Turning research evidence into teaching action: Teacher educators' attitudes toward evidence-based teaching

Despoina Georgiou [a,*], Annika Diery [b], Sog Yee Mok [c], Frank Fischer [d], Tina Seidel [b]

[a] Department of Pedagogical and Educational Sciences, Utrecht University, The Netherlands
[b] TUM School of Social Sciences and Technology, Technical University of Munich, Munich, Germany
[c] University of Teacher Education of the Grisons, Chur, Switzerland
[d] Faculty of Psychology and Educational Sciences, Ludwig-Maximilians-Universität München, Munich, Germany

ARTICLE INFO

ABSTRACT

Teacher educators are seen as potential brokers able to bridge the research-practice gap and accelerate the adoption of current evidence in teacher education. The present study focuses on the in-depth exploration of teacher educators' attitudes toward evidence-based teaching practices and provides a deeper understanding of the challenges encountered when turning evidence into teaching action. Moreover, facilitating factors to foster the implementation of evidence-based teaching are explored. Twelve teacher educators working in various teacher education programs in Germany reflected on challenges and facilitators to evidence-based teaching implementation. Thematic analysis was used to analyze the data. Results indicate that although teacher educators show positive attitudes towards evidence-based teaching, they still feel challenged to translate research evidence into their teaching practice. Our research suggests that evidence-based teaching may not be successfully implemented if teacher educators lack appropriate preparation and support from higher education institutions.

Introduction

Over the last decade, the European Commission (2012) has placed an increased emphasis on supporting the profession of teacher educators by accepting research evidence as the foundation of teaching practice (Bauer et al., 2015; Wiseman, 2010). Evidence-based teaching (EBT) refers to instructional approaches that are founded on strong evidence, derived from high-quality research studies. Despite its relevance, to date, EBT has been primarily researched within the field of health professions, yet is significantly lacking in teacher education (e.g., Davies, 1999; Slavin, 2008). Because teacher educators' role is multifaceted and demanding, it requires continuous professional decision-making and action (Swennen et al., 2010). Thus, communicating about and reflecting on research evidence is essential for educators' professional development (Hamilton, 2020) and for improving their teaching skills (Dimmock, 2016).

Teacher educators act as liaisons between academia, schools, and local authorities. They come from various professional backgrounds and diverse national and institutional contexts (Lunenberg et al., 2014; MacPhail et al., 2018). They can be academic staff in higher education or researchers at universities, but they can also be former school teachers (Vanassche et al., 2015). Regardless of their background, teacher educators need to be able to identify and incorporate the best available evidence into their teaching practice to prepare future teachers adequately. However, this is not an easy task due to the quick expansion of research literature and the demanding task of turning research evidence into teaching action (Diery et al., 2020; Georgiou et al., 2020).

This study focuses on teacher educators' attitudes toward EBT along with barriers and facilitators to EBT implementation. It is essential to first investigate teacher educators' attitudes because they constitute an important starting point for changes in teaching practice (Kin et al., 2018) and then identify the biggest challenges and facilitators to successfully increase EBT practices in higher education institutions (Georgiou et al., 2020). We focus on teacher educators because they serve as a link between research and practice (Guberman & Mcdossi, 2019), and most importantly they construct and foster future teachers' attitudes that teaching is a profession based on evidence-based principles (Greenwood & Mabeady, 2001). Given the complexity of teacher educators' profession and their important role as brokers between research and practice, we aim to build a knowledge base that will support EBT professional development initiatives tailored to teacher educators' specific needs.

---

* Corresponding author.
  E-mail address: d.georgiou@uu.nl (D. Georgiou).

A comprehensive model for evidence-based teaching

Davies (1999) defines evidence-based teaching as an approach to instruction that is based on solid evidence obtained from high-quality research studies. While different terms have been used to describe evidence-based teaching, such as research-based education (Hargreaves, 2007), evidence-based practice (Thomas, 2004), or evidence-informed practice (Brown & Zhang, 2016), they all refer to the same fundamental concept of utilizing research evidence to inform teaching practices.

As shown in Fig. 1, evidence-based teaching encourages educators to use research evidence to inform their teaching practices (Henderson & Dancy, 2009). However, it does not replace educators' judgment or tacit knowledge but rather unites these two elements to provide a sound basis for practice (Davies, 1999). To successfully incorporate research evidence into teaching practice, educators must pose answerable questions, locate and systematically retrieve evidence, critically appraise and analyze evidence, organize and grade its power, and determine its relevance to their educational needs and environments (Davies, 1999).

Evidence-based teaching is not a cure-all solution or a simplistic recipe for the complexities of modern education (Davies, 1999). Instead, it's a collection of principles and practices that can transform the ways in which educators approach education and make informed decisions based on evidence and expertise. By adopting evidence-based teaching methods, educators can enhance their teaching effectiveness, support their professional development, and promote positive student outcomes (Dancy et al., 2016; Newton et al., 2020).

Teacher educators as brokers between research and practice

Teacher educators working in initial teacher education belong to a unique, complex, and multifaceted profession because first, they must be able to apply their professional knowledge to practical challenges and second, they need to permanently 'update' their professional knowledge concerning new research findings and insights (Bauer & Prenzel, 2012). In detail, teacher educators are expected to know how to implement evidence in their own teaching practice and be able to facilitate and communicate this knowledge to the future teachers they instruct (Vanderlinde et al., 2016). Teacher educators' role in the total ecology of teacher education is pivotal due to the support they offer to future teachers learning since they act as role models through their own teaching (Lunenberg et al., 2007).

