



Predictors of teachers' appreciation of evidence-based practice and educational research findings

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Abstract: Teachers' reception of educational research is considered important for improving teaching and student learning. Yet, it is a challenging task requiring teachers to have access to scientific sources, the skill and time to find and exhaust such resources, and the capacity to interpret retrieved information. If such essential conditions are not met, teachers have hardly any chance to engage in research reception and, consequently, may question the value and relevance of research findings to their practice. Prior research has suggested that teachers are indeed critical of educational research findings and rarely refer to them. Based on data from the field trial ($N = 674$) and main study ($N = 2,549$) of a national extension study of the Programme for International Student Assessment (PISA) 2012 in Germany, this study explored the role of (a) teachers' access to scientific sources, (b) perceived lack of skill and time to search for research findings, and (c) their familiarity with research methods / statistics as potential predictors of their appreciation of evidence-based practice, and perceived irrelevance of educational research findings. Structural equation models demonstrated that perceived lack of skill and time to find research findings, in particular, substantially affected participants' irrelevance perceptions. The more participants assessed their sourcing skill and time to be too constrained to engage in research reception, the more they judged research findings to be irrelevant to their practice. Though source access and familiarity with research methods / statistics indicated only small or even no effects, they strongly correlated with participants' perceived lack of sourcing skill and time. Better source access and greater familiarity were associated with less concern about one's skill and time resources to search for relevant research findings. These findings potentially underline the relevance of strengthening both teachers' access to scientific sources and individual capacities to understanding research contents.

Keywords: Appreciation of educational research findings, irrelevance of research findings, research reception, source access, teacher education

Zu Prädiktoren der Wertschätzung evidenzbasierter Praxis und bildungswissenschaftlicher Befunde bei Lehrkräften

Die Rezeption bildungswissenschaftlicher Befunde soll Lehrkräften zur Verbesserung ihrer Unterrichtspraxis dienen. Dies stellt eine anspruchsvolle Aufgabe dar, die es erfordert, dass Lehrkräfte Zugang zu Forschungsliteratur haben, über die nötigen Fähigkeiten und Zeitressourcen zur Rezeption verfügen, und im Stande sind, solche Befunde zu interpretieren. Sind solche essentiellen Voraussetzungen nicht erfüllt, haben Lehrkräfte kaum Chancen, bildungswissenschaftliche Befunde heranzuziehen und zu rezipieren. Dies kann dazu führen, dass sie bildungswissenschaftlichen Befunden und evidenzbasiertem Handeln weniger Wert und Relevanz für ihr Handeln beimessen. Vorangegangene Untersuchungen deuten tatsächlich darauf hin, dass Lehrkräfte die Relevanz bildungswissenschaftlicher Befunde kritisch betrachten und diese kaum nutzen. Basierend auf Daten von Mathematiklehrkräften, die an der Befragung der nationalen Erweiterungsstudie zur PISA Studie 2012 (Deutschland) im Feldversuch ($N = 674$) sowie in der Hauptstudie ($N = 2549$) teilnahmen, untersucht dieser Beitrag, welchen Einfluss (a) der Zugang zu Forschungsliteratur, (b) die Wahrnehmung eigener Fähigkeiten und Zeitressourcen, Forschungsergebnisse finden zu können, sowie (c) die Vertrautheit mit Forschungsmethoden und Statistik auf die Wertschätzung von evidenzbasierter Praxis einerseits und auf die wahrgenommene Irrelevanz von bildungswissenschaftlichen Befunden andererseits haben. Analysen mittels Strukturgleichungsmodellen ergaben, dass die Beurteilung bildungswissenschaftlicher Befunde als irrelevant insbesondere durch die Wahrnehmung unzureichender Fähigkeiten und Zeitressourcen vorhergesagt wurde. Je mehr die Lehrkräfte ihre Fähigkeit und Zeit als unzureichend einschätzten, desto stärker lehnten sie bildungswissenschaftliche Befunde auch als irrelevant ab. Der Zugang zu Forschungsliteratur bzw. die Vertrautheit mit Forschungsmethoden und Statistik hatten nur kleine, teils auch keine, Effekte auf die Wahrnehmung evidenzbasierten Handelns und bildungswissenschaftlicher Befunde. Allerdings korrelierten diese beiden Prädiktoren hoch mit der Wahrnehmung der eigenen Fähigkeiten und Zeitressourcen. Je besser der Zugang zu Forschungsliteratur bzw. je höher die Vertrautheit mit Forschungsmethoden und Statistik angegeben wurde, desto weniger äußerten Lehrkräfte Bedenken hinsichtlich ihrer Fähigkeiten und Zeitressourcen, Forschungsbefunde finden und lesen zu können. Diese Ergebnisse untermauern die Relevanz, den Zugang zu Forschungsliteratur sowie auch grundlegende Fähigkeiten zur Wissenschaftsrezeption zu stärken.

