



Evidence-Based Practice in Higher Education: Teacher Educators' Attitudes, Challenges, and Uses

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Teacher educators are encouraged to promote evidence-based practice in teaching and to use evidence for their own teaching. In the present study, teacher educators' attitudes, perceived challenges, and uses regarding evidence-based practice are described. Moreover, the extent to which personal factors are related to the use of evidence is investigated. In an exploratory study, 58 teacher educators from higher education participated in an online survey. The results reveal that teacher educators generally have a positive attitude toward evidence-based practice. They use evidence regularly, both for individual learning and for teaching purposes. Furthermore, the study reveals that teacher educators with more experience in research and teaching have a more positive attitude toward evidence-based practice and higher uses of evidence. In comparison, less experienced teacher educators perceived more challenges. It is discussed, how teacher educators can be supported in their professional learning, particularly in light of the increasing scientific knowledge base in education.

Keywords: teacher educators, evidence-based practice, higher education, educational research evidence, teacher education

INTRODUCTION

Current developments in teacher education highlight the importance of evidence-based practice as a way of linking research and practice in teaching (Cutspec, 2004; Bauer and Prenzel, 2012). These developments ground in the idea that empirical evidence should constitute one vital source of knowledge and information for teachers in classrooms (Niemi, 2008). Internationally, professional standards for teacher education increasingly mention the pivotal role of empirical evidence from educational research into teachers' professionalism (European Commission, 2007). These professional standards identify a crucial agenda for teacher education and training: teachers should be enabled to use empirical evidence productively, and to integrate this evidence with their personal expertise and teaching experience. In doing so, teacher educators, as *teachers of teachers* and *second-order practitioners* (Lunenburg et al., 2014), play a crucial role in promoting evidence-based practice in the teaching profession (Cochran-Smith, 2005; Darling-Hammond, 2016).

Being a professional teacher educator requires engaging with evidence-based practice as a role model for future teachers (Geerdink et al., 2016). Thus, teacher educators need to be critical readers of educational research publications. They should base their teaching on the best empirical evidence available, and they should understand that part of their professional role is to contribute to the development and dissemination of research-based knowledge (Livingston et al., 2009; Loughran, 2014). Particularly in the field of educational science, teacher educators need to be able to deal with

(fragile) evidence from different sources (Burkhardt and Schoenfeld, 2003). They should value the idea and benefits of integrating empirical evidence in teaching practice (Fleckenstein et al., 2015; Nelson and Campbell, 2017). Besides fulfilling normative standards, engaging with educational research promises to improve teacher educators' own practice and skills, how their teacher trainees learn, and the further development of research on teacher education (Bell et al., 2010).

Although there is a common appreciation for the relevance of educational research to the work of teacher educators, so far, little attention has been paid to teacher educators' perspectives toward evidence-based practice and their engagement with empirical evidence (e.g., Ping et al., 2018). It is an open question as to what extent teacher educators value and integrate evidence-based practice in their teaching and, moreover, what personal factors might influence their perceptions. Examining their perspectives appear to be the first step in developing research on evidence-based practice in the teaching profession (Rousseau and Gunia, 2016; Reddy et al., 2017). This may also lead to better insight into influencing aspects that hinder or facilitate evidence-based practice in higher education teaching and learning (Kane et al., 2004; Schwartz and Gurung, 2012; Czerniawski et al., 2017).

The present study provides an overview of the current debates regarding evidence-based practice in teaching. Evidence-based practice is introduced as a way to foster higher education teaching. Following this, the target group of teacher educators from higher education (HE), and the current state of research on their viewpoints with regard to empirical evidence from educational research are described. In order to promote the use of evidence in higher education teaching, understanding the teacher educators' role and perspective toward evidence-based practice appears to be crucial.

Evidence-Based Practice and Teaching

To investigate evidence-based practice in teaching, it is reasonable to build on knowledge and experience from other disciplines that have a longer tradition of promoting evidence-based practice, such as the health care sector. In medicine, evidence-based practice was defined as "integrating individual clinical expertise with the best available external clinical evidence from systematic research" (Sackett et al., 1996, p. 71–72). The purpose of this approach is to improve patient well-being by considering empirical evidence, the practitioner's expertise, and the patient's preferences (Spring, 2007). Here, empirical evidence is primarily constituted by external, systematic research with randomized control trials as the "golden standard" (e.g., Burns et al., 2011). Physicians should consider this evidence to come to an informed decision. In the medical profession, a common understanding of evidence-based practice has already been established, which defines standards for the training and practical work of physicians as well as mechanisms to promote evidence-based practice (Dawes et al., 2005; Tilson et al., 2011).

Reform efforts in teaching professions have highlighted the importance of evidence-based practice as a crucial part of the professionalization of teachers in the past two decades (Bauer and Prenzel, 2012). Like the medical profession, teaching should be considered a vocational field, in which practitioners are required

to act upon and apply empirical evidence (Haberfellner and Fenzl, 2017). Although research on the practical benefits of evidence-based practice in teaching is rare, initial efforts suggest positive benefits for teachers' pedagogical knowledge and skills (Bell et al., 2010).

Nonetheless, evidence-based practice in teaching has evoked extensive discussion (e.g., Biesta, 2007, 2010). Primarily, the discussion revolves around what should be considered relevant evidence for education and teaching (Oancea and Pring, 2008; Hammersley, 2009; Kvernbekk, 2018), how and when evidence should be used (Rubin and Bellamy, 2012; Farley-Ripple et al., 2018), and how personal expertise and external evidence are related (Hammersley, 2013).

Currently discussed concepts propose a pragmatic view of evidence-use, including evidence-based education and research-informed practice. For instance, Davies (1999) described evidence-based education as "integrating individual teaching and learning expertise with the best available external evidence from systematic research" (p. 117). The growing body of research in educational science and the use of multi- and mixed-method approaches, however, make it difficult to define the most relevant evidence (Berliner, 2002; Hedges, 2017). Additionally, it is practically impossible to back up every single decision in teaching contexts with empirical evidence (Biesta, 2010). This means that evidence-based education cannot be seen as a panacea, but encompasses principles and practices that form the basis upon which practitioners make professional judgments (Davies, 1999). Empirical evidence, thus, constitutes an additional resource, next to local evidence and individual expertise (Rousseau and Gunia, 2016). The concept of research-informed practice also proposes a moderate view of evidence-use (Brown and Zhang, 2016; Nelson and Campbell, 2017). Although educational research in itself cannot improve the practice of educators and teachers, it provides foundational knowledge about teaching and learning (Niemi, 2008). For instance, evidence from educational research comprises findings of teaching approaches, learning strategies, and didactics. This knowledge supports teachers and teacher educators in creating new ideas and reflecting upon teaching (Nutley et al., 2003).

In line with these concepts proposing a pragmatic understanding of evidence-use, in this paper, evidence-based practice in teaching is defined as the productive use of the best empirical evidence available from educational research for teaching purposes. In this sense, empirical evidence should serve as a resource, corrective, guide, and orientation for professional decision-making in teacher education (Bauer et al., 2017; Brown et al., 2017).

To promote evidence-based practice for future teachers, firstly, teacher educators themselves need to be able to access, understand, and appraise the current state of educational research (Cochran-Smith, 2005; Livingston et al., 2009). Secondly, given national and international teaching standards (e.g., Standing Conference of the Ministers of Education Cultural Affairs, 2004; European Commission, 2007), teacher educators are encouraged to deal regularly with empirical evidence in their practice. Finally, it is important to teach skills for using this evidence (and evidence-based practice) in teaching (Wenglein

et al., 2015; Scheeler et al., 2016). Ultimately, these efforts should lead to better teaching and student learning. However, this requires that teacher educators have not only the skills but also the will, in the sense of a positive attitude and mindset toward evidence-based practice in teaching (Suttle et al., 2015; Bauer et al., 2017; Reddy et al., 2017).