In the EBT approach, teacher educators can act as professional stakeholders who inspire future teachers to reflect on how to improve students' well-being and support classroom learning using for instance research evidence on students' motivational and emotional characteristics (Wentzel & Miele, 2016). Another example relates to research evidence on specific teaching actions, such as game-based learning (Wouters et al., 2013) or flipped learning (van Alten et al., 2019), that may provide support to future teachers' decision-making about the interventions that best promote students' learning outcomes and satisfaction. The need to incorporate research evidence more systematically in the legitimation process of teaching requires paradigmatic shifts in teacher education. These shifts should start from core structures of teacher education, namely, from higher institutions and specifically from teacher educators (Korthagen et al., 2006). Thus, focusing on teacher educators as brokers between research and practice (Shavelson, 2020) in higher education is of high relevance for the advancement and successful bridge of research and practice (Darling-Hammond, 2016).

Teacher educators' attitudes and challenges to EBT implementation

In the context of EBT, attitudes toward changes in practice and the adoption of new innovative strategies have long been studied in medicine (e.g., Aarons, 2006; Brown et al., 2009). Similarly, evidence in teacher education showed that educators' positive attitudes towards new teaching reforms are necessary for the effective implementation of evidence in practice (Kin et al., 2018). This study integrates the theory of
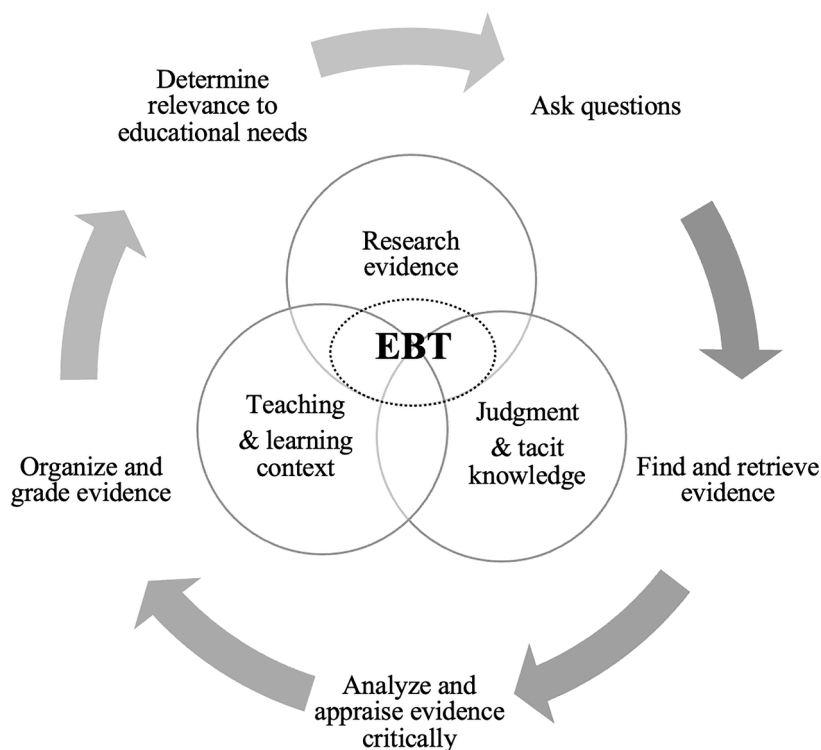

Fig. 1. The Evidence-Based Teaching Implementation Model.
Note. Fig. 1 was developed based on *What is evidence-based education?* by Davies (1999, p. 109) and *The Case for Pragmatic Evidence-Based Higher Education: A Useful Way Forward?* by Newton et al. (2020, p. 5). The figure incorporates elements from both sources but is not restricted to the information presented in either source.

planned behavior (Ajzen, 1991) which emphasizes the important role of attitudes in shaping individuals' behavioural intentions. The theory supports the notion that positive attitudes towards change, or a certain idea may determine an individual's readiness to act in a certain way. Thus, teacher educators expressing attitudes of doubt towards the implementation and efficacy of evidence can be perceived as a major challenge to EBT, which might hinder its successful implementation (Lilienfeld et al., 2013; Reddy et al., 2017).

Positive attitudes towards research and EBT implementation are common even among less research-experienced teacher educators (Georgiou et al., 2020). However, the evidence-based implementation process outlined in Fig. 1 can pose several challenges for educators, including a lack of institutional support (resource-related challenge), a lack of knowledge and skills (knowledge-related challenge), and difficulties in connecting research evidence to everyday teaching practice (practice-related challenge), which may lead to discrepancies between attitudes and actual behavior (Brown & Zhang, 2016; Cochran-Smith, 2005). For instance, if teacher educators show positive attitudes towards EBT but lack the knowledge or time to effectively integrate research evidence into their research practice, this will hinder their efforts. In a nutshell, for the successful implementation of EBT, teacher educators need to not only show positive attitudes but also to be able to face challenges and to have opportunities to facilitate EBT (Diery et al., 2021).

Aim of the study

This study aims to further explore teacher educators' attitudes towards EBT along with challenges and facilitators to foster EBT implementation. A few quantitative studies have looked at this issue mainly focusing on primary and secondary school teachers exploring the interactions of teachers with researchers or the role of organizational factors namely the culture of the school (Williams & Coles, 2007). Our study adds to the existing body of research focusing on teacher educators' role in the EBT context (e.g., Diery et al., 2021; Georgiou et al., 2020) following a qualitative approach. With this study, we allow practitioners to articulate their attitudes towards EBT, we identify important factors that influence the implementation of EBT, and we allow researchers to capture the complexity of educators' perspectives. The data collected for this research will complement earlier survey research and shed light on important areas of consideration to foster EBT in teacher education. The following three research questions guided the present study:

(1) What are teacher educators' attitudes toward the use of EBT in their own practice?
(2) Which are the perceived challenges that hinder EBT implementation for teacher educators?
(3) Which are the perceived facilitators that foster EBT implementation for teacher educators?

