacher educators can use the material to stay abreast of the newest developments in the field and as ready-to-use teaching material for educating student teachers. In accordance with existing intermediary organizations (e.g., WWC, Campbell Collaboration), the CHU platform offers synthesized findings as the currently best available evidence in easy-to-access language, freely available on the platform

6.2 Participants

For both studies, teacher educators from German universities and schools of education were recruited as participants. Participation in the online surveys was voluntary and uncompensated. Participants were assured that their data would be collected anonymously and evaluated for scientific research purposes only (according to the ethical standards of the American Psychological Association [2017]). They gave informed consent before participation. So as not to influence the participants' attitudes, the term "evidence-based practice" was explicitly omitted from the introduction of the survey. Instead, the survey intro explained that the study was about the use and implementation of current evidence in teaching.

The first study was conducted with 58 university-based teacher educators in August 2017. The convenience sample included teacher educators who responded to a call for participants on the CHU platform. Based on the alignment between the CHU project (which has a focus on STEM

teaching) and the study, the teacher educators were likely to have university teaching experience in either education sciences or STEM education.

In the second study, 488 university-based teacher educators participated in the online survey. They were recruited for the study via email between February and May 2019. The systematic sampling considered teacher educators from all 16 federal states who were teaching in education sciences or STEM education. A more detailed description of the samples can be found in the respective manuscripts (see the appendices).

6.3 Instrument and measures

In both studies, a two-part online survey instrument adapted from existing scales was used. The first part of the survey instrument was designed to measure teacher educators' attitudes, knowledge- and resource-related challenges, and forms of research evidence usage. The second part of the survey instrument focused on gathering evaluative information on the CHU platform. All scales were based on self-report measures to capture the individual perceptions of each participant. A brief overview of the instrument and measures is provided below.

For the first part of the instrument, a systematic literature review of research instruments concerning EBP and its implementation was conducted. To address the research questions, the review process focused on the three constructs of attitudes toward, challenges related to, and uses of EBP. For the present research, valid and reliable scales from six peer-reviewed and published studies stemming from the fields of medicine, psychology, and social work were identified:

Aarons, 2004: Evidence-based practice attitude scale for mental health provider.

Hendricson et al., 2011: Evidence-based practice knowledge, attitudes, access, and confidence questionnaire for dentists.

Johnston et al., 2003: Evidence-based practice knowledge, attitude and behavior questionnaire for medical undergraduates.

Reddy et al., 2017: Evidence-based practice attitudes and beliefs questionnaire for school psychology trainers.

Rubin & Parrish, 2010: Evidence-based practice process assessment scale for social work practitioners.

Upton & Upton, 2006: Evidence-based practice questionnaire for nurses.

The identified scales and items mostly focused on the practitioners themselves (i.e., nurses, physicians, etc.) and not on the practitioners' educators, who are required to promote EBP. Thus, we adapted the identified scales to our research subject and the target group of teacher educators and developed new items where necessary. Since the study was conducted with a German-speaking sample, all items were translated into German.

For the selection of the items, we followed a three-step approach, including two rounds of expert ratings and one pilot study. The first instrument draft comprised 73 items. To check the content and suitability of the items regarding the dissertation project, feedback was gathered from five experienced educational researchers of the project. Discussions and reformulations led to the exclusion of 23 items. The remaining 50 items were further validated through three think-aloud interviews with university-based teacher educators from various disciplines (i.e., mathematic didactics, psychology, and education sciences). We kept 45 items in the final instrument. Twenty-four of the items aimed to assess teacher educators' attitudes and perceived challenges. For scale development, an exploratory factor analysis using principal axis factoring and oblique rotation (direct oblimin, which allows the factors to correlate) was performed for $n = 89$ respondents. For the 24 items, the Bartlett test ($\text{Chi-squared}(276) = 1,277,171, p < 0.000$) and the Kaiser–Meyer–Olkin measure of sampling adequacy ($\text{KMO} = 0.840$) indicated that the variables were suitable for factor analysis (Henson & Roberts, 2006). The communalities of the items ranged from 0.43 to 0.88, with an average of 0.65, which allowed for satisfactory factor recovery, even with a small sample size (Winter et al., 2009). To decide on an adequate number of factors, eigenvalue-criterion and the scree test were applied, as outlined in Costello and Osborne (2005). A five-factor solution showed the best fit for the analyzed data. Cronbach's alpha was calculated for all scales. The results indicate that the scales had a good internal consistency, ranging from $\alpha = 0.87$ to 0.91. The final scales for attitudes and perceived challenges are depicted in Table 1.

The first part of the instrument consisted of 21 additional items that aimed to assess forms of evidence usage in terms of intensity, purposes, and sources. The three scales were designed to measure the extent to which teacher educators use and integrate evidence (intensity), the

different purposes for which they currently use evidence (purposes), and the sources of evidence they use to plan their lessons (sources) (Table 1).