As a first step in tackling this agenda it is crucial to know how teacher educators' currently perceive the discussion on evidence-based practice in teacher education and what might be obstacles and supportive means to their following of an evidence-based practice agenda.

Teacher Educators' Perception of Evidence-Based Practice

The literature in other professional fields such as medicine offers a wealth of research on practitioners' perception and views of evidence-based practice (e.g., Johnston et al., 2003; Sullivan et al., 2017). In the context of teacher education, studies exploring teacher educators' perception with regard to evidence-based practice rarely exist. In a recent model on teacher educators' professional development, Tack and Vanderlinde (2014) provide a tripartite conception of teacher educators' disposition toward research use, which they describe as "researcherly disposition," i.e., the tendency to engage in and with research as producers and consumers. This engagement is a key component of teacher educators' professional practice and development. It is closely related to the actual use of scientific knowledge from research in teacher education practice (Loughran, 2014; MacPhail et al., 2018). Researcherly disposition involves three inter-related dimensions: an affective, a cognitive, and a behavioral dimension. The affective dimension expresses teacher educators' personal value of research in their daily practice. The cognitive dimension describes their ability to engage in and with research in their teaching practice, and the behavioral dimension illustrates their engagement in research activities as both consumers and producers of research findings.

In testing their model, Tack and Vanderlinde (2016) showed that teacher educators tend to perceive themselves as being skilled consumers of research and as being able to conduct research. Additionally, they value research in their role as teacher educators. This is in line with the findings of an interview-study conducted by Smith (2005) in which teacher educators were asked what they consider important for their practice. Besides pedagogical and subject matter knowledge, one of the most frequently mentioned aspects in the interviews was knowledge about how to conduct and make use of research. As Tack and Vanderlinde offer a recent and comprehensive conceptualization of teacher educators' perceptions of empirical evidence and its use, the current study adopts their conceptualization as follows.

Affective Aspect: Attitudes Toward Evidence-Based Practice

Prior research suggests that a negative or skeptical attitude toward the use of evidence needs to be considered as an important barrier to evidence-based practice and its implementation (Forman et al., 2012; Lilienfeld et al., 2013; Reddy et al., 2017). However, the research-oriented working

environment of teacher educators is likely to result in a positive attitude toward evidence-based practice in teaching (Cochran-Smith, 2005).

Cognitive Aspect: Challenges Regarding Evidence-Based Practice

In this dimension, the focus lies on the perceived ability to engage with empirical evidence as "smart consumers." With regard to the cognitive component, it is important to identify challenges teacher educators may face when using empirical evidence. A lack of relevant skills (regarding the reception, understanding, and evaluation of research) and lack of important resources, such as time and institutional support, appear to hinder the use of evidence in HE teaching (Lilienfeld et al., 2013; Scheeler et al., 2016).

Prior research suggests that differences between attitudes and actual behavior concerning evidence-based practice can be explained by a lack of resources, knowledge, and institutional support (Smith, 2005; Brown and Zhang, 2016). Given the academic background of teacher educators and their occupational engagement with research, it is expected that they might struggle more with resource-related challenges than with knowledge-related challenges of engaging with empirical evidence (Czerniawski et al., 2017).

Behavioral Aspect: Use of Empirical Evidence

The behavioral aspect describes the engagement with evidence-based practice, referring to teacher educators using empirical evidence. This engagement can serve personal purposes (individual knowledge and practice) or teaching-related purposes (promoting knowledge and practice of future teachers). Given teaching standards, concerning the tasks of HE teacher education, it is assumed that teacher educators regularly deal with empirical evidence in their practice.

In summary, three perceptual aspects are relevant for teacher educators to promote evidence-based practice in teacher education. These include attitudes, perceived challenges, and uses. Teacher educators also represent a rather heterogeneous group, differing in their background experience and professional expertise in research and in teaching (Goodwin et al., 2014). They gain their professional expertise through formal education (e.g., different academic degrees) and practical teaching experiences (Cochran-Smith and Lytle, 2016). For example, Murray and Male (2005) state that it takes novice teacher educators 3 years of experience in HE teaching to develop a professional identity. Before that, it is assumed they do not have a clear vision of how to teach as a teacher educator and are led by their own experiences of being taught. It is, therefore, assumed that teacher educators with different experiences and expertise in research and teaching might differ in their perspectives toward evidence-based practice. These differences might emerge particularly when it comes to the various levels in which engagement with empirical evidence occurs. For example, engagement can serve personal purposes (expand our own knowledge base and inform our own practice) or teaching-related purposes (integrate evidence in teaching classes and convey it to future teachers).

THE PRESENT STUDY

The aim of the present study is to describe teacher educators' perceptions of evidence-based practice in teacher education and to investigate the extent to which prior research and teaching experience might affect engagement with empirical evidence. The central aspects of the present investigation are the teacher educators' attitudes toward evidence-based teaching, their perceived challenges, and the current uses of evidence in HE teaching. We investigate teacher educators in HE who are teaching at universities or schools of education. The research questions are

1. What are HE teacher educators' (a) attitudes, (b) challenges, and (c) current uses regarding evidence-based practice in teaching?
2. To what extent do teacher educators with different types of experience such as (a) research experience, (b) HE teaching experience, and (c) in-school teaching experience differ in their attitudes, challenges, and uses regarding evidence-based practice in teaching?

METHOD

Sample and Data Collection

This study was conducted in August 2017. We invited a sample of $N = 200$ teacher educators from German universities via e-mail to participate in an online survey. The recruitment of the participants was part of the project "Clearinghouse on Effective Teaching" (www.clearinghouse-unterricht.de) funded by the German Ministry of Education and Research (BMBF) (Seidel et al., 2017a,b). In this project, an online information platform for evidence-based practice was created, which served as a suitable context for recruiting potential users of this platform as participants for this first explorative study. The convenience sample considered teacher educators who responded to a call on the project website. Based on the alignment between the selected project (which has a focus on STEM teaching) and this study, the teacher educators were likely to have HE teaching experience either in educational sciences or STEM education.

The study was conducted according to the Ethical Principles of Psychologists and Code of Conduct of the American Psychological Association from 2017 (APA American Psychological Association, 2017). Participants have been assured that their data will be collected anonymously and evaluated for scientific research purposes only. They gave informed consent before participation. In order not to influence the participants' attitudes and to avoid the effect of social desirability, we have explicitly omitted the term "evidence-based practice" in the introduction of the survey. Instead, the survey intro explained that the study is about the use of current research findings on effective teaching in teacher education.

A total of $N = 58$ teacher educators returned completed surveys (29% response rate). In the sample, 55.2% of the participants were female ($n = 32$) and on average 44.15 years old ($SD = 10.68$, $Min = 27$, $Max = 67$). Additional information regarding the sample and the participants' experience in HE

teacher education is presented in the results section (see Chapter 4.2).

Development of the Online Survey

We conducted a literature search to identify relevant instruments, which have been used in the context of evidence-based practice. In the review process we focused on the three constructs of attitudes, perceived challenges, and uses regarding evidence-based practice. We adapted existing items from several sources (e.g., Upton and Upton, 2006; Hendricson et al., 2011) to target the group of HE teacher educators and developed new items where required. To assess the validity and feasibility of the new instrument, we conducted a pilot study with expert ratings ($N = 8$ HE teacher educators from mathematic didactics, psychology, and educational science) and incorporated this feedback into the final questionnaire.

Variables

The online survey consisted of 51 questions¹. The first part of the online survey encompassed general questions about background variables of the teacher educators (nine items): gender, age, highest degree, subject area taught, years of experience (HE teaching and in-school teaching), country, institution, and course type taught. The main body of the questionnaire comprised the three constructs of attitudes, challenges, and uses regarding evidence-based practice.

Attitudes

Attitudes were operationalized with a focus on the personal relevance of evidence-based practice. The teacher educators were asked to rate their agreement on four items addressing the relevance of evidence-based practice for teaching (e.g., "I have priorities other than evidence-based practice;" answering format ranging from 1: "I totally disagree" to 6: "I fully agree;" $\alpha = 0.79$, $M = 5.32$, $SD = 0.71$) (adapted from Hendricson et al., 2011).