Methods

Participants

Participants were 12 teacher educators working in two German universities. We used a case-study approach (Cohen et al., 2017), with the two universities representing the larger cases and within these, teacher educators representing the individual case-study. Purposive sampling (Cohen et al., 2017) was used to identify teacher educators (six men, six women) who represented a range of ages and gender, as well as varying experience in schools, university teaching, and research. All participants received an invitation email and provided their written consent to participate in the interview study. Due to ethical considerations, the interviewees' characteristics have been aggregated into broad categories and pseudonyms have been used to protect their

privacy. Table 1 presents the participants selected characteristics.

Interviews

The semi-structured interviews consisted of four parts. In the first part, the participants were asked about their attitudes towards research, their understanding of the term EBT and the importance of EBT in their teaching practice. The second part focused on perceived challenges that hinder EBT implementation. The third part focused on perceived facilitators that foster EBT implementation. Finally, teacher educators were asked about additional aspects relevant to their EBT professional development or EBT implementation. All interviewees were interviewed at the university. All interviews have been carried out in German, the native language of all participants. Interviews lasted from 20 to 35 min. All interviews were recorded and transcribed.

Data analysis

Thematic analysis was used to analyze the interviews (Braun & Clarke, 2006). A theoretical or deductive approach was applied to the data where the participants' statements were coded through a step-by-step thematic analyzing method. The interviews were transcribed verbatim. The initial categories were based on previous research (Diery et al., 2021; Georgiou et al., 2020) and the interviewees' actual words. Themes were defined as ideas that have a certain level of pattern or meaning to previous research and the aims of this study. The relevance of single statements was critically reviewed to determine whether there was only one person's opinion or a general opinion among the interviewees. The initial themes were modified in an iterative process where too general themes were split into subthemes and non-frequent themes were merged into general themes or omitted (Braun & Clarke, 2006). To verify the presence of themes and ensure the reliability of the coding a second coder reviewed and recoded all transcripts. After the themes were decided and to ensure there is agreement on the interview segments attached to each theme, the first and the second author reviewed and coded the full set of coded interviews again based on the final themes. See Table 2 for a further description of the analytic steps.

Results

The findings are presented according to the research questions and the identified themes. Three themes were identified, with a total of seven sub-themes. The three main themes were *'attitudes', 'challenges'* and *'facilitators'*. We first describe teacher educators' attitudes and general views about EBT, and we provide examples of the impact of EBT on teacher educators' teaching practice (research question 1). We then outline challenges to the implementation of EBT (research question 2) and finally, we discuss potential facilitators to foster EBT implementation (research question 3). The quotations presented may contain grammatical inaccuracies which were deliberately kept to capture the authenticity of teacher educators' voices.

Attitudes

All interviewees expressed positive attitudes towards research and the significant role of the implementation of research evidence into their teaching practice. Eleven interviewees identified EBT as a knowledge base to inform practice, as a useful tool to support young or less experienced teacher educators and as a means to improve teaching practice. Three novice teacher educators identified research evidence as an important tool to support their teaching practice: 'research evidence is simply a guide for me as a career starter. Since I do not have any knowledge, based on my experience that I can refer to, I can at least look into studies'. Three teacher educators mentioned that research evidence can be seen as a knowledge base which can largely affect teaching practice: 'research evidence for me is actually the basis of every kind of

Table 1
Interviewees' Characteristics.

Name	Gender	Age	Discipline	School Experience	Experience in teacher education (more than 5 years)	Experience in research (more than 5 years)
Frida	F	40	Education	No	Yes	Yes
Albert	M	38	STEM	No	Yes	Yes
Bert	M	29	Education	No	Yes	Yes
Elke	F	31	Social Sc.	Yes	Yes	No
Laura	F	28	Education	No	No	No
Markus	M	55	Education	Yes	Yes	No
Linus	M	36	Social Sc.	No	Yes	Yes
Karl	M	50	Education	Yes	Yes	Yes
Felix	M	48	Education	Yes	Yes	No
Barbara	F	37	Social *Sc.*	Yes	Yes	No
Sabine	F	27	Education	No	Yes	Yes
Lina	F	45	Education	Yes	Yes	Yes

Note: Pseudonyms were used to avoid disclosure.

Table 2
Analytic steps description.

Analytic steps (Braun & Clarke, 2006)	Analytic steps followed in this study
Familiarizing with your data	Verbatim transcription. The first two authors read all interviews several times and separately identified initial ideas and patterns.
Generating initial codes	Single statements and interesting patterns were coded by both coders individually. Initial codes were generated.
Searching for themes	Initial codes were merged into general themes and general themes were split into subthemes. Themes and subthemes were discussed regarding their relevance to the goals of this study.
Reviewing themes	Themes were critically reviewed concerning the coded extracts and the entire dataset.
Defining and naming themes	The first two authors in an iterative process discussed the definition and precision of the relevant themes to the research questions. Relevant names to describe the core of the theme were identified and applied.
Producing the final report	In the final step, the analysis was discussed mutually along with the final description of the themes in an article.

teaching. What I teach in terms of content is based on research and is actually based on current scientific knowledge'.