For the second part, 19 survey questions were self-developed by the project team to assess the usefulness and support of the CHU platform. The developed items were validated through one round of expert ratings and three think-aloud interviews. After the items were revised, they were included in the final instrument. For scale development, reliability analyses were conducted with the sample of the second study, which revealed good internal consistency, ranging from $\alpha = 0.90$ to 0.94 . The final scales are depicted in Table 1. The full version of the items can be found in the manuscripts contained in the appendices.

Table 1. Overview of the scales, the respective number of items, the answering format, and the related manuscript.

Scales	Number of Items	Answering format	Manuscript
Attitudes			
Perceived usefulness	5	Six-point agreement scale	B
Personal relevance	4	Six-point agreement scale	A & B
Perceived challenges			
General challenges	4	Six-point agreement scale	A
Resource-related challenges	6	Six-point agreement scale	A & B
Knowledge-related challenges	4	Six-point agreement scale	A & B
Forms of use			
Intensity of use	5	Six-point frequency scale	A & B
Purposes of use	5	Six-point agreement scale	A
Sources of evidence	11	Four-point frequency scale	A
Usefulness			
Individual usefulness	5	Six-point agreement scale	B
Teaching-related usefulness	5	Six-point agreement scale	B
Support			
Knowledge-related support	5	Six-point agreement scale	B
Resource-related support	5	Six-point agreement scale	B

6.4 Statistical analyses

In light of the research questions, various statistical analyses were conducted using IBM SPSS Statistics (Version 25) and *R* 3.6.1. For both studies, the data were first analyzed using descriptive statistics. For reliability analysis, Cronbach's alpha and McDonald's omega were calculated to determine the internal consistency of the study scales. In the first study, correlation analyses (Pearson's r and Kendall's tau) were conducted to examine the relationships between study variables. Multivariate analyses of variance (MANOVAs and follow-up ANOVAs) were used to identify differences between teacher educators with varying experience with research and teaching. In the second study, statistical analyses included latent profile analysis to identify subgroups of teacher educators based on their attitudes and knowledge- and resource-related challenges (R package *tidyLPA*; Rosenberg et al., 2018) and MANOVAs and follow-up ANOVAs to examine differences between the subgroups. The R package *mice* was used to impute missing values from teacher educators' self-reports using the predictive mean-matching algorithm (van Buuren & Groothuis-Oudshoorn, 2011). The following significance levels were used throughout the data analyses: *** $p < .001$, ** $p < .010$, * $p < .050$. More detailed descriptions of the statistical analyses can be found in the respective manuscripts (see the appendices).

7 Summary of Studies

7.1 Manuscript A: “Evidence-based practice in higher education: Teacher educators’ attitudes, challenges, and uses”

To pursue research–practice transfer in teaching, it is the responsibility of teacher educators’ to promote EBP, i.e., to select, use, and communicate relevant and high-quality research evidence to student teachers. Previous research has found that in order to fulfill their role as research–practice agents, teacher educators’ need to have a positive attitude, perceive few challenges (knowledge- as well as resource-related), and have the will and opportunity to use evidence on a regular basis (e.g., Rousseau & Gunia, 2016; Tack & Vanderlinde, 2014). Thus, the objective of the first study was to examine teacher educators’ attitudes, perceived challenges, and forms of use regarding EBP in teaching. Moreover, as teacher educators represent a rather heterogeneous group with regard to previous professional experience (European Commission, 2013), it was expected that this heterogeneity might be reflected in teacher educators’ perceptions of EBP (Tack & Vanderlinde, 2016). Therefore, the study investigated whether teacher educators with varying experience in research and teaching differed in their attitudes, perceived challenges, and forms of use.

By means of a newly developed online survey (as described in Section 6.3), teacher educators’ attitudes, perceived challenges, and current forms of evidence usage were assessed. Data was gathered from 58 university-based teacher educators. The results showed that teacher educators held positive attitudes toward EBP. At the same time, teacher educators emphasized being challenged by the resources necessary to implement and support EBP. The time required to manage the steadily growing body of research literature in education appeared to present a challenge to teacher educators. Concerning the use of research evidence, we found that teacher educators used research evidence on a regular basis (i.e., on average every month) and more often for individual purposes (e.g., to expand their own knowledge) than for teaching purposes (e.g., to keep student teachers up to date on the newest research findings). Regarding the sources used to plan and design their courses, teacher educators rated highest on scientific journals, textbooks, and conferences. Findings of the MANOVAs indicated that teacher educators’ experience in research and teaching was beneficial for the following of an EBP agenda; teacher

educators with more experience in research and teaching perceived fewer challenges than those with less experience.