Perceived Challenges

Perceived challenges were measured using 14 items (adapted from Upton and Upton, 2006). We performed an exploratory principal axis factoring analysis on the data to investigate the underlying factor structure of the 14 items. We analyzed using direct oblimin rotation, since we assumed the factors to be correlated (Costello and Osborne, 2005). The Bartlett test [$\chi^2(91) = 551.80$, $p < 0.000$] and the Kaiser-Meyer-Olkin Measure of sampling adequacy ($KMO = 0.79$) indicate that the variables are suitable for factor analysis (Henson and Roberts, 2006). The communalities of the items ranged from 0.47 to 0.83, with an average of 0.67, which allows for satisfactory factor recovery even with a small sample size (De Winter et al., 2009; Hogarty et al., 2016).

To decide on the adequate number of factors, we used the eigenvalue-criterion and scree test as outlined by Cutspec (2004). Table 1 presents the results of the exploratory factor analysis, in which the 14 items load on three factors (eigenvalues of 1.98, 6.91, and 1.46). Factor loadings for the three factors were good,

¹Since the study was conducted in German, all items were translated into English for this paper.

TABLE 1 | Results of the exploratory factor analysis ($N = 58$).

Item	Factor 1	Factor 2	Factor 3
1. *Integrating evidence into my teaching is effortless for me	0.890		
2. *It is easy for me to integrate evidence into my teaching	0.818		
3. I feel overwhelmed using evidence in my teaching	0.520		
4. Integrating evidence into my teaching is a burden for me I find it difficult to ...	0.731		
5. Assess conflicting findings		0.553	−0.398
6. Assess study quality		0.683	
7. Assess trustworthiness		0.621	−0.330
8. Interpret effects and effect sizes		0.866	
9. Understand the English language		0.793	
10. Understand scientific terminology		0.728	
11. Spend the necessary amount of time			−0.889
12. Overview number of publications			−0.791
13. Stay up-to-date			−0.819
14. Find practical relevant studies	0.348		−0.419

Extraction method: principal axis factoring; Rotation method: direct oblimin with Kaiser Normalization.

*Inverted items.

Bold numbers indicate the final assignment of items to scales.

Empty cells: suppressing loadings <0.300 in absolute value.

with only three cross-factor loadings (item loads >0.32 on more than one factor). We decided to retain the items in factors on which they loaded the highest. As assumed, the three factors are moderately correlated (between 0.36 and 0.49). However, due to the high factor loadings (mostly above 0.50), the good values for the internal consistency of the three factors (all above 0.80) and the interpretability, the three-factor solution was accepted and all items were retained in factors (Costello and Osborne, 2005; De Winter et al., 2009).

Factor 1, general challenges, assesses the extent to which teacher educators perceive the use of empirical evidence in their HE teaching in general as difficult (four items, $\alpha = 0.83$, $M = 2.21$, $SD = 0.99$). The second factor measures knowledge-related challenges regarding the use of empirical evidence in HE teaching (six items, $\alpha = 0.91$, $M = 2.20$, $SD = 1.06$). For the third factor, teacher educators were asked about resource-related challenges of evidence-based practice (four items, $\alpha = 0.88$, $M = 3.82$, $SD = 1.31$).

Uses

To assess the intensity of use, we designed a scale to rate the extent to which teacher educators use and integrate evidence in their HE teaching (five item categories: integrating with

course, reading, discussing with students, researching, discussing with colleagues. Answering format ranged from 1: “never” to 6: “> once a week,” $\alpha = 0.87$, $M = 4.48$, $SD = 1.05$). Furthermore, to assess the purposes of use, based on the work of Brown and Zhang (2016), teacher educators had to rate the different purposes for which they currently use evidence (five items, e.g., to expand own knowledge or to plan teaching. Range: 1: “I totally disagree” to 6: “I fully agree”). Additionally, we asked the participants what sources of evidence they use to plan their lessons (11 items, e.g., scientific journals, textbooks, or conferences. Scored on a six-point Likert scale ranging from 1: “never” to 6: “> once a week,” adapted from Johnston et al., 2003).

We calculated scale values and analyzed interrelations between selected constructs. Thereby, perceived challenges were negatively correlated with attitudes ($r = -0.30$, $p < 0.01$) and uses ($r = -0.45$, $p < 0.01$), whereas attitudes and uses were positively correlated ($r = 0.52$, $p < 0.01$). Addressing our second research question, three constructs addressing teacher educators’ exposures to research and teaching were considered: research experience, HE teaching experience, in-school teaching experience.

Research Experience

As a proxy for teacher educators’ research experience, we used their highest academic degree. The highest degree of a professorial level was used as a proxy for the most intensive experience with research, followed by a doctoral degree and then a university degree.

HE Teaching Experience

To investigate the relationship between HE teaching experience and the three variables mentioned above, participants were divided into three groups: novices (<3 years’ experience), intermediates (more than three but <10 years’ experience), and experts (more than 10 years’ experience). According to Murray and Male (2005), it takes teacher educators 3 years to establish a professional identity. Research on expertise and professional development suggests that 10 years of experience are necessary to become an expert (Ericsson, 2006).

In-school Teaching Experience

Teacher educators were asked if they had in-school teaching experience (dichotomous, yes or no). Teacher educators with in-school experience are familiar with the daily routine in schools and what it means to be a teacher of students.

Analyses

First, we computed descriptive statistics to explore teacher educators’ attitudes, challenges, and uses regarding evidence-based practice. Pearson product moment correlations and Kendall’s tau correlations were computed to examine bivariate relations among variables. Additionally, we computed multivariate analyses of variance (MANOVAs) to assess differences in the dependent variables. For between-group analyses, analyses of variance (ANOVAs) were conducted with *post-hoc* Tukey HSD correction for multiple comparisons.

RESULTS

HE Teacher Educators' Attitudes, Challenges, and Uses

Attitudes Toward Evidence-Based Practice

Regarding the personal relevance of evidence-based practice the participants stated high mean values in the attitudes variable, with an average of 5.32 ($SD = 0.71$). Overall, the majority of the teacher educators considered evidence-based practice as beneficial (90% agree) and indispensable for teacher education (86% agree) (Table 2). Most participants agreed that the knowledge they convey in their teaching should be evidence-based (85%). For more than half of the teacher educators, evidence-based practice constitutes a priority in their HE teaching.

Challenges Regarding Evidence-Based Practice

The general challenges ($M = 2.39$, $SD = 0.97$) and knowledge-related challenges ($M = 2.20$, $SD = 1.06$) of evidence-use were overall considered medium to low by teacher educators in the sample. On average, they rated only resource-related challenges ($M = 3.56$, $SD = 1.24$) as more difficult.

At the level of the single items for knowledge-related challenges, few teacher educators perceived the assessment of findings (10% agreed) and of study quality (15% agreed) as difficult (Table 3). The used language and terminology were not seen as difficult when using evidence for HE teaching (2–5% agreed). Relating to resource-related challenges, the results show that workload-related constraints such as time were rated challenging by 38% of the participants. Thirty-five percent of the teacher educators rated the increasing amount of publications in educational research as a difficult challenge, and 29% rated the demand to keep knowledge about research up-to-date as a difficult challenge. Fifteen percent of the teacher educators agreed that they find it difficult to identify practically relevant studies for their own teaching or subject area, while 46% did not perceive this as challenging at all.

Use of Empirical Evidence

Regarding the intensity of use the participants stated they deal with empirical evidence at least once a month on average ($M = 4.48$, $SD = 1.05$) (Table 4). About 65% of the teacher educators stated they integrate empirical evidence in their courses and read current studies at least once a month. Sixty-two

percent stated they discuss current evidence with their colleagues at least every month. On average, teacher educators discuss empirical evidence less often with their colleagues than with their student in their courses. Conducting research for relevant evidence primarily takes place every second month (31%) or every month (28%).