Four teacher educators said that EBT actively helps them improve their teaching practices:

'It's no coincidence…the seminars that I really design on the basis of research evidence are of course better. Why? because students learn more, the discussions get better, students are more active, and the two things simply merge well with each other…my personal experience and what research says on the subject'.

Two teacher educators although they expressed positive attitudes towards EBT they seemed concerned that teaching might be of low quality if teachers incorporate only EBT approaches. Thus, they emphasized the need to adopt a teaching approach where EBT and teaching experience are equally valuable. For example, Frida pointed out that: 'Hm, well yes, ok in my research, I somehow accept all these (EBT) criteria but when I teach then I'll do it from my gut or from what I just believe! Well, I think that teaching is just a mixture, so uhm, it's a mixture of experience and evidence'.

Impact of EBT on teaching practice

Eight teacher educators provided examples of the impact of EBT in their teaching practices. Three teacher educators who also work as researchers mentioned they either use their research findings to support their teaching practice or while reviewing the literature they collect research evidence that can be implemented in practice. Albert explained

'In my research, I work with digital media, this is why I have evidence that I can refer to while preparing to teach. For example, I know how many hours students should sit in front of a screen or which apps support their learning'. Two interviewees stated that they work in teams where they discuss research findings and their potential implementation into teaching practice. For example, Bert mentioned: 'We are all thinking about how to use evidence together. We discuss weekly how to incorporate current research results into our teaching. It's very extensive…'.

Another interviewee described how EBT can not only transform teacher educators teaching practice but also pre-service teachers future teaching practice.

'We discuss for example research on teaching effectiveness…we work together (with students), we break down the most relevant points and explain why X consists of Y dimensions and how this can be implemented in practice. This way we support students to understand research findings and to learn how to simplify literature to be able to implement it in teaching practice'.

Two teacher educators referred to the impact of EBT on their professional development. Elke mentioned: 'I try to reflect on my teaching, I notice, ah there I have a gap, there I still need to improve…EBT helps you to become more open, more sensitive, to search more for better evidence that supports your learning'. Laura said: 'Last year I was teaching a very *dry* subject and my students were very bored…I needed a solution. Research studies helped me to understand the topic better and improve my teaching…also students were happier'.

Challenges

Although teacher educators in this study exhibited general positive attitudes towards EBT they also identified several challenges when using EBT. Based on previous literature (Diery et al., 2021; Georgiou et al., 2020) challenges have been categorized into three subthemes, *'knowledge-related challenges', 'resource-related challenges'* and *'practice-related challenges'*.

Knowledge-related challenges

Teacher educators mainly expressed concerns about their critical appraisal skills (seven interviewees), their knowledge and understanding of methods and statistics (five interviewees), the difficulty to read international literature (five interviewees), the discrepancy between the different set of skills needed to conduct research and to teach (three interviewees) and finally the availability of evidence (two interviewees). Bert who works in research and teaching reports: 'Interpreting results from research studies can be very difficult…I am involved in research, but I can imagine that this is a huge problem for people who do not work in research'. Laura mentioned: 'It is very important to reflect critically on results, of course…you shouldn't simply accept the results of a study without reflection. But to be able to do so you need to know various statistical methods very well'. Another interviewee who worked as a

school teacher for many years and after decided to teach in academia, emphasizes the need to put extra effort to be able to interpret research findings, she reports:

'Understanding methods and interpreting results is a challenge! So… I really had to learn, uh, the basics of statistics - and I'm not a math teacher myself, I am a German teacher. And of course, that is, uh, additional effort. That's, of course, one side of the story, when you come out of school, you have to teach at the university, uh, you simply have to deal with it, you can't just ignore it'.

Markus explained that teacher educators with less research experience may need a different set of skills to be able to interpret and incorporate research evidence into teaching practice: 'I have studied teacher education which means we did not really focus on statistics. This is why in my first years as a lecturer it was even more difficult for me to assess research evidence and understand the analysis section in research papers'. Reading research papers in English seemed to be a struggle for almost half interviewees. Indicatively, Albert explained that Anglo-American literature differs from German literature in terms of scientific rigor and complexity.

Resource-related challenges

Lack of time seemed to be a major difficulty referred to by eleven interviewees. Linus pointed out that to have a successful career in academia there is a lot of pressure to actively work on research (e.g., publications, third party funding) which leads to less time devoted to teaching duties.

'Nowadays, you don't have to be a good teacher to become a very successful academic. That is an imbalance in the system, that teaching actually does not play a major role and that leads to people perceiving teaching as a compulsory task, or as a nice accessory, which just has to be quickly done…Investing time to incorporate EBT is problematic. Why? If you want to get ahead, if you want to have a good job afterwards, then you have to spend as little time as possible on teaching. Teaching time is wasted time! You need to have time for third party funding and to have time for publications. Unfortunately, this is the uh… reality and of course, it leads to little energy being invested in teaching or evidence-based teaching'.

Another interviewee explained that: 'Time is a problem! It is always a lot of effort to plan your courses…it is, of course, more convenient to say oh! a colleague has already taught this course, I'll just ask them to share their slides quickly…I did that last semester. I'll do it again'. Karl reported that it is time-consuming to find research evidence and assess its quality: 'I think it takes a lot of time if you want to assess the quality of research correctly. Of course, there are also very simple indicators, such as the impact factor of a journal…when I check this I have a certain degree of quality assurance'. Other interviewees mentioned that they rely on their teaching experience when they face time constraints. For example, Felix explained:

'Well, I would say that my teaching is not based extensively on research, because first of all, I need the time to read studies, I need time to incorporate findings into the classroom and often classes are based on practical knowledge. Especially when you have been doing it for a long time…Sometimes what you do in class is just spontaneous'.