In summary, this study extends the research on an important target group—teacher educators—and provides new empirical insights into teacher educators and their heterogeneity in the context of EBP. The findings of the study indicate that teacher educators generally have a positive perception of EBP but might require support, for example, from service initiatives and professional development programs addressing the knowledge- and resource-related challenges of EBP. Moreover, the findings suggest that teacher educators’ professional heterogeneity in terms of previous experience, attitudes, and perceived challenges deserves further research.

7.2 Manuscript B: “Supporting evidence-based practice through teacher education: A profile analysis of teacher educators’ perceived challenges and possible solutions”

Based on the findings of the first study, the goal of the second study was to examine teacher educators’ professional heterogeneity more closely in the context of the EBP agenda. Prior research has demonstrated that, in particular, teacher educators’ attitudes and knowledge- and resource-related challenges might afford them to fulfill their role as research–practice agents (Ajzen, 1991; Rousseau & Gunia, 2016). Given that teacher educators are a professionally heterogeneous group, it was assumed that treating them as one group might be too simplistic and that they could be better described as different subgroups characterized by specific profiles in terms of attitudes and perceived challenges related to EBP. Consequently, the aim of the second study was to identify subgroups of teacher educators based on their attitudes and perceived challenges related to EBP. Since prior research has demonstrated that these characteristics might also have implications for the use of evidence and the design of effective support (Rousseau & Gunia, 2016), we investigated whether subgroups differed in their reported use of evidence and whether they perceived an exemplary service initiative (i.e., the CHU platform) as useful and supportive.

Using the online survey developed in the first study, self-report data was gathered from 484 university-based teacher educators. With latent profile analysis, five distinct subgroups of teacher educators were identified and labeled according to the challenges they reported: *high challenges*, *no challenges*, *knowledge & resource challenges*, *resource challenges*, and

skeptical. Teacher educators in the *high challenges* profile ($n = 23$) reported knowledge- and resource-related challenges above the grand mean. The *no challenges* profile ($n = 71$) was represented by teacher educators reporting favorable attitudes and no perceived challenges related to EBP. Teacher educators represented in the *knowledge & resource challenges* profile ($n = 178$) expressed feeling challenged by the knowledge and resources necessary to support EBP. The most common profile among teacher educators was the *resource challenges* profile ($n = 204$), which encompassed teachers who had favorable attitudes and the necessary knowledge but still faced resource-related challenges. The *skeptical* profile ($n = 8$) was the least common profile among teacher educators and was characterized by attitude ratings below the grand mean and average knowledge- and resource-related challenges. Further analyses of variance revealed statistically significant differences between the identified subgroups in their reported use of evidence in that subgroups with few or no challenges reported using evidence more frequently in their teaching than the subgroups characterized by high challenges ratings. With regard to the support solution, the findings demonstrated that the freely available CHU platform offered a useful and supportive approach for all identified subgroups, regardless of their perceived challenges.

In conclusion, the findings of the second study indicate that teacher educators must be further supported in their agent function by taking their individual attitudes and perceived challenges into account. Although the CHU platform provides a useful and supportive first step, future research and initiatives might consider targeting this group of professionals more strongly by providing tailored material. Teacher educators should have access to high-quality, continuing professional development designed to address their specific challenges and their individual responsibility to future teachers

8 Discussion

The overall aim of the present research was to develop a better understanding of teacher educators as central agents in the EBP agenda in teaching. By conceptualizing teacher educators' professional characteristics as relevant to supporting EBP in terms of their attitudes and knowledge- and resource-related challenges, the present research contributes to the literature on EBP in teacher education and to an understanding of the factors that facilitate or hinder teacher educators in their transfer mission.

In the two empirical studies presented in the present research, two samples of German university-based teacher educators were used to examine differences in previous experience, professional characteristics related to EBP, and forms of research evidence usage. In addition, an exemplary support solution for EBP in university teaching was tested. In the following sections, the empirical findings of both studies are summarized and discussed. Based on this discussion and methodological and theoretical reflections, implications for practice are presented. Finally, limitations and directions for future research are discussed.

8.1 Interpretation of empirical findings

8.1.1 Teacher educators' professional heterogeneity

According to theoretical considerations, the successful implementation and support of EBP in teacher education depends on whether teacher educators have a positive attitude toward EBP and possess the knowledge and resources necessary to implement and support EBP (Rousseau & Gunia, 2016; Tack & Vanderlinde, 2014). A main goal of the present research, therefore, was to explore teacher educators' attitudes and knowledge- and resource-related challenges.