Schlüsselwörter: Wertschätzung evidenzbasierten Handelns, Irrelevanz bildungswissenschaftlicher Befunde, Wissenschaftsrezeption, Zugang zu Forschungsliteratur, Lehrerbildung

Introduction

Educational policy as well as researchers consider teachers' access to and reception of educational research findings important for improving both student learning through evidence-based practice and teachers' own professional development (e.g., Bauer & Prenzel, 2012; Brown & Zhang, 2016; Darling-Hammond & Bransford, 2005; European Commission [EC], 2007; Kultusministerkonferenz [KMK], 2004; Organisation for Economic Cooperation and Development [OECD], 2005; Stark, 2017). However, in their everyday professional practice, teachers rarely refer to or draw from knowledge provided by educational research (Dagenais et al., 2012; Hemsley-Brown & Sharp, 2003; Slavin, 2020; van Schaik, Volman, Admiraal & Schenke, 2018). This observation prompts the question which relevance teachers assign to educational research findings and evidence-based practice eventually.

The acquisition and selection of knowledge that could be relevant for their practice is already a challenging task for teachers. The reception of educational research findings requires teachers to use sources of primary or compiled scientific evidence. Yet, their access to scientific sources is often limited or even lacking completely, as are their personal time resources to consult such sources (Ratcliffe et al., 2005; van Schaik et al., 2018). Because research methodology is typically not a standard part of teacher education, teachers may also feel insufficiently competent to evaluate and interpret findings of educational research (see Duke & Ward, 2009; Williams & Coles, 2007). If teachers miss opportunities to access research knowledge due to insufficient source access, time resources and/or skills, their chances of becoming familiar with and experienced in referring to research findings will be low (Bauer, Berthold, Hefter, Prenzel & Renkl, 2017; Diery, Vogel, Knogler & Seidel, 2020; Seidel, Mok, Hetmanek & Knogler, 2017). Such lack of opportunity may also reflect negatively on teachers' appreciation of educational research findings and ultimately may undermine their intentions to retrieve educational research.

This article aims to shed light on teachers' appreciation of educational research findings and evidence-based practice and its relation to the necessary conditions of research reception. Specifically, we investigate source access, perception of one's skill and time to find relevant research findings, and familiarity with research methods/statistics as basic requirements for teachers' engagement with educational research knowledge, including sourcing activities targeted at this research (i.e., search, selection, and evaluation of sources providing educational research; e.g., Braasch, Bråten & McCrudden, 2018; Bromme, Stadler & Scharrer, 2018). Drawing on data from a large sample of active teachers selected for a national extension study of

the OECD Programme for International Student Assessment (PISA) 2012 in Germany, we explore the impact of these factors on teachers' appreciation of educational research knowledge (comprising their appreciation of evidence-based practice and perceived irrelevance of educational research findings). The following sections will first highlight the role of teachers' reception and appreciation of educational research findings and then discuss its relationship with vital conditions that make research reception feasible in the first place.