Time constraints were also apparent when reading international literature. Several German-speaking teacher educators mentioned that reading international literature is more time-consuming because it requires more energy and sometimes more advanced language skills.

Practice-related challenges

Nearly all interviewees (eleven out of twelve) expressed the difficulty of connecting research findings to their teaching practice. Barbara talked about the nexus between research and practice and the challenges she faces to incorporate evidence into teaching practice:

'This bridge between theory and practice or that of the abstracted findings in the form of some statistical values is very challenging. This translation of research findings into teaching practice is always the biggest challenge for me'.

Another interviewee added:

'Translating research findings into teaching practice is incredibly difficult because it is always very abstract…the results are never that clear or one cannot break them down to the specific case in practice. We need training where you think about how you can transfer these findings into practice…but I think you need people who come from all sides…who know about research and practice'.

Other teacher educators mentioned that although they have research experience they still face challenges in incorporating evidence into teaching practice. For example, Sabine said: 'I still find the transfer to concrete action or the *what am I doing now*…um… difficult. Not only in guiding students but also when I design my courses'.

Three teacher educators mentioned explicitly the practical challenges they face to incorporate research evidence into their teaching practice due to their set of skills and background. In detail, they discussed the difference in the set of skills between a researcher and a teacher and specifically between a teacher with many years of experience outside academia. They also mentioned the importance of practical experience and the need to work closely with researchers and learn from one another. For example, Karl mentioned: 'We both belong to the same model, research and practical experience. This unique combination has an educational value which becomes apparent when research and practise go hand in hand'. He continued:

'Of course when you have to deal with a specific problem and you need to search the literature or become aware of the research projects working on this issue you do not need me as a teacher but a researcher working at the University…that is the challenge, after 20 years of teaching experience you have to go into new areas without knowing whether you can really do that, whether you will be accepted by colleagues and students'.

Another interviewee referred to the same challenge following a different approach, mentioning the need for a better connection between research findings and teaching practice. Markus said:

'I sometimes have the impression that research is being carried out on topics that may be very interesting for researchers but a teacher who teaches 23 years says, uh, I don't care, I can't see how this finding will help me…Um, I think teachers would be grateful, for example, to receive more information on how to effectively incorporate research findings in their lessons to support students learning and to design better lessons…It would be beneficial if researchers ask teachers what do they need? What would be of interest to you? How can I support your teaching practice?'.

Facilitators

After describing several challenges, interviewees proposed a couple of facilitators to foster EBT implementation. Based on previous literature (Diery et al., 2021; Georgiou et al., 2020) facilitators have been categorized into two subthemes, '*individual facilitators*' and '*institutional facilitators*'.

Individual facilitators

At an individual level, most interviewees referred to the need to promote teachers positive attitudes towards research and increase familiarity with research methodology. Albert mentioned: 'It is important to support teachers to understand the need for the implementation of research evidence. To support positive attitudes towards research'. Bert

adds to that:

> 'I think what is a very essential… is that teachers should make themselves aware of how important it is to evaluate their own teaching based on research evidence and not to see evaluation per se as criticism… but as an opportunity to find out what works and what doesn't work in a certain context, for a certain target group…and also what works best for you as a teacher'.

Another important point mentioned by the vast majority of the interviewees refers to the need for active communication and collaboration between researchers and teachers. A synergy that would foster teacher educators' professional growth. One of the interviewees explains:

> 'In principle, I think we all have to work a bit on science communication. That's a big topic…There are a lot of things that don't make it any easier, such as the time constraints we talked about beforehand…Further training could help as well… I know studies, um, which clearly show that the participation in further training among lecturers is rather low which means that many lecturers are self-taught'.

Institutional facilitators

In line with the individual facilitators mentioned above interviewees identified two major factors which need to be improved at an institutional level, namely; relationship building and communication between researchers and teachers. Both researchers and teachers mentioned that initiatives to foster collaborations among practitioners and researchers are necessary to close the gap between research and practice. Linus mentioned: 'What an institution can do? First, increase the contact between science and practitioners and then try to get your research out of the ivory tower of the university into school classrooms and university hauls'.

Another interviewee emphasized the need to create communities of practice with teachers and researchers who share the same interest to support EBT and learning. She said: 'I think you always need collaborations between people. You need people from practice, you also need people from research and you probably need someone who communicates that, a facilitator or someone who feels at home in both areas'. Solidarity between practice and theory formation is required, based on another interviewee. This can be achieved through the formation of interest groups (how she called them) where researchers and practitioners identify the potential problem, get involved in fruitful dialogues and come up with a solution. She continued saying: 'This is how you bring them together (theory and practice)… Knowledge is available, implementation parameters are abundant, but I think the problem starts from the fact that *everyone cooks their own soup* and doesn't really like to think out of the box'.

Online forums for example where practitioners and researchers exchange ideas could be another way to bridge the gap between theory and practice as Frida suggested. But first, you need to 'talk to each other, change your perspective…still a lot of things are running in parallel' as explained by Barbara who works as a teacher. Online forums can create possibilities for interdisciplinary or multidisciplinary exchange among practitioners and researchers. For example, Karl said: 'This way I can also involve people from other disciplinary cultures. And not people working in the field of educational research or psychological research, but also practitioners from both fields. That would help us to exchange feedback'. Another suggestion refers to professional development opportunities that need to be organized at an institutional level. Elke explains: 'For example, an institution could organize teacher training events where teachers (in universities and schools) are invited to the university, and then via workshops or plenary events or even poster presentations are introduced to the research community'.