The descriptive findings of the first study demonstrated that most teacher educators hold positive attitudes toward EBP but may struggle with the knowledge or resources necessary to support EBP optimally. Given that teacher educators represent a rather heterogeneous group of professionals (European Commission, 2013; Lunenberg et al., 2014), a major goal of the present research was to investigate whether teacher educators' with varying professional background experiences differ in their professional characteristics related to EBP. In particular, previous experience in research and teaching was assumed to determine teacher educators' attitudes toward and perception of challenges associated with EBP in that teacher educators with more

experience might have more favorable attitudes as well as the knowledge and resources necessary to support EBP (Fleckenstein et al., 2015; Georgiou et al., 2020). The results of the first study partly support this assumption. They showed that teacher educators with more teaching experience (i.e., ≥ 3 years) perceived fewer knowledge- and resource-related challenges than those with less experience (i.e., ≤ 3 years). The same pattern was observed for research experience, approximated by the highest degree obtained by an individual (details in Manuscript A). Teacher educators with more research experience (i.e., with a doctoral degree or professorship) seemed to perceive challenges related to EBP as less demanding than participants with less experience (i.e., university degrees). This can be interpreted as an indicator that teacher educators with more expertise in teaching and research have more knowledge and experience, and thus feel more confident in promoting EBP among student teachers. This adds to previous findings that illustrated the beneficial impact of (formal) experience in academia on individuals' motivation and ability to engage with and in research (Murray & Male, 2005; Tack & Vanderlinde, 2016). Together, the findings indicate that beginning or less academically affiliated teacher educators need more support to compensate for their lack of experience (Loughran, 2014).

8.1.2 Attitudes and professional challenges

In addition to examining differences based on teacher educators' previous experience, the present research investigated whether different subgroups of teacher educators could be identified based on their professional characteristics (i.e., their attitudes and knowledge- and resource-related challenges). The person-centered approach applied in the second study led to the identification of five distinct subgroups of teacher educators characterized by different combinations of these three professional characteristics: *high challenges, no challenges, knowledge & resource challenges, resource challenges, and skeptical*. These subgroups reflect how teacher educators rated themselves in terms of their professional characteristics relevant to the implementation and support of EBP. The different combinations of challenges found in the second study corroborate the notion that teacher educators are a heterogeneous professional group with varying support needs (Czerniawski et al., 2017; Tack & Vanderlinde, 2014).

To support EBP optimally, previous research has suggested that teacher educators need to have a certain profile regarding the three professional characteristics. In the second study, a rather small percentage of teacher educators considered themselves to be in an optimal position to support EBP; only 15% of teacher educators possessed positive attitudes and saw themselves

as well-equipped to meet the knowledge- and resource-related challenges posed by EBP (see *no challenges* profile). The majority of teacher educators were concerned about at least one professional characteristic and thus did not perceive themselves as being in an optimal position to support EBP. Most teacher educators were found to belong to subgroups that included resource-related challenges. This replicates the findings of the first study and aligns with the findings of previous research, which have identified teacher educators' high need for support solutions designed to manage the growing body of relevant research evidence and to reduce teacher educators' workload (Czerniawski et al., 2017; Georgiou et al., 2020; MacPhail & O'Sullivan, 2019).

Supporting EBP requires time, institutional support, and source access (Jette et al., 2003). Consistent with previous findings (Czerniawski et al., 2017; Kosnik et al., 2020), balancing these resources appeared to be the primary concern of most teacher educators in the second study sample. Teacher educators in two profiles (*high challenges* and *knowledge & resource challenges*) additionally stated that they struggled with knowledge-related challenges. Supporting EBP among student teachers is a complex task that requires teacher educators to be critical consumers of research evidence and to be able to deal with (fragile) evidence from different sources (Burkhardt & Schoenfeld, 2003; Nicholson & Lander, 2020). In line with previous findings, many teacher educators were challenged by having limited time and training to engage with research and evidence and to support EBP (Brown & Zhang, 2016; Cochran-Smith et al., 2020; MacPhail & O'Sullivan, 2019).

Despite the challenges reported, the findings of the second study showed that teacher educators from four of the five subgroups had positive attitude ratings (i.e., above the numerical scale mean). This indicates that teacher educators mostly supported the EBP agenda. However, a *skeptical* profile was identified, which was represented by a small number of teacher educators with low attitude scores (i.e., below the numerical scale mean). According to the empirical framework presented in Section 4.1 (integrated AMO framework; Rousseau & Gunia, 2016), teacher educators' intention to implement and support EBP depends on their attitudes toward EBP. Moreover, every single teacher educator is responsible for a great number of students and must therefore be considered individually. Thus, despite the low number of teacher educators in the *skeptical* profile, future research is recommended to investigate teacher educators' skepticism in the EBP agenda.