Theoretical background

Relevance of teachers' educational research reception

Demands for evidence-based practice have increasingly gained importance in many professions (Rosseau & Gunia, 2016). Professionalism requires individuals to act and reflect their actions upon the best available (research) knowledge in order to improve their professional practice (Bauer, Prenzel & Renkl, 2015; Sackett, Rosenberg, Gray, Haynes & Richardson, 1996). This also pertains to the field of education and, in particular, to teachers' professional work. Current debates around standards of teacher professionalism are grounded in an understanding of teaching as a research-based profession (e.g., Bauer & Prenzel, 2012; Bromme, Prenzel & Jäger, 2014; Cain, Wieser & Livingston, 2016; Hemsley-Brown & Sharp, 2003; Slavin, 2002).

Knowledge gained from research can provide information to enrich, explicate, and justify professional actions and judgments, and to promote critical reflection on one's practice. Its reception is expected to have beneficial effects because it can foster improvement and innovation in teaching and student learning (Bauer & Prenzel, 2012; Brown & Zhang, 2016; Diery et al., 2020). Research reception, however, requires teachers to take several crucial steps: First, they need to locate and get access to research that is relevant to their profession-related questions and problems; second, once accessed, teachers must be able to make sense of the provided information by reading and interpreting the presented theoretical reasoning and research findings; finally, they need to relate this information to the situation at hand and use it to make the required decisions (Bauer et al., 2017; Brown, Schildkamp & Hubers, 2017; Darling-Hammond & Bransford, 2005; Davis, 1999; Duke & Ward, 2009; EC, 2007; Niemi, 2008). Such processes of evidence-based judgement "involve a mindful integration of both scientific evidence (e.g., research studies) and local evidence (e.g., situational assessments)" (Rosseau & Gunia, 2016, p.685). Consequently, knowledge of educational re-

search should not replace teachers' professional experiences, individual expertise, and judgements; rather, it should complement their array of resources and serve as a guide, corrective, and orientation to improve and justify professional actions (Bauer et al., 2017; Ratcliffe et al., 2005).

Despite the importance of findings from educational research, teachers rarely seem to refer to them. Instead, they frequently base their practice on tradition, common knowledge, and experience (Cain, 2016; Hargreaves, 2000; Hetmanek et al., 2015; Kutash, Duchnowski & Lynn, 2009; Schildkamp & Kuiper, 2010; van Schaik et al., 2018). Nonetheless, teachers seem (or may think) to manage quite well with that approach. In the recent Austrian national extension study of the *Teaching and Learning International Survey* (TALIS 2018; Schmich & Itzlinger-Bruneforth, 2019), 92 percent of the interviewed teachers indicated confidence in making an essential pedagogical contribution to their students' lives, and 97 percent were confident in succeeding with students in their classes. If teachers feel that they are successful in instruction and student learning, the question may arise as to why they should actually invest effort into dealing with knowledge from educational research.

Appreciation of educational research findings and evidence-based practice

Research reception does not occur automatically. Teachers must also conceive it as beneficial to their actions and, thus, valuable to improve their teaching (Bauer et al., 2017; Lysenko, Abrami, Bernard, Dagenais & Janosz., 2014; Rousseau & Gunia, 2016). Prior research corroborates that teachers' appreciation of research findings can be a crucial facilitator of its reception (Joram, Gabriele & Walton, 2020; Hemsley-Brown & Sharp, 2003; van Schaik et al., 2018). For instance, Lysenko et al. (2014) found appreciation of educational research (including perceptions of relevance, usefulness, and applicability of research knowledge) to be an important predictor of research reception. However, research reviews consistently document that the value teachers assign to educational research findings varies considerably, ranging from positive to critical stances towards educational research findings and evidence-based practice (Hemsley-Brown & Sharp, 2003; Dagenais et al., 2012; van Schaik et al., 2018).