The need to introduce digital libraries especially to practitioners and less research-oriented teachers was mentioned as the second most important institutional factor. Six interviewees provided their arguments. Albert for example said:

> 'What could be helpful? We have to make databases widely accessible, to offer people lower-threshold access to research and maybe even to deal with meta-analysis, where one can simply look at what the current research trends and results are in a particular field and then communicate it in a short comprehensible format. In other words, to simply create basic knowledge that could be made available to people in the form of such a meta-analysis of current research.'

Another interviewee discussed the benefits of learning about digital libraries (e.g., What Works Clearinghouse) using an example from his practice: 'I might want for example to further develop new materials for one of my lessons… then I'll see what's available in the clearinghouse databases…there you get everything at once and it saves you time'. Another interviewee said: 'Wherever I am concerned with a topic, I try to use clearinghouse databases…in those databases, they try to process research results in an easily accessible and usable way not only for me but for the ordinary consumer or in this case school-based teachers… That would also be an option for the university context.' Another interviewee adds to that: 'I find that offer very helpful for teachers and I recommend it to future teachers as well as in my seminars…I say use this offer because it is very easy to understand, it is well summarized and you can use it effectively and efficiently'. One teacher educator was less enthusiastic and mentioned that she has used clearinghouse databases and finds them promising but she can see obstacles and points of improvement to successfully foster active communication between research and practice.

Discussion

This study aimed to develop a deeper understanding of teacher educators' attitudes towards EBT and identified challenges and facilitators to EBT implementation. Findings in our interview study indicate that although teacher educators show positive attitudes towards EBT they still experience major challenges when required to put research findings into practice. Overall teacher educators' responses reflected three main themes about the challenges to EBT implementation targeting knowledge-, resource- and practice-related challenges. Institutional and individual facilitators to successful evidence implementation have been proposed and discussed.

In line with previous studies (Guberman & Mcdossi, 2019; Tack & Vanderlinde, 2014), most teacher educators expressed positive attitudes not only towards research but also towards the implementation of research evidence into their teaching practices. EBT was identified as a useful knowledge base to inform practice and specifically support less experienced teacher educators. However, it is worthwhile to mention that a few teacher educators expressed their hesitation in the EBT reform pointing out the need to value both tacit and academic knowledge. As the EBT implementation model dictates (see Fig. 1), a balanced combination of evidence-based and tacit knowledge must be the aim of future professional development efforts (Dimmock, 2016).

Our findings showed that research-active teacher educators tend to inform their practice mainly through their research while teacher educators with less or no research experience consult research evidence when applicable. When teacher educators were asked to provide examples of their evidence-based teaching practices the need to adopt the 'dialectic of scholarship and practice' (Cochran-Smith, 2005) became apparent. It is widely agreed that teacher educators are expected to act as researchers and to be able to adopt a research/practitioner stance (e. g., Cochran-Smith, 2005; Menter et al., 2011). Yet, teacher educators may lack the opportunities to engage in research (Livingston et al., 2009), or even if they manage to engage, their research efforts rarely receive proper attention from colleagues and their institutions (Guberman & Mcdossi, 2019). The division between teaching and research staff

along with the hiatus between knowledge production and knowledge application as a challenge to EBT implementation still seems prevalent in higher education institutions (Dimmock, 2016; Griffiths, 2004).

Teacher educators have voiced their difficulties in systematically examining the value and relevance of research evidence, particularly in relation to the third, fourth, and fifth steps of the evidence-based teaching implementation model illustrated in Fig. 1. Even research-active teacher educators find it challenging to fully comprehend advanced research methods and read international literature (Czerniawski et al., 2017). Selecting, critically examining, and successfully incorporating research evidence into teaching action is not only a knowledge-related challenge but also a resource-related one. To address these challenges, professional development efforts should provide support by offering courses and workshops where educators can learn how to search, identify, and evaluate evidence produced by others.

Lack of time to engage in EBT activities has been identified as a major resource-related challenge (der Klink et al., 2017). Teacher educators referred to the shift of focus from teaching to research and publication observed in higher education institutions (Bok, 2009). A shift that forces them to devote time and effort to conduct and publish research sometimes at the expense of other important tasks like EBT. Allocation of reserved time for professional learning, teaching, and research activities combined with differentiated promotion paths that will take into account not only research but also teaching achievements may support the implementation of EBT practices (e.g., Guberman & Mcdossi, 2019; Meeus et al., 2018).

The difficulty to translate research evidence into teaching practice has been also identified as a main practice-related challenge. Teaching or research experience alone may not support teacher educators' efforts to put research into practice. Teacher educators expressed the need to become members of communities of inquiry or else collaborative teams of teachers-researchers where they will be allowed to learn from one another (Cochran-Smith, 2005). For example, in collaborative teams, teacher educators will be able to critically examine and internalize research findings, analyze the implications of new methods for teaching and learning, and determine appropriate ways to put evidence into practice (Dimmock, 2016). Collaborative teams can also support relationship building and active communication between teacher educators, alleviate loneliness which characterizes their work, and support their professional development (Willemse et al., 2016).

Aside from the need to collaborate, teacher educators identified digital libraries such as the 'What Works Clearinghouse' or 'The Best Evidence Encyclopedia' as important facilitators to establish EBT practices in education. Clearinghouse databases or digital libraries support evidence-based decision-making by collecting, screening, and identifying studies on the effectiveness of educational programs (Higgins et al., 2016). This way the time needed to identify, examine, and select the best available evidence can naturally minimize and lead to successful evidence implementation in teaching practice. Easy access to knowledge databases may also support less research-active teacher educators' professional learning and development (Georgiou et al., 2020).