Taken together, most teacher educators in the second study expressed favorable attitudes toward EBP while also describing resource-related challenges. It seems that teacher educators support an EBP agenda but struggle with having limited time and training to implement and support EBP. Thus, these findings may suggest systematic barriers to EBP at the organizational level (Kosnik et al., 2020). Future research can explore this topic and consider contextual features of teacher educators' workplaces, such as institutional constraints and working conditions, as these might affect the implementation and support of EBP (Brown & Zhang, 2016)

8.1.3 Forms of research evidence usage

Apart from teacher educators' attitudes and perceived challenges, the present research aims to illuminate teacher educators' use of research evidence in terms of intensity and purposes. Findings from the first study suggest that teacher educators use research evidence on a regular basis (at least once a month on average). Due to the academic environment of German universities, regular engagement with research evidence can be considered a self-evidential part of the teacher educator profession. Additionally, teacher educators expressed using research evidence more often for personal purposes (i.e., expanding their own knowledge) than for teaching purposes (i.e., integrating research into courses, discussing it with students). These findings suggest that although the majority of teacher educators seem to be well informed, they need to be supported, particularly in their EBP-related teaching agenda.

Teacher educators need not only to understand and appreciate the benefits of EBP themselves but also to find ways of communicating these benefits to their student teachers. Previous research has suggested that engaging student teachers in EBP is a key challenge for teacher educators, as student teachers are more likely to believe in practically derived than theoretical or research-based sources of knowledge (Bråten & Ferguson, 2015; Kiemer & Kollar, 2021). In this context, concepts and materials are needed to help teacher educators communicate the utility value of research evidence for teaching (see Section 8.3).

Although the self-report data outlined in the first study provides the first insights into teacher educators' purposes and intensity of evidence use, little is known about how and when teacher educators actually use evidence in their teaching. It could, therefore, be illuminating to complement the teacher educator data with student reports and observations of their actual practice. Gaining empirical and conceptual clarity on teacher educators' actual practice is necessary to develop a clear vision of what the support of EBP in teacher education should look

like. These insights could contribute to the design of tailored support measures, as discussed in Section 0.

Based on research across various disciplines, which has suggested that professional characteristics (i.e., attitudes and perceived challenges) determine the implementation of EBP (Furlong, 2014; Georgiou et al., 2020; Rousseau & Gunia, 2016), the second study investigated whether teacher educators with different professional characteristic profiles differ in their self-reported forms of research evidence usage. The results revealed that teacher educators with the *high challenges, skeptical, and knowledge & resource challenges* profile reported less frequent use of evidence in their teaching than subgroups with favorable attitudes and no or few perceived challenges. Teacher educators in the *high challenges* profile reported the least frequent use of evidence. These findings comply with the integrated AMO framework (see Section 4.1) and further validate it in the context of teacher education. Positive attitudes and few knowledge- and resource-related challenges are more likely to result in the frequent use and implementation of research evidence in teacher education than other combinations. Consequently, an important way to promote EBP in teacher education is to support teacher educators and help them address the individual challenges they face.

8.1.4 Supporting teacher educators as research–practice agents

In the second study, the CHU platform was used as a means to investigate an exemplary support solution. The CHU platform offers targeted and freely accessible material from recent meta-analyses and thus addresses teacher educators' role in implementing and supporting EBP (see Section 6.1). The teacher educator participants were asked to evaluate the support and usefulness of this service. They generally acknowledged the CHU platform as a supportive approach. It appears that the service of the CHU platform—i.e., preselection, synthesis, and free access to high-quality evidence—relieves teacher educators from the highly demanding (knowledge- and resource-related) activities related to EBP. Additionally, teacher educators rated the CHU platform as useful for individual as well as teaching purposes.

Closer examination of the previously identified subgroups of teacher educators revealed that the service platform was considered a supportive and useful approach, regardless of the individual challenges perceived by the teacher educators—even for teacher educators with few or no self-reported challenges. These findings indicate that providing teacher educators with an open-access knowledge base with easy-to-digest findings from (meta-analytic) research is a

helpful first approach to supporting teacher educators in their individual engagement with research evidence. The design of additional support material needs to target teacher educators' specifically in their teaching mission.

Taken together, the findings of the present research offer valuable empirical insights into teacher educators' professional heterogeneity, their attitudes and perceived challenges related to EBP, their self-reported use of evidence, and their evaluation of a support solution (the CHU platform). They provide important information on teacher educators' role as transfer agents in EBP as they show that (1) teacher educators generally support an EBP agenda, (2) teacher educators differ in the challenges they encounter in their support of EBP, and (3) support solutions, such as the CHU platform, offer a supportive and useful service for teacher educators.

8.2 Methodological and theoretical reflections

The present research provides conceptual and empirical clarity on teacher educators' role in supporting EBP among student teachers. Since a theoretical framework with an empirical basis is still lacking, the two studies presented here can be considered enriching from both a methodological and a theoretical perspective.