Regarding the purposes of use Table 5 shows that almost all teacher educators agreed that they use evidence to expand their own knowledge (95%). More than 70% of the teacher educators agreed that they consider empirical evidence to convey empirical evidence for their teaching subjects, integrate it as content in their teaching and to update the students' knowledge with regard to a specific topic. These results suggest that teacher educators use empirical evidence mostly for individual purposes (e.g., their own learning).

Additionally, we asked the teacher educators which sources they use to plan and design their courses. In Table 6 it can be seen that scientific journals, textbooks (psychology and STEM subject didactics), and conferences are the most often used sources. Discussions with colleagues, internet sources, and application-oriented journals are, on average, used rarely to sometimes by the participants.

Higher Education Teacher Educators' Exposure to Research and Teaching: Differences With Regard to Evidence-Based Practice

The second research question addresses the extent to which teacher educators with varying exposure to research and teaching might differ in their attitudes, challenges, and uses regarding evidence-based practice. To this end, we considered three variables: research experience, HE teaching experience, and in-school teaching experience. Since there were statistically significant correlations between all three outcome variables (Pearson's r between 0.29 and 0.52, with $p < 0.05$), multivariate analyses were conducted.

Regarding research experience, 22.4% participants reported holding a university degree ($n = 13$), 31% holding a doctoral degree ($n = 18$), and 46.6%, who had qualified for the professorial level ($n = 27$). With respect to HE teaching experience, 15.5% of the participants were novices ($n = 9$), 29.3% intermediates ($n = 17$), and 55.2% were experts ($n = 32$). Research and HE teaching experience correlate with each other (Kendall's

TABLE 2 | Descriptive statistics for attitudes: percentage of nominations, mean values (M), and standard deviation (SD) of the single items.

Single items	I totally disagree (%)	I disagree (%)	I rather disagree (%)	I rather agree (%)	I agree (%)	I fully agree (%)	M	SD
(1) I have priorities other than evidence-based practice	33	24	24	10	9	0	*4.62	1.28
(2) Evidence-based practice is indispensable for teacher education	0	0	0	14	17	69	5.55	0.73
(3) Knowledge should be evidence-based	0	2	0	14	26	59	5.40	0.86
(4) There is no benefit of evidence-based practice	81	9	10	0	0	0	*5.71	0.65

$N = 58$.

*Inverted item value.

TABLE 3 | Descriptive statistics for perceived challenges: percentage of nominations, mean scores (M), and standard deviation (SD) of the single items.

Single items	I totally disagree (%)	I disagree (%)	I rather disagree (%)	I rather agree (%)	I agree (%)	I fully agree (%)	M	SD
General challenges								
1) Integrating evidence into my teaching is effortless for me	3	4	7	15	13	16	*4.36	1.45
2) It is easy for me to integrate evidence into my teaching	3	3	6	17	15	14	*4.38	1.37
3) I feel overwhelmed using evidence in my teaching	30	17	8	3	0	0	1.72	0.89
4) Integrating evidence into my teaching is a burden for me	28	18	7	2	3	0	1.86	1.10
Knowledge-related challenges								
5) Assess conflicting findings	22	16	31	21	7	3	2.84	1.36
6) Assess study quality	33	22	21	9	12	3	2.55	1.50
7) Assess trustworthiness	34	38	7	9	5	3	2.20	1.35
8) Interpret effects and effect sizes	41	28	14	9	5	3	2.19	1.38
9) Understand English language	52	26	10	5	3	2	1.86	1.20
10) Understand scientific terminology	59	29	10	0	2	0	1.57	0.82
Resource-related challenges								
11) Spend necessary time	10	9	14	29	24	14	3.90	1.49
12) Overview number of publications	12	7	9	38	28	7	3.83	1.42
13) Stay up-to-date	7	16	14	33	17	12	3.75	1.43
14) Find practical relevant studies	24	22	26	12	10	5	2.78	1.48

N = 58. Single items are numbered from (1) to (14). *Inverted item value.

TABLE 4 | Descriptive statistics for intensity of use: percentage of nominations, mean scores (M), and standard deviation (SD) of single items.

Single items	Never (%)	<Once a year (%)	2–4 times a year (%)	5–11 times a year (%)	1–3 times a month (%)	>Once a week (%)	M	SD
(1) Integrating in course	2	5	7	21	40	26	4.69	1.19
(2) Reading	3	2	10	19	43	22	4.64	1.19
(3) Discussing with students	5	2	21	26	36	10	4.50	1.39
(4) Researching	5	2	12	31	28	22	4.41	1.29
(5) Discussing with colleagues	3	9	10	16	36	26	4.17	1.23

N = 58.

TABLE 5 | Descriptive statistics for purposes of use: percentage of nominations, mean scores (M), and Standard Deviation (SD) of the single items.

Single items	I totally disagree (%)	I disagree (%)	I rather disagree (%)	I rather agree (%)	I agree (%)	I fully agree (%)	M	SD
(1) Expand own knowledge	0	0	2	3	24	71	5.64	0.64
(2) Convey empirical evidence	2	0	5	10	34	48	5.21	1.02
(3) Integrate in teaching	2	0	5	14	34	43	5.12	1.04
(4) Update students	2	0	5	19	40	34	4.98	1.02
(5) Plan teaching	0	7	16	21	31	26	4.53	1.23

N = 58.

τ : 0.65, $p < 0.001$). Additionally, the participants were asked about their in-school teaching experience. Approximately half of the teacher educators had experience teaching in schools (43.1%, $n = 25$).

Research Experience

Regarding the question of “to what extent do teacher educators with different research experience differ in their attitudes,

challenges, and uses?” the calculation of the one-way MANOVA showed a significant main effect of the research experience on the three variables, Pillai's trace $V = 0.34$, $F_{(6,108)} = 3.63$, $p < 0.01$, partial $\eta^2 = 0.17$. One-way ANOVAs on each of the three dependent variables were conducted as follow-up tests. The results in Table 7 show statistically significant effects for research experience on challenges (partial $\eta^2 = 0.27$) but not on attitudes or uses. As part of the *post-hoc*

TABLE 6 | Descriptive statistics for sources of evidence: percentage of nominations, mean scores (M), and standard deviation (SD) of the single items.

Single items	Never (%)	Rarely (%)	Sometimes (%)	Often (%)	M	SD
Scientific journals	4	2	11	84	3.75	0.67
Textbooks psychology	7	14	28	51	3.23	0.95
Conferences	5	9	56	30	3.11	0.77
Discussions with colleagues	2	30	45	23	2.89	0.78
Internet resources	7	36	36	20	2.69	0.88
Textbooks general didactics	22	15	40	24	2.65	1.08
Application-oriented journals	16	27	43	14	2.55	0.93
Textbooks STEM didactics	36	13	17	34	2.49	1.30
Newspaper article	20	51	22	7	2.16	0.83
TV reports	47	44	9	0	1.62	0.65
Radio reports	57	34	9	0	1.52	0.66

N = 58.

TABLE 7 | Differences in the mean scores of the teacher educators on attitudes, challenges, and uses, and *F*-value.

	Attitudes M (SD)	Challenges M (SD)	Uses M (SD)
Research experience			
University degree (<i>n</i> = 13)	4.96 (0.64)	3.50 (0.86)	3.95 (1.21)
Doctoral degree (<i>n</i> = 18)	5.36 (0.57)	2.86 (0.65)	4.71 (0.71)
Professorial level (<i>n</i> = 27)	5.46 (0.79)	2.31 (0.84)	4.58 (1.10)
<i>F</i> ^a	2.32 (n.s.)	10.33**	2.32 (n.s.)
HE teaching experience			
Novices (<i>n</i> = 9)	4.69 (0.56)	3.50 (0.64)	4.11 (1.19)
Intermediates (<i>n</i> = 17)	5.22 (0.65)	2.96 (0.85)	4.29 (0.93)
Experts (<i>n</i> = 32)	5.55 (0.68)	2.42 (0.86)	4.69 (1.05)
<i>F</i> ^a	6.21*	6.77*	1.48 (n.s.)
In-school teaching experience			
In-school experience (<i>n</i> = 25)	5.46 (0.55)	2.98 (0.95)	4.46 (1.07)
No school experience (<i>n</i> = 33)	5.21 (0.81)	2.57 (0.85)	4.50 (1.05)
<i>F</i> ^a	(n.s.)	(n.s.)	(n.s.)