Limitations

Two limitations of this study are worth highlighting. First, having only teacher educators from German universities is a potential limitation of our study, which may restrict the generalizability of our findings. It is important to note that we followed a constructivist approach, which values and recognizes the significance of individual perspectives and experiences in shaping attitudes towards EBT (Creswell & Poth, 2018). Nevertheless, we addressed this potential limitation by purposely selecting a diverse group of teacher educators and using a rigorous data analysis process to ensure the trustworthiness of our findings. As with other qualitative research, our goal was not to generalize our findings to a broader population. Rather, we aimed to offer a rich and contextualized understanding of teacher educators' attitudes and experiences

towards EBT (Polit & Beck, 2010). Nonetheless, future studies could consider replicating our study with more diverse samples of teacher educators from different countries and cultures to explore similarities and differences between these countries and cultures.

Secondly, the interviews were conducted only in German, which may have excluded non-German-speaking teacher educators from participating in the study and introduced translation and interpretation biases in the data analysis. While we took steps to mitigate these biases, such as having interviews translated and reviewed by a bilingual researcher and using an iterative coding process, the use of translation and interpretation can still introduce some limitations. To address this, future studies should consider conducting interviews in multiple languages to ensure inclusivity. Additionally, triangulating data sources such as observations and surveys can further enhance the trustworthiness of the findings.

Conclusion

The successful implementation of evidence-based teaching practices is a complex and multifaceted process, and it involves various stakeholders in education. Our study provides valuable insights into the attitudes and challenges faced by teacher educators towards EBT and emphasizes their critical role in promoting evidence mobilization within and outside of academia. However, it's important to acknowledge that policymakers and higher education structures also play a crucial role in facilitating evidence-based teaching implementation.

Ultimately, the successful implementation of EBT practices requires a collaborative effort among all stakeholders in education. To support the integration of research findings into teaching practice, teacher educators need to develop the skills to identify and implement evidence-based teaching practices that are suitable to their specific educational contexts. Hence, there is a need to continue promoting and exploring evidence-based teaching practices to improve teaching quality and enhance student learning outcomes in the long run.

Ethics statement

The present study was approved by The Ethics Commission of the Faculty of Psychology and Educational Sciences at the LMU Munich. The participants provided their written informed consent to participate in this study.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

References

Aarons, G. A. (2006). Transformational and transactional leadership: Association with attitudes toward evidence-based practice. *Psychiatric services (Washington, D.C.), 57* (8), 1162–1169. https://doi.org/10.1176/ps.2006.57.8.1162

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

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

Bauer, J., Prenzel, M., & Renkl, A. (2015). Evidenzbasierte Praxis - im Lehrerberuf?! Einführung in den thementeil. [Evidence-based practice in teacher education]. *Unterrichtswissenschaft, 43*(3), 188–192. Retrieved from http://www.beltz.de/fach medien/erziehungs_und_sozialwissenschaften/zeitschriften/unterrichtswissensch aft/article/Journal.html?tx_beltz_journal[article]=30962&cHash=534db58739fd0 fc34f8479554f5ef314. h.t.t.p.s://w.w.w..digizeitschriften.de/dms/img/? PID=PPN513613439_0043%7CLOG_0029.

Bok, D. (2009). *Our underachieving colleges: A candid look at how much students learn and why they should be learning more - New edition*. Princeton: Princeton University Press. https://doi.org/10.1515/9781400831333

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

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

Brown, C. E., Wickline, M. A., Ecoff, L., & Glaser, D. (2009). Nursing practice, knowledge, attitudes and perceived barriers to evidence-based practice at an academic medical center. *Journal of Advanced Nursing, 65*(2), 371–381. https://doi.org/10.1111/j.1365-2648.2008.04878.x

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

Cohen, L., Manion, L., & Morrison, K. (2017). *Research methods in education* (8th ed.). Routledge https://doi-org.proxy.library.uu.nl/10.4324/9781315456539.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Thousand Oaks: SAGE Publications, Inc.

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

Dancy, M., Henderson, C., & Turpen, C. (2016). How faculty learn about and implement research-based instructional strategies: The case of peer instruction. *Phys. Rev. Phys. Educ. Res., 12*, Article 010110. https://doi.org/10.1103/PhysRevPhysEducRes.12.010110

Darling-Hammond, L. (2016). Research on teaching and teacher education and its influences on policy and practice. *Educational Researcher, 45*(2), 83–91. https://doi.org/10.3102/0013189X16639597

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

der Klink, M., Van Kools, Q., Avissar, G., White, S., & Sakata, T (2017). Professional development of teacher educators: What do they do? Findings from an explorative international study. *Professional Development in Education, 43*(2), 163–178. https://doi.org/10.1080/19415257.2015.1114506

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*, Article 100056. https://doi.org/10.1016/j.ijedro.2021.100056

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*, 183. https://doi.org/10.3389/feduc.2020.00062

Dimmock, C. (2016). Conceptualising the research–practice–professional development nexus: Mobilising schools as 'research-engaged' professional learning communities. *Professional Development in Education, 42*(1), 36–53. https://doi.org/10.1080/19415257.2014.963384

European Commission. (2012). *Supporting the teaching professions for better learning outcomes. Commission staff working document 374*. Strasbourg: European Commission, 120 Retrieved from: https://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2012:0374:FIN:EN:PDF.