From a methodological perspective, the present research provides a systematic and quantitative study in a field that is currently characterized by small-scale and qualitative research (Lunenberg et al., 2014). The empirical findings of these studies provide new and important insights into the under-researched target group of German university-based teacher educators (Kosnik et al., 2020). While the first study explored teacher educators' attitudes, perceived challenges, and use of research evidence, as well as the role of experience in EBP support, the second study identified different subgroups of teacher educators based on their attitudes and knowledge- and resource-related challenges related to EBP. These findings add empirical information on teacher educators' self-reported professional characteristics and use of research evidence to the research literature.

In terms of data collection, an adapted online survey instrument based on self-report measures was developed, tested, and published. At the time the scales for the new survey instrument were developed, no appropriate scales for addressing professional characteristics related to EBP existed in the field of teacher education. Thus, validated scales from other disciplines, including health fields, were adapted, as outlined in Section 6.3. The moderate correlations between the

developed scales and good reliability values suggest a distinct but related nature of professional characteristics (DeVellis, 2017). Despite the previously discussed shortcomings of self-report measures (see Section 8.4; Fryer & Dinsmore, 2020), these measures provide the possibility not only to assess the subjective perspective of each individual participant but also to reach samples of considerable size (Fryer & Dinsmore, 2020). Additionally, due to the general formulation of the items, they can easily be adapted to other samples.

With respect to the statistical analyses, latent profile analysis (LPA) was implemented as an advanced person-centered approach that identified homogenous subgroups within the sample of teacher educators based on their attitudes and knowledge- and resource-related challenges (Hickendorff et al., 2018). LPA was used to investigate teacher educators' attitudes and their knowledge- and resource-related challenges simultaneously to gain insights into the individual differences of teacher educators based on specific profiles. Taken together, the newly developed scales and the statistical approach of LPA provide an opportunity to determine whether similar combinations of attitudes and challenges emerge across samples of teacher educators and geographic regions. With this being the case, a theoretically meaningful taxonomy of teacher educators' professional challenges concerning EBP could be developed and utilized in future studies.

Apart from these methodological considerations, the findings of the present research need to be considered from a theoretical perspective. The present research used the integrated AMO framework based on theories of goal-based and workplace behavior (Ajzen, 1991; Hughes, 2007; Rousseau & Gunia, 2016) to organize teacher educators' professional characteristics relevant to supporting EBP as attitudes and knowledge- and resource-related challenges. To support EBP successfully, teacher educators need to have positive attitudes toward EBP and possess the knowledge and resources necessary to explain and promote EBP among student teachers. The empirical findings of the present research revealed that teacher educators with positive attitudes and few knowledge- and resource-related challenges reported using research evidence more frequently in their teaching. This further validates the integrated AMO framework in the context of teacher education. Investigating teacher educators' attitudes and knowledge- and resource-related challenges simultaneously can help identify possible facilitators or barriers to teacher educators' support of EBP.

Additionally, the results of the first study empirically support the assumption that teacher educators' professional characteristics are related to their background experience. Consistent

with previous research, teacher educators' experience with and in research is an important factor in their professional learning and practice (Cochran-Smith et al., 2020; Lunenberg et al., 2014; Tack & Vanderlinde, 2016). Thus, there is a clear need for further research to clarify the role of formal knowledge and expertise in EBP research in teacher education (Georgiou et al., 2020).

The findings of the second study further offer empirical support for different profiles of teacher educators in terms of attitudes and knowledge- and resource-related challenges. These findings refine the notion that teacher educators are a heterogeneous group of professionals. At the same time, they suggest that teacher educators' contextual and situational constraints relevant to EBP (e.g., time and source access) need to be captured more precisely, since most teacher educators were found to adhere to profiles with resource-related challenges. Further exploration of this area is strongly recommended.

Together, the theoretical considerations for relevant professional characteristics and the empirical data of the present research provide a first impression of the professional characteristics relevant to implementing and supporting EBP. However, a comprehensive and accepted theoretical framework that recognizes the complexity and heterogeneity of the characteristics and factors relevant to EBP is needed. With interest in both teacher educators (Ping et al., 2018) and EBP in teaching (Slavin, 2020) growing, more theoretical and methodological approaches have recently emerged. These approaches examine various aspects, including teacher educators' professional learning, their formal knowledge, their broker role, and their professional identity (e.g., Georgiou et al., 2020; Kosnik et al., 2020; Shavelson, 2020). Future work should try to establish order among these approaches, with the goal of an integrated and joint approach. Current efforts, such as the multinational InFo-TED group (see www.info-ted.eu), which aims to conceptualize teacher educators' professional knowledge and learning in an adaptive, international framework, can serve as an example (Kelchtermans et al., 2018).