^aUnivariate Tests. *M*, means; *SD*, standard deviation.

p* < 0.05. *p* < 0.01.

analyses (Tukey HSD), the multiple comparisons revealed that university degree holders tended to perceive evidence-based practice as more difficult than those at the professorial level (*p* < 0.001).

We conducted a second follow-up analysis to examine the effect of research experience on the challenges in more detail. Using Pillai's trace, there was a significant effect of the research experience on challenges [*V* = 0.39, *F*_(6, 108) = 4.32, *p* < 0.01, partial η^2 = 0.19]. Separate one-way ANOVA in the outcome variables revealed non-significant degree-effects on general challenges (*p* = 0.07). However, there were significant differences between the different degree-groups for knowledge-related (η^2 = 0.30) and resource-related challenges (η^2 = 0.20) (Table 8). *Post-hoc* multiple

TABLE 8 | Differences in the mean scores of the teacher educators on challenges and *F*-value.

	General challenges M (SD)	Knowledge-related challenges M (SD)	Resource-related challenges M (SD)
Research experience			
University degree (<i>n</i> = 13)	2.75 (0.90)	3.22 (1.11)	4.54 (1.13)
Doctoral degree (<i>n</i> = 18)	2.17 (0.68)	2.18 (0.87)	4.22 (0.89)
Professorial level (<i>n</i> = 27)	1.98 (1.14)	1.73 (0.81)	3.21 (1.38)
<i>F</i> ^a	2.80 (n.s.)	11.89**	6.86**
HE teaching experience			
Novices (<i>n</i> = 9)	3.14 (1.05)	2.81 (1.04)	4.55 (0.93)
Intermediates (<i>n</i> = 17)	2.12 (0.69)	2.60 (1.26)	4.12 (1.06)
Experts (<i>n</i> = 32)	2.00 (0.99)	1.82 (0.79)	3.44 (1.42)
<i>F</i> ^a	5.42**	5.43**	3.63*
In-school teaching experience			
In-school experience (<i>n</i> = 25)	2.24 (1.00)	2.62 (1.22)	4.07 (1.16)
No school experience (<i>n</i> = 33)	2.19 (1.01)	1.88 (0.81)	3.63 (1.41)
<i>F</i> ^a	0.04 (n.s.)	7.71**	1.54 (n.s.)

^aUnivariate Tests. *M*, means; *SD*, standard deviation.

p* < 0.05. *p* < 0.01.

comparisons revealed that university degree holders rated knowledge-related challenges one point higher than teacher educators at the doctoral or professorial level (*p* < 0.01). Regarding resource-related challenges, university degree and doctoral degree holders showed statistically significant higher mean values than teacher educators on the professorial level (*p* < 0.01; *p* < 0.05).

HE Teaching Experience

In order to test whether teacher educators differ in their perceptions of evidence-based practice based on their previous teaching experiences, we conducted similar steps in the empirical analyses. The one-way MANOVA showed a significant main effect of the HE teaching experience on the three variables [Pillai's trace $V = 0.32$, $F_{(6, 108)} = 3.40$, $p < 0.01$, partial $\eta^2 = 0.16$]. Follow-up ANOVAs indicated that attitudes and perceived challenges are significantly different for teacher educators with different HE teaching experience (Table 7). Multiple comparisons show that experts stated significantly higher attitudes than novices, on a 0.003 level. The novices also perceived challenges of evidence-based practice to be more difficult than the experts did ($p < 0.01$), but still with an average mean value below 3.50.

A follow-up analysis closer examined the significant main effect of HE teaching experience on challenges. Using Pillai's trace, there was a significant main effect of teaching experience on challenges [$V = 0.29$, $F_{(6, 108)} = 3.10$, $p < 0.01$, partial $\eta^2 = 0.15$]. Follow-up ANOVAs showed a significant effect of HE teaching experience on all three scales: general challenges ($\eta^2 = 0.16$), knowledge-related challenges ($\eta^2 = 0.16$), and resource-related challenges ($\eta^2 = 0.12$) (Table 8). *Post-hoc* multiple comparisons revealed statistically significant higher mean scores in the general challenges for novices than for intermediates ($p < 0.05$) and experts ($p < 0.01$). For knowledge-related challenges, experts showed statistically significant lower mean values than novices ($p < 0.05$) and intermediates ($p < 0.05$). For resource-related challenges, none of the groups differed significantly.

In-School Teaching Experience

To scrutinize whether teacher educators with in-school teaching experience differ from those with no experience in their attitudes, challenges, and uses, we conducted a one-way MANOVA. Using Pillai's trace, we found no significant main effect for in-school teaching experience on attitudes, challenges, and uses ($p = 0.08$).

We conducted an additional MANOVA to inspect the differences in the challenges more closely. Using Pillai's trace, there was a significant effect of the in-school teaching experience on challenges regarding evidence-based practice [$V = 0.14$, $F_{(3, 54)} = 2.99$, $p < 0.05$, partial $\eta^2 = 0.14$]. Separate univariate ANOVAs in the outcome variables revealed that significant differences were found only in knowledge-related challenges ($\eta^2 = 0.12$), not in general ($p = 0.85$) and resource-related challenges ($p = 0.22$) (Table 8). Teacher educators who had previous in-school teaching experience tended to perceive knowledge-related challenges as more difficult than those with no in-school experience (but still with an average mean value below 3.50).

DISCUSSION

The aim of the present study was to explore teacher educators' perceptions of evidence-based practice and their engagement with empirical evidence in teacher education. By means of an online survey, we investigated which attitudes, challenges, and uses regarding evidence-based practice teacher educators report (research question 1). Additionally, differences between teacher

educators with varying levels of experience in research and teaching were examined (research question 2).

The descriptive findings of our study reveal that the teacher educators generally reported positive attitudes toward evidence-based practice. This is in line with prior research in teaching (e.g., Reddy et al., 2017) and in the health professions (e.g., Johnston et al., 2003). Since HE teacher educators are involved in both research and teaching they are required to have knowledge about research and how to interpret and use it in daily practice (Loughran, 2014). Most of them are involved in a research environment: they actively work in research projects and have achieved some academic qualification-levels (MacPhail et al., 2018). This is supported by the present study, in which we showed that, overall, the use of empirical evidence does not seem to be a major challenge for teacher educators.

Most teacher educators did not report struggling with the general aspects and knowledge-related challenges of evidence-based practice; they mainly reported resource-related challenges. The discrepancy between time constraints and a growing body of scientific literature in educational research seems to be especially challenging. This finding is in line with prior research in education (Shlonsky and Stern, 2007; Brown and Zhang, 2016) and in medicine (e.g., Sullivan et al., 2017), in which the lack of time is considered as great barrier for evidence-based practice and its implementation. In a study by Czerniawski et al. (2017), teacher educators were asked about their learning needs with regard to professional development. The most mentioned needs were the availability of time and the development of research skills. Thus, initiatives and service institutions that support teacher educators with regard to balancing limited time with a multitude of professional tasks might be of particular promise. For example, initiatives that offer a pre-selection and qualified summaries of current findings in educational research might be of particular help to teacher educators. There already exist several established institutions, summarizing and disseminating research findings for teaching and teacher education, such as the "What Works Clearing House" in the US, the Educational Endowment Foundation in the UK, or the Clearinghouse Project in Germany. These kinds of initiatives particularly address resource intensive processes such as searching, selecting, and rating relevant and recent research. They also provide toolkits, user guides, and quality ratings of evidence. Thus, they offer easy access to a public knowledge base, which can be seen as a crucial aspect of practitioner professional engagement with research (Tack et al., 2017). Importantly, such initiatives carry a high responsibility and thus need to be well aware and transparent about which evidence they promote and why. They also need to make sure to avoid bias and to cover high quality educational research in its breadth and depth (see e.g., Malouf and Taymans, 2016).