Often disapproval is directly expressed in judging research knowledge irrelevant to one's own practice (van Schaik et al., 2018). Perceptions of irrelevance primarily revolve around the disconnection that teachers perceive between research and daily challenges in classrooms (e.g., Broekkamp & van Hout-Wolters, 2007; Merk, Rosman, Rueß, Syring & Schneider, 2017). Educational research

frequently provides tentative or even contradictory results, which may not fit exactly to the situation at hand and, thus, may not be directly transferable into actions (Farley-Ripple, May, Karpyn, Tilley & McDonough, 2018). The nature of scientific knowledge already confronts teachers with great challenges. They tend to miss clarity of the implications of research findings (Farley-Ripple et al., 2018; Williams & Coles, 2007) and consider research findings to be unhelpful because they are detached from and inapplicable to their practice (e.g., Gore & Gitlin, 2004; Joram et al., 2020; Lysenko et al., 2014; Martinovich et al., 2012; Ratcliffe et al., 2005). Such generalized judgments undermine research reception and represent a persistent barrier (Dagenais et al., 2012; Gore & Gitlin, 2004).

Appreciation and perceived irrelevance of educational research findings may mark a pivotal point in whether or not teachers engage in research reception. Therefore, it is desirable to understand the factors that may shape both teachers' appreciation and irrelevance perceptions of educational research findings.

Examining conditions of research reception

Aside from the motivational aspects of appreciation discussed above, reception of educational research requires competence to search for, evaluate, and reflect on scientific evidence to make use of it (e.g., Ramos, Schafer & Tracz, 2003; Rubin, 2008; Shaneyfelt et al., 2006; Wenglein, Bauer, Heiningner & Prenzel, 2015). Although each of these steps is associated with different tasks and requirements, they share a set of necessary and interrelated conditions: (1) Teachers need to have (physical or digital) access to sources providing educational research findings, (2) they need to be confident of their skills and time resources to find and identify relevant research findings, and (3) they must be competent in understanding and interpreting the retrieved knowledge (Bauer & Prenzel, 2012; Brown et al., 2017; Lysenko et al., 2014; Niemi, 2008; Rousseau & Gunia, 2016; van Schaik et al., 2018). If such essential conditions are not fulfilled, teachers are unlikely to consult research findings for their practice. As a side effect, it is possible that they may judge educational research findings to be irrelevant and attach less or no further value to evidence-based practice.

Finding and selecting relevant sources are essential sourcing skills and arguably crucial gatekeeper competences for engaging with research knowledge (Braasch et al., 2018; Thomm & Bromme, 2016). However, to do so, teachers also require actual access to scientific sources, such as professional and scholarly journals and databases. Despite its relevance, source access is often scarce, highly effortful, or lacking completely (van Schaik et al., 2018). Missing opportunities to approach scientific sources may discourage

teachers from referring to research knowledge. Teachers often have access to practitioner journals on teaching or publications by teachers' unions. However, the information provided by such sources is frequently not research-based. To improve access to research knowledge, following the example of medicine, education-related clearinghouses have been established to increase the dissemination and availability of research resources among teacher educators (e.g., Department for Education, 2016; Seidel et al., 2017; What Works Clearinghouse [WWC], 2020). So far, however, clearinghouses have covered only a small scope of educationally relevant topics and, thus, cannot completely replace direct access for teachers. After all, source access remains the minimum prerequisite for teachers to become familiar with its reception and value to their practice.