8.3 Practical implications

The findings of the present research have several practical implications for EBP in teacher education, particularly for the design of support solutions and professional development for teacher educators. A central finding of the studies presented here was that teacher educators perceived resources as a major barrier to EBP support. In this respect, support solutions are needed to relieve teacher educators from the large amount of time and resources required to

manage the steadily growing body of educational research (i.e., top-down perspective). Several initiatives already exist that provide practitioners with a robust, selected, and accessible knowledge base to promote EBP in the broader context of education (e.g., WWC, EEF, BEE). Similarly, the CHU platform offers target-specific and accessible material based on recent meta-analyses. The findings of the present research suggest that this type of support solution, which is directly targeted at teacher educators, provides a useful and supportive service for teacher educators. However, previous research has shown that simply providing such services is not enough to support EBP (Blamires, 2015; Gorard et al., 2020; Hammersley, 2009), as seen in the present research where many of the teacher educators struggled not only with the resources but also with the attitudes and knowledge necessary for EBP.

It follows that teacher educators must be motivated and trained in how to utilize the services and support provided (Blamires, 2015). In this regard, complementary material or explanatory resources that instruct teacher educators on how to use the content and services provided may be helpful. Such support services can also be implemented as part of a professional development program (i.e., a bottom-up perspective) to provide teacher educators with the mindset and skillset to engage with research evidence in a practical manner (Tack et al., 2018). Such programs may need to be designed differently to serve teacher educators with different background experience. The findings of the present research showed that higher levels of (formal) experience in research and teaching are beneficial for the knowledge and resources necessary to support EBP. Thus, the development of this expertise should be facilitated through qualification and professional development programs for teacher educators. In particular, beginning and novice teacher educators require more support to compensate for their lack of experience. To address the lack of systematic induction phases for teacher educators (Czerniawski et al., 2017), it could be useful to design professional development programs for different expertise levels with tailored content and material. For instance, programs provided on a basic level could foster basic knowledge regarding the generation and dissemination of research evidence, while programs provided on an expert level could provide in-depth knowledge of the evidence related to a specific teaching strategy (e.g., inquiry learning or critical thinking). Furthermore, professional development programs need to provide teacher educators with opportunities to practice and actively engage with research evidence. Additional research is needed to further underpin the development of such programs (Lunenberg et al., 2014).

Additionally, teacher educators could be further encouraged to share and discuss their learning experiences with others, such as teacher educators with more knowledge or different expertise levels (MacPhail & O’Sullivan, 2019). Collaboration and exchange on a specific topic based on recent research evidence could lead to a sustainable EBP culture (Cain et al., 2019; Fischer, 2021). Teacher educators must be encouraged to understand research as an integral part of their teacher education practice (Cochran-Smith, 2005; Murray & Male, 2005). In this respect, they need to become active agents in their professional development by actively and continuously engaging with research relevant to their teaching practice (Tack et al., 2018).

The findings also suggest that, in addition to their ability to access and apply research evidence, teacher educators need to be supported in the selection and communication of research evidence relevant to future teachers (i.e., their transfer function). Teacher educators in the first study stated that they used evidence more often for individual than teaching purposes. In this context, concepts and material that can be implemented easily and help communicate the utility value of research evidence for teaching are required. As Shavelson (2020) argues, teacher educators have the potential to act as brokers in the “trading zone” between research and teaching practice. This could be realized through joint efforts between researchers and teacher educators/teachers (e.g., research–practice partnerships; Penuel et al., 2015) to develop design solutions and through service solutions that provide teacher educators with course concepts or ready-made material. For the design and conceptualization of future initiatives, however, practitioners should be aware of teacher educators’ varying professional challenges and how they can be addressed individually.

8.4 Limitations and directions for future research

The present research has several limitations that can inform directions for future research. The first limitation concerns the generalizability of the findings to the population of teacher educators. The non-probabilistic sampling focused on German university-based teacher educators for secondary education in education sciences or STEM education subjects. Therefore, the samples used are not representative of the total population of teacher educators of German higher education. Future research could extend the findings reported here by including teacher educators from a broader range of disciplines (e.g., language arts, history, and physical education). Additionally, it would be interesting to explore the professional characteristics of EBP in in-service teacher educators. This practice-oriented group of teacher

educators primarily consists of former teachers with many years of teaching experience. It can be expected that teacher educators who are not closely involved in academia and research activities will experience more critical attitudes and challenges related to EBP (Richter et al., 2021; Tack & Vanderlinde, 2014).

In addition to the pre-focused sampling, the voluntary nature of participation in the study might have provoked sample selection bias in that teacher educators who were already in favor of the topic or the CHU project may have been more likely to participate in the study than skeptics or opponents of EBP. This may also explain the large dropout rate in both studies (about 70%). Although this rate is quite common in online survey studies, it is possible that the teacher educators who participated were somehow different from those who chose not to participate. Future research is needed to examine this hypothetical gap more closely. In sum, the findings of both studies are limited to the samples used, and replications of this research are necessary to test the generalizability of the present findings.