Concerning their self-reported engagement with empirical evidence, the teacher educator participants of this study stated that they mostly engage with research on the first-order level, which is related to their own knowledge, and less on a second-order level, like conveying and promoting evidence-based practice or discussion and collaboration around empirical evidence. Although teacher educators seem to be ready and motivated to promote evidence-based practice, students and

learners must also be considered. Investigating the student-perspective, Bråten and Ferguson (2015) showed that students in teacher education are more likely to believe in practically derived than research-based sources of knowledge and that they are also more motivated to learn from these. Engaging teacher students in evidence-based practice appears to be a key challenge for future teacher education.

The results for the uses of evidence in teacher education reveal that teacher educators integrate evidence in their courses on a regular basis. As assumed, teacher educators regularly use course books and scientific sources to plan their lessons (journals, articles, conferences). Besides they state to also use discussions with colleagues as an evidence-source for lesson-planning. Except for these initial self-report data, little is known about how and when teacher educators actually use empirical evidence in their teaching (Farley-Ripple et al., 2018). We suggest interviews or focus group discussions to identify more insights and a more detailed perspective of teacher educators. It could also be illuminating to complement the teacher educator data with student reports and observation of their actual practice. These insights would be necessary to develop a clear vision of how the actual practice of teacher educators concerning evidence-based practice should look. This vision then needs to be aligned with the teacher educators' vision and current practices.

Another major finding of our study concerns the differences between teacher educators with various levels of experience in research and teaching. The teacher educators with more experience in research and teaching generally had a more positive attitude toward evidence-based practice and used empirical evidence more intensively in their HE teaching. Previous research has shown that the more teacher educators engage with research, the more likely it is for them to have a positive mindset toward the use of empirical evidence and to adopt it in their practice (Lunenberg et al., 2014; Tack and Vanderlinde, 2016). Additionally, teacher educators with more experience perceived challenges related to evidence-based practice as less demanding than less experienced participants. This gap between teacher educators with various experience backgrounds also calls for a closer examination of how different levels of expertise correspond with evidence-based practice. To this end, future research is well advised to investigate teacher educators' actual knowledge about evidence and its use in teaching, e.g., with knowledge tests, vignettes, or video studies.

Based on the different perceptions of the challenges of evidence-based practice for novice and experienced teacher educators, the idea arises that teacher educators could learn from one another. In their study, MacPhail et al. (2018) showed that teacher educators aspire to learn from one another but are also aware that this would require time, which seems to constitute a continuous barrier. Therefore, the establishment of a working environment that promotes exchange between colleagues and discussion regarding research, and that supports the exchange and joint reflection on current empirical evidence and its use on a colleague- and student-level (Brown and Zhang, 2016), seem to be necessary to meet these needs. In regard to the time-problem, concepts that can be implemented simply are required, e.g., in the form of collaborative professional

networking (Niemi, 2008) or digital offers (Seidel et al., 2017a,b). For such professional development activities, interpersonal exchanges and discussions appear to be important features (Geerdink et al., 2016; Tack et al., 2017).

This goes along with the idea of a professional qualification for beginning teacher educators. Research on this illuminates that, on average, teacher educators do not feel adequately prepared for their teaching jobs (Goodwin et al., 2014). This can be ascribed to the fact that there is no induction phase to address relevant knowledge and skills. Based on the results of our study, beginning teacher educators would gain from professional training, e.g., with regard to the use of evidence in their HE teaching, but also with regard to their own scientific skills such as understanding and reflecting on important information from research articles. They should be offered less complex information on the outcomes of research articles and their application to practice. In doing so, further research could clarify if different presentation formats of evidence and explanatory material can further support teacher educators' integration of evidence into teaching practice (Cochran-Smith, 2005).

LIMITATIONS AND DIRECTIONS FOR FURTHER RESEARCH

The voluntary participation of the study participants very likely resulted in a positive selection of the sample, as those who were already interested in evidence-based practice might have been equally interested in taking part in the survey. Furthermore, the broad heterogeneity of the target group needs to be considered. In order to address this diversity, further studies including larger and systematic samples are needed to consider different systems of teacher education in different locations.

In addition, since research and teaching are intertwined in the profession of teacher educators, it would be interesting to consider the self-perception of the teacher educators and to which role they ascribe themselves (Vanassche and Kelchtermans, 2014; Avidov-Ungar and Forkosh-Baruch, 2018): do they consider themselves to be more researchers or HE teachers? How are they working the dialectic and how is this related to their perception of empirical evidence and its practical value? Furthermore, relevant information about institutional constraints and working conditions of the teacher educators is missing, which might affect the use of empirical evidence (Brown and Zhang, 2016). It needs to be clarified whether teacher educators work in an environment that appreciates and fosters evidence-based practice, whether it is part of their professional identity to use evidence, and whether they have the opportunity to collaborate with their colleagues.

Concerning the instrument, we used self-reported measures, which are prone to various biases including social desirability. To address social desirability partly, we stressed that there were no "right or wrong" answers in the introduction of the survey, and we assured absolute confidentiality to the participants. Due to the small sample size, we recommend validating the instrument with a broader sample.

CONCLUSION

In the present study, teacher educators appeared to hold positive attitudes toward evidence-based practice and to use empirical evidence. However, they emphasized that they need more time and resource-related support to cope with the growing body of educational research. To provide future teachers with an empirically supported knowledge base and with the appropriate skills to use that knowledge, teacher educators first have to acquire the necessary skills on their own. In this context, expertise in teaching and research seems to be beneficial. A future goal should be to facilitate the development of this expertise through qualification and professional development programs for teacher educators in which they can reflect on the use of research in teaching and engage with empirical evidence through a curated collection of the latest research results and supportive material. To particularly relieve teacher educators from the large amount of time it takes to review research, service initiatives such as [blinded for submission] can be established and strengthened.

Future research should clarify how teacher educators with different expertise backgrounds and mindsets apply their positive attitudes and perceptions toward empirical evidence into their HE teaching practice. Since this study has shown that expertise level plays an important role in teacher educators' perceptions,

it would be relevant to investigate how programs to support evidence-based practice could be designed differently to serve teacher educators with different expertise levels.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

AUTHOR CONTRIBUTIONS

All authors contributed to conception and design of the study, contributed to manuscript revision, read, and approved the submitted version. AD and FV developed the survey questionnaire. AD organized the data collection, database, performed the statistical analysis, and wrote the first draft of the manuscript.