Yet, as aforementioned, mere source access is not enough; teachers have to overcome further related subjective accessibility issues (van Schaik et al., 2018). This specifically pertains to the perceived subjective accessibility in terms of one's skill and time resources to identify relevant research findings across and within scientific sources, and to read the information. Thus, teachers need to be confident of finding valid and reliable research findings relevant to them, and consider their time resources sufficient to do so (van Schaik et al., 2018; Levin, 2011; Martinovitch et al., 2012). Research reception is often deemed impracticable in light of an already full work schedule (e.g., Ratcliffe et al., 2005; Vanderlinde & Van Braak, 2010; van Schaik et al., 2018; Williams & Coles, 2007). Assessing one's sourcing skills and time resources as insufficient (i.e., perceived lack of sourcing skill/time), teachers might view research reception as an additional burden that is disproportionate to its returns. Consequently, they may question the value and relevance of educational research findings to justify *non*-reception.

In addition, teachers must be able to understand and evaluate their contents. According to Niemi (2008), teachers need to possess "critical scientific literacy which helps them to understand validity and relevance of information from research and other evidence sources" (p.65). Low skills in interpreting and reasoning on scientific evidence can hinder them to approach scientific sources at all (Williams & Coles, 2007). In particular, knowledge of research methods, including statistics, may play a crucial role in how teachers perceive and value educational research knowledge eventually (Joram et al., 2020). Familiarity with at least basic concepts of research methods is of high importance to assign meaning to research knowledge (Vetter & Ingrisani, 2013), but teachers rarely have the methodological training required to properly evaluate research findings. Williams and Coles (2007) found that teachers considered the reliability of methodological approaches that underlie research knowledge when reason-

ing about scientific sources. Their study showed that teachers varied in their confidence in being able to judge information, such as statistics, which may impede research reception. To cope with their insufficient understanding, teachers may also tone down the relevance of educational research findings to improving their professional practice.

Insufficient access in these three ways potentially counteracts the reception of educational research before teachers (could) have even faced any piece of research finding and may contribute to low expectations about the value and relevance of educational research findings. It may also explain why teachers frequently refer to experience reports (e.g., from colleagues) rather than scientific sources (van Schaik et al., 2018; Williams & Coles, 2007).

Prior research has considered research accessibility and teachers' time resources, skills, and stances on educational research findings as potential barriers; however, so far, studies have mainly focused on *identifying* such factors in general (e.g., van Schaik et al., 2018) rather than *examining potential relationships* between them. In this contribution, we aim to extend prior research by modeling relevant associations based on prior theoretical considerations and empirical findings that highlight the relevance of both the necessary affordances for research reception in teachers' environment and critical individual skills (Niemi, 2008; Rousseau & Gunia, 2016; van Schaik et al., 2018; Wenglein et al., 2015). While there are already established models of relevant competencies and processes of evidence reception in other professional fields (e.g., medicine; Diery et al., 2020; Ramos et al., 2003; Rubin, 2008), there is not yet a consistent model explicating the conditions and processes of research reception and research use in relation to teachers' engagement with educational research knowledge (Farley-Ripple et al., 2018; Nutley, Walter & Davies, 2003). Differentiating and exploring the discussed relationships can contribute to theory and model building and inspire corresponding training measures in teacher education.

Study aims

The present study contributes to the scope of this special issue by investigating vital conditions of teachers' reception of educational research findings, including sourcing activities. To this end, we used data of the national extension study of PISA 2012 (in Germany), which included a survey of teachers at the tested schools. We consider the data valuable for monitoring both teachers' appreciation of educational research and the critical conditions of research reception in a larger sample.

The study had two aims. Our first goal was to examine descriptively the extent to which teachers' value educa-

tional research knowledge as reflected in their appreciation of evidence-based practice and perceived irrelevance of educational research findings. In addition, we reviewed teachers' responses regarding their options for accessing scientific sources, perceived lack of sourcing skill/time, and self-assessed familiarity with research methods/statistics, viewing them as critical affordances and prerequisites of research reception.

Since prior research has reported mixed results on teachers' appreciation of research knowledge and evidence-based practice, our second goal was to explore whether the aforementioned conditions may allow for explaining such differences. Therefore, we inspected the effects of source access, perceived lack of sourcing skill/time and familiarity with research methods/statistics on both teachers' appreciation of evidence-based