A second limitation pertains to the instrument used in the present research, which relied fully on self-report measures of data collection. Self-reported data is prone to social desirability bias, which might lead to an over- or underestimation of the results regarding teacher educators' professional characteristics and thus weaken their validity (DeVellis, 2017). In order to reduce this effect, various measures were taken during the development of the instrument and the data collection process: polarizing phrasing was carefully omitted in the selection and formulation of items, the introduction of the online survey explicitly stated that there were no correct answers, and participants were assured of the anonymization and confidentiality of the data.

Despite these measures, future research is advised to develop a more balanced approach, i.e., supplement self-reports with other observed measures to improve the understanding of the interrelations between the variables and monitor discrepancies between teacher educators' reports and reality (Fryer & Dinsmore, 2020). In this context, the use of multiple methods might be promising. One method could be to triangulate the variables with a variety of methods. For example, interviews, videography, or knowledge tests might provide additional clues as to how to interpret teacher educators' professional characteristics related to EBP. Teacher educators could be interviewed regarding their attitudes and motivation toward EBP (MacPhail & O'Sullivan, 2019; Tack & Vanderlinde, 2014), or their knowledge of EBP could be tested with vignettes. The results of the present research also point to the important role of contextual factors, which might hinder teacher educators' support of EBP. Further research could account

for additional internal factors (e.g., beliefs or knowledge; Georgiou et al., 2020) and external factors (e.g., student characteristics or institutional constraints; Brown & Zhang, 2016) and help to provide a more nuanced picture of the professional characteristics relevant to EBP. Additionally, randomization of items during data collection and open-answer questions might help prevent response biases.

The third limitation of the present research is that the correlational design of the survey methodology did not allow for the identification of the cause and effect of teacher educators' professional characteristics related to EBP, their use of research evidence, or their evaluation of the CHU platform. The underlying assumptions of the present research were that (a) less experience in research and teaching is beneficial for teacher educators' perceptions of the EBP agenda and (b) positive attitudes and few perceived challenges are beneficial for the use of research evidence and, thus, for EBP support. However, it also seems plausible that teacher educators who actively use research evidence and engage with support solutions (such as the CHU platform) increase their attitudes, acquire the necessary knowledge, and learn how to efficiently use their resources. Future research is, therefore, advised to investigate specific effects under controlled conditions. For instance, a controlled experiment with various conditions might elucidate the strength of the findings identified in the present studies. These conditions could differ in their intensity, ranging from specific material or instructions on EBP (e.g., plain language summaries; Kerwer et al., 2021) to training interventions (Wenglein et al., 2015).

9 Conclusion

Teacher educators are the central agents of the EBP agenda in teaching. The aim of the present research was to advance theoretical and empirical clarity regarding the central and heterogeneous group of teacher educators. The empirical studies presented above contribute to the literature and research on teacher educators by providing empirical information about their attitudes and professional challenges related to EBP, as well as possible solutions to these challenges. It was shown that teacher educators in the present research held positive attitudes toward EBP overall but also emphasized the need for more resource-related support to manage the ever-increasing body of educational research. Person-centered analysis revealed that teacher educators represent subgroups with shared profiles in terms of attitudes and knowledge- and resource-related challenges, which might prevent them from supporting EBP successfully. The findings further showed that support solutions, such as the CHU platform, provide a supportive and useful approach to supporting EBP. However, teacher educators with varying professional backgrounds and characteristic profiles need to be able to access and use the support provided thoughtfully to improve decisions and practice outcomes in teaching. Thus, a future goal should be to establish and strengthen existing support solutions, to enrich the services provided with tailored, supportive material that considers teacher educators' individual differences, and to provide adequate professional development. According to an EBP agenda, the professional development of teacher educators as central agents should help improve teaching and learning and strengthen the teaching profession, both in higher education and in schools, as a research-oriented profession.

10 References

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Appendix

Appendix A – Manuscript A

Diery, A., Vogel, F., Knogler, M., & Seidel, T. (2020). Evidence-based practice in higher education: Teacher educators' attitudes, challenges, and uses. *Frontiers in Education*, 5, 62. <https://doi.org/10.3389/educ.2020.00062>

Appendix B – Manuscript B

Diery, A., Knogler, M., & Seidel, T. (2021). Supporting evidence-based practice through teacher education: A profile analysis of teacher educators' perceived challenges and possible solutions. *International Journal of Educational Research Open*, 2-2, 100056. <https://doi.org/10.1016/j.ijedro.2021.100056>

Note:

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