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REFERENCES

- APA American Psychological Association (2017). *Ethical Principles of Psychologists and Code of Conduct* (Washington, DC), (2017).
- Avidov-Ungar, O., and Forkosh-Baruch, A. (2018). Professional identity of teacher educators in the digital era in light of demands of pedagogical innovation. *Teach. Teach. Educ.* 73, 183–191. doi: 10.1016/j.tate.2018.03.017
- Bauer, J., Berthold, K., Hefter, M. H., Prenzel, M., and Renkl, A. (2017). Wie können Lehrkräfte und ihre Schülerinnen und Schüler lernen, fragile evidenz zu verstehen und zu nutzen? How can teachers and students learn to understand and use fragile evidence? *Psychol. Rundschau* 68, 188–192. doi: 10.1026/0033-3042/a000363
- Bauer, J., and Prenzel, M. (2012). Science education. European teacher training reforms. *Science* 336, 1642–1643. doi: 10.1126/science.1218387
- Bell, M., Cordingley, P., Isham, C., and Davis, R. (2010). *Report of Professional Practitioner Use of Research Review: Practitioner Engagement in and/or With Research*. Coventry: CUREE, GTCE, LSIS & NTRP. Available online at: <http://www.curee.co.uk/node/2303>
- Berliner, D. C. (2002). Comment: educational research: the hardest science of all. *Educ. Res.* 31, 18–20. doi: 10.3102/0013189X031008018
- Biesta, G. J. J. (2007). Why 'what works' won't work: evidence-based practice and the democratic deficit in educational research. *Educ. Theory* 57, 1–22. doi: 10.1111/j.1741-5446.2006.00241.x
- Biesta, G. J. J. (2010). Why 'what works' still won't work: from evidence-based education to value-based education. *Stud. Philos. Educ.* 29, 491–503. doi: 10.1007/s11217-010-9191-x
- Bråten, I., and Ferguson, L. E. (2015). Beliefs about sources of knowledge predict motivation for learning in teacher education. *Teach. Teach. Educ.* 50, 13–23. doi: 10.1016/j.tate.2015.04.003
- Brown, C., Schildkamp, K., and Hubers, M. D. (2017). Combining the best of two worlds: a conceptual proposal for evidence-informed school improvement. *Educ. Res.* 59, 154–172. doi: 10.1080/00131881.2017.1304327
- Brown, C., and 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? *Br. Educ. Res. J.* 42, 780–801. doi: 10.1002/berj.3239
- Burkhardt, H., and Schoenfeld, A. H. (2003). Improving educational research: toward a more useful, more influential, and better-funded enterprise. *Educ. Res.* 32, 3–14. doi: 10.3102/0013189X032009003
- Burns, P. B., Rohrich, R. J., and Chung, K. C. (2011). The levels of evidence and their role in evidence-based medicine. *Plast. Reconstr. Surg.* 128, 305–310. doi: 10.1097/PRS.0b013e318219c171
- Cochran-Smith, M. (2005). Teacher educators as researchers: multiple perspectives. *Teach. Teach. Educ.* 21, 219–225. doi: 10.1016/j.tate.2004.12.003
- Cochran-Smith, M., and Lytle, S. L. (2016). Relationships of knowledge and practice: teacher learning in communities. *Rev. Res. Educ.* 24, 249–305. doi: 10.3102/0091732X024001249
- Costello, A. B., and Osborne, J. (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Pract. Assess.* 10, 1–9. doi: 10.7275/jyj1-4868
- Cutspec, P. A. (2004). Bridging the research-to-practice gap: evidence-based education. *Evid. Based Approach. Early Childh. Dev.* 2
- Czerniawski, G., Guberman, A., and MacPhail, A. (2017). The professional developmental needs of higher education-based teacher educators: an international comparative needs analysis. *Eur. J. Teach. Educ.* 40, 127–140. doi: 10.1080/02619768.2016.1246528
- Darling-Hammond, L. (2016). Constructing 21st-century teacher education. *J. Teach. Educ.* 57, 300–314. doi: 10.1177/0022487105285962
- Davies, P. (1999). What is evidence-based education? *Br. J. Educ. Stud.* 47, 108–121.
- Dawes, M., Summerskill, W., Glasziou, P., Cartabellotta, A., Martin, J., Hopayian, K., et al. (2005). Sicily statement on evidence-based practice. *BMC Med. Educ.* 5:1. doi: 10.1186/1472-6920-5-1
- De Winter, J. C. F., Dodou, D., and Wieringa, P. A. (2009). Exploratory factor analysis with small sample sizes. *Multivariate Behav. Res.* 44, 147–181. doi: 10.1080/00273170902794206
- Ericsson, K. A. (2006). "The influence of experience and deliberate practice on the development of superior expert performance," in *The Cambridge Handbook of Expertise and Expert Performance*, ed K. Ericsson (Cambridge: Cambridge University Press), 685–705.
- European Commission. (2007). *Improving the Quality of Teacher Education*. Brussels. Available online at: https://ec.europa.eu/education/com392_en.pdf