Georgiou, D., Mok, S. Y., Fischer, F., Vermunt, J. D., & Seidel, T. (2020). Evidence-based practice in teacher education: The mediating role of self-efficacy beliefs and practical knowledge. *Frontiers in Education, 5*, 256. https://doi.org/10.3389/feduc.2020.559192

Greenwood, C. R., & Mabeady, L. (2001). Are future teachers aware of the gap between research and practice and what should they know? *Teacher Education and Special Education, 24*(4), 333–347. https://doi.org/10.1177/088840640102400407

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

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

Hargreaves, D. (2007). Teaching as a research-based profession: Possibilities and prospects (The Teacher Training Agency Lecture 1996). In M. Hammersley (Ed.), *Educational research and evidence-based practice* (pp. 3–17). Milton Keynes: Open University Press.

Hamilton, M. (2020). Evidence-based portfolios: A cross-sectoral approach to professional development among teachers. *Professional Development in Education, 46*(1), 160–174. https://doi.org/10.1080/19415257.2018.1555183

Henderson, C., & Dancy, M. H. (2009). Impact of physics education research on the teaching of introductory quantitative physics in the United States. *Physical Review Physics Education Research, 5*, Article 020107. https://doi.org/10.1103/PhysRevSTPER.5.020107

Higgins, S., Katsipataki, M., Kokotsaki, D., Coleman, R., Major, L. E., & Coe, R. (2016). *The sutton trust-education endowment foundation teaching and learning toolkit*. London: Manual. Education Endowment Foundation. https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit/.

Kin, T. M., Kareem, O. A., Nordin, M. S., & Bing, K. W. (2018). Principal change leadership competencies and teacher attitudes toward change: The mediating effects of teacher change beliefs. *International Journal of Leadership in Education, 21*(4), 427–446. https://doi.org/10.1080/13603124.2016.1272719

Korthagen, F., Loughran, J., & Russell, T. (2006). Developing fundamental principles for teacher education programs and practices. *Teaching and Teacher Education, 22*(8), 1020–1041. https://doi.org/10.1016/j.tate.2006.04.022

Lilienfeld, S. O., Ritschel, L. A., Lynn, S. J., Cautin, R. L., & Latzman, R. D. (2013). Why many clinical psychologists are resistant to evidence-based practice: Root causes and constructive remedies. *Clinical Psychology Review, 33*(7), 883–900. https://doi.org/10.1016/j.cpr.2012.09.008

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

Lunenberg, M., Dengerink, J., & Korthagen, F. (2014). *The professional teacher educator: Roles, behaviour, and professional development of teacher educators. professional learning*. Rotterdam: SensePublishers. https://doi.org/10.1007/978-94-6209-518-2. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=779488.

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

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

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

Menter, I., Elliot, D., Hulme, M., Lewin, J., & Lowden, K (2011). *A guide to practitioner research in education*. SAGE Publications Ltd. https://www-doi-org.proxy.library.uu.nl/10.4135/9781473957770.

Newton, P. M., Da Silva, A., & Berry, S. (2020). The case for pragmatic evidence-based higher education: A useful way forward? *Frontiers in Education, 5*, Article 583157. https://doi.org/10.3389/feduc.2020.583157

Polit, D. F., & Beck, C. T. (2010). Generalization in quantitative and qualitative research: Myths and strategies. *International Journal of Nursing Studies, 47*(11), 1451–1458.

Reddy, L. A., Forman, S. G., Stoiber, K. C., & González, J. E. (2017). A national investigation of school psychology trainer's attitudes and beliefs about evidence-based practice. *Psychology in the Schools, 54*(3), 261–278. https://doi.org/10.1002/pits.21999

Shavelson, R. J. (2020). Research on teaching and the education of teachers: Brokering the gap. *Beiträge zur Lehrerinnen-und Lehrerbildung, 38*(1), 37–53. https://doi.org/10.25656/01:21773

Slavin, R. E. (2008). Perspectives on evidence-based research in education – What works? Issues in synthesizing educational program evaluations. *Educational Researcher, 37*(1), 5–14. https://doi.org/10.3102/0013189X08314117

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

Tack, H., & Vanderlinde, R. (2014). Teacher educators' professional development: Towards a typology of teacher educators' researcherly disposition. *British Journal of Educational Studies, 62*(3), 297–315. https://doi.org/10.1080/00071005.2014.957639

Thomas, G (2004). Introduction: Evidence and practice. In G. Thomas, & R. Pring (Eds.), *Evidence-based practice in education* (pp. 42–66). Maidenhead: Open University Press.

van Alten, D. C. D., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review, 28*, Article 100281. https://doi.org/10.1016/J.EDUREV.2019.05.003

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

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

Wentzel, K. R., & Miele, D. B. (2016). *Educational psychology series. handbook of motivation at school* (2nd ed.). Routledge Taylor & Francis Group https://doi-org.proxy.library.uu.nl/10.4324/9781315773384.

Willemse, T. M., Boei, F., & Pillen, M. (2016). Fostering teacher educators' professional development on practice-based research through communities of inquiry. *Vocations and Learning, 9*(1). https://doi.org/10.1007/s12186-015-9142-3

Williams, D., & Coles, L (2007). Teachers' approaches to finding and using research evidence: An information literacy perspective. *Educational Research, 49*(2), 185–206. https://doi.org/10.1080/00131880701369719

Wiseman, A. W. (2010). The uses of evidence for educational policymaking: Global contexts and international trends. *Review of Research in Education, 34*(1), 1–24. https://doi.org/10.3102/0091732X09350472

Wouters, P., van Nimwegen, C., van Oostendorp, H., & van der Spek, E. D (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology, 105*(2), 249–265. https://doi.org/10.1037/a0031311