- Farley-Ripple, E., May, H., Karpyn, A., Tilley, K., and McDonough, K. (2018). Rethinking connections between research and practice in education: a conceptual framework. *Educ. Res.* 47, 235–245. doi: 10.3102/0013189X18761042
- Fleckenstein, J., Zimmermann, F., Köller, O., and Möller, J. (2015). What works in school? Expert and novice teachers' beliefs about school effectiveness. *Front. Learn. Res.* 3, 27–46. doi: 10.14786/flr.v3i2.162
- Forman, S. G., Fagley, N. S., Chu, B. C., and Walkup, J. T. (2012). Factors influencing school psychologists' "willingness to implement" evidence-based interventions. *Sch. Ment. Health* 4, 207–218. doi: 10.1007/s12310-012-9083-z
- Geerdink, G., Boei, F., Willemse, M., Kools, Q., and van Vlokhoven, H. (2016). Fostering teacher educators' professional development in research and in supervising student teachers' research. *Teach. Teach.* 22, 965–982. doi: 10.1080/13540602.2016.1200544
- Goodwin, A. L., Smith, L., Souto-Manning, M., Cheruvu, R., Tan, M. Y., Reed, R., et al. (2014). What should teacher educators know and be able to do? Perspectives from practicing teacher educators. *J. Teach. Educ.* 65, 284–302. doi: 10.1177/0022487114535266
- Haberfellner, C., and Fenzl, T. (2017). The utility value of research evidence for educational practice from the perspective of preservice student teachers in Austria – a qualitative exploratory study. *J. Educ. Res. Online* 9, 69–87.
- Hammersley, M. (2009). "What is evidence for evidence-based practice?" in *Evidence-Based Practice - Modernising the Knowledge Base of Social*, eds H. U. Otto, A. Polutta, and H. Ziegler (Budrich: Opladen), 139–150.
- Hammersley, M. (2013). *The Myth of Research-Based Policy & Practice*. Los Angeles, Calif: Sage.
- Hedges, L. V. (2017). Challenges in building usable knowledge in education. *J. Res. Educ. Eff.* 11, 1–21. doi: 10.1080/19345747.2017.1375583
- Hendricson, W. D., Rugh, J. D., Hatch, J. P., Stark, D. L., Deahl, T., and Wallmann, E. R. (2011). Validation of an instrument to assess evidence-based practice knowledge, attitudes, access, and confidence in the dental environment. *J. Dent. Educ.* 75, 131–144.
- Henson, R. K., and Roberts, J. K. (2006). Use of exploratory factor analysis in published research. *Educ. Psychol. Meas.* 66, 393–416. doi: 10.1177/001316440528248
- Hogarty, K. Y., Hines, C. V., Kromrey, J. D., Ferron, J. M., and Mumford, K. R. (2016). The quality of factor solutions in exploratory factor analysis: the influence of sample size, communality, and overdetermination. *Educ. Psychol. Meas.* 65, 202–226. doi: 10.1177/0013164404267287
- Johnston, J. M., Leung, G. M., Fielding, R., Tin, K. Y. K., and Ho, L.-M. (2003). The development and validation of a knowledge, attitude and behaviour questionnaire to assess undergraduate evidence-based practice teaching and learning. *Med. Educ.* 37, 992–1000. doi: 10.1046/j.1365-2923.2003.01678.x
- Kane, R., Sandretto, S., and Heath, C. (2004). An investigation into excellent tertiary teaching: emphasising reflective practice. *High. Educ.* 47, 283–310. doi: 10.1023/B:HIGH.0000016442.55338.24
- Kvernbekk, T. (2018). Evidence-based educational practice. Oxford research encyclopedia of education. *Adv. Online*. doi: 10.1093/acrefore/9780190264093.013.187
- Lilienfeld, S. O., Ritschel, L. A., Lynn, S. J., Cautin, R. L., and Latzman, R. D. (2013). Why many clinical psychologists are resistant to evidence-based practice: root causes and constructive remedies. *Clin. Psychol. Rev.* 33, 883–900. doi: 10.1016/j.cpr.2012.09.008
- Livingston, K., McCall, J., and Morgado, M. (2009). "Teacher educators as researchers," in *Becoming a Teacher Educator*, eds A. Swennen and M. van der Klink (Dordrecht: Springer Netherlands), 191–203.
- Loughran, J. (2014). Professionally developing as a teacher educator. *J. Teach. Educ.* 65, 271–283. doi: 10.1177/0022487114533386
- Lunenberg, M., Dengerink, J., and Korthagen, F. (2014). *The Professional Teacher Educator: Roles, Behaviour, and Professional Development of Teacher Educators*. Professional Learning. Rotterdam: Sense Publishers.
- MacPhail, A., Ulvik, M., Guberman, A., Czerniawski, G., Oolbekkink-Marchand, H., and Bain, Y. (2018). The professional development of higher education-based teacher educators: needs and realities. *Prof. Dev. Educ.* 39, 1–14. doi: 10.1080/19415257.2018.1529610
- Malouf, D. B., and Taymans, J. M. (2016). Anatomy of an evidence base. *Educ. Res.* 45, 454–459. doi: 10.3102/0013189X16678417
- Murray, J., and Male, T. (2005). Becoming a teacher educator: evidence from the field. *Teach. Teach. Educ.* 21, 125–142. doi: 10.1016/j.tate.2004.12.006
- Nelson, J., and Campbell, C. (2017). Evidence-informed practice in education: meanings and applications. *Educ. Res.* 59, 127–135. doi: 10.1080/00131881.2017.1314115
- Niemi, H. (2008). "Advancing research into and during teacher education," in *Monographs on Journal of Research in Teacher Education. Teacher Education Policy in Europe: A Voice of Higher Education Institutions*, eds B. Hudson and P. Zgaga (Umeå: University of Umeå, Faculty of Teacher Education), 183–208.
- Nutley, S., Walter, I., and Davies, H. T. O. (2003). From knowing to doing: a framework for understanding the evidence-into-practice agenda. *Evaluation* 9, 125–148. doi: 10.1177/1356389003009002002
- Oancea, A., and Pring, R. (2008). The importance of being thorough: on systematic accumulations of 'what works' in education research. *J. Philos. Educ.* 42, 15–38. doi: 10.1111/j.1467-9752.2008.00633.x
- Ping, C., Schellings, G., and Beijard, D. (2018). Teacher educators' professional learning: a literature review. *Teach. Teach. Educ.* 75, 93–104. doi: 10.1016/j.tate.2018.06.003
- Reddy, L. A., Forman, S. G., Stoiber, K. C., and González, J. E. (2017). A national investigation of school psychology trainer's attitudes and beliefs about evidence-based practice. *Psychol. Sch.* 54, 261–278. doi: 10.1002/pits.21999
- Rousseau, D. M., and Gunia, B. C. (2016). Evidence-based practice: the psychology of EBP implementation. *Annu. Rev. Psychol.* 67, 667–692. doi: 10.1146/annurev-psych-122414-033336
- Rubin, A., and Bellamy, J. (2012). *Practitioner's Guide to Using Research for Evidence-Based Practice, 2nd Edn*. Hoboken: Wiley. Available online at: <http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10582619>
- Sackett, D. L., Rosenberg, W. M. C., Gray, J. A. M., Haynes, R. B., and Richardson, W. S. (1996). Evidence based medicine: what it is and what it isn't. *BMJ* 312, 71–72. doi: 10.1136/bmj.312.7023.71
- Scheeler, M. C., Budin, S., and Markelz, A. (2016). The role of teacher preparation in promoting evidence-based practice in schools. *Learn. Disabil. A Contemp. J.* 14, 171–187.
- Schwartz, B. M., and Gurung, R. A. R. (eds) (2012). *Evidence-Based Teaching for Higher Education*. Washington, DC: American Psychological Association.
- Seidel, T., Knogler, M., Mok, S. Y., Hetmanek, A., Vogel, F., Bannert, M., et al. (2017a). Forschung fördert Bildung. Das Clearing House Unterricht (Research promotes education. The Clearinghouse on Effective Teaching). *J. Für LehrerInnenbildung* 17, 23–28.
- Seidel, T., Mok, S. Y., Hetmanek, A., and Knogler, M. (2017b). Meta-Analysen zur unterrichtsforschung und ihr beitrage für die realisierung eines clearing house unterricht für die lehrerbildung (meta-analyses of classroom research and their contribution to the realisation of a clearinghouse initiative for teacher education). *Zeitschrift für Bildungsforschung* 7, 311–325. doi: 10.1007/s35834-017-0191-6
- Shlonsky, A., and Stern, S. B. (2007). Reflections on the teaching of evidence-based practice. *Res. Soc. Work Pract.* 17, 603–611. doi: 10.1177/1049731507301527
- Smith, K. (2005). Teacher educators' expertise: what do novice teachers and teacher educators say? *Teach. Teach. Educ.* 21, 177–192. doi: 10.1016/j.tate.2004.12.008
- Spring, B. (2007). Evidence-based practice in clinical psychology: what it is, why it matters; what you need to know. *J. Clin. Psychol.* 63, 611–631. doi: 10.1002/jclp.20373
- Standing Conference of the Ministers of Education and Cultural Affairs (2004, 2014). *Standards For Teacher Education: Educational Sciences*. Available online at: <https://www.kmk.org/kmk/information-in-english.html>
- Sullivan, K. J., Wayne, C., Patey, A. M., and Nasr, A. (2017). Barriers and facilitators to the implementation of evidence-based practice by pediatric surgeons. *J. Pediatr. Surg.* 52, 1666–1673. doi: 10.1016/j.jpedsurg.2017.02.001
- Suttle, C. M., Challinor, K. L., Thompson, R. E., and Pesudovs, K. (2015). Attitudes and barriers to evidence-based practice in optometry educators. *Optom. Vis. Sci.* 92, 514–523. doi: 10.1097/OPX.0000000000000550
- Tack, H., Valcke, M., Rots, I., Struyven, K., and Vanderlinde, R. (2017). Uncovering a hidden professional agenda for teacher educators: A mixed method study on flemish teacher educators and their professional development. *Eur. J. Teach. Educ.* 41, 86–104. doi: 10.1080/02619768.2017.1393514
- Tack, H., and Vanderlinde, R. (2014). Teacher educators' professional development: towards a typology of teacher educators' researchly disposition. *Br. J. Educ. Stud.* 62, 297–315. doi: 10.1080/00071005.2014.957639

- Tack, H., and Vanderlinde, R. (2016). Measuring teacher educators' researcherly disposition: Item development and scale construction. *Vocat. Learn.* 9, 43–62. doi: 10.1007/s12186-016-9148-5
- Tilson, J. K., Kaplan, S. L., Harris, J. L., Hutchinson, A., Ilic, D., Niederman, R., et al. (2011). Sicily statement on classification and development of evidence-based practice learning assessment tools. *BMC Med. Educ.* 11:78. doi: 10.1186/1472-6920-11-78
- Upton, D., and Upton, P. (2006). Development of an evidence-based practice questionnaire for nurses. *J. Adv. Nurs.* 53, 454–458. doi: 10.1111/j.1365-2648.2006.03739.x
- Vanassche, E., and Kelchtermans, G. (2014). Teacher educators' professionalism in practice: positioning theory and personal interpretative framework. *Teach. Educ.* 44, 117–127. doi: 10.1016/j.tate.2014.08.006
- Wenglein, S., Bauer, J., Heining, S., and Prenzel, M. (2015). Kompetenz angehender Lehrkräfte zum argumentieren mit evidenz: erhöht ein training von

heuristiken die argumentationsqualität? (Pre-service teachers' evidence-based argumentation competence: can a training of heuristics improve argumentative quality?) *Unterrichtswissenschaft* 43, 209–224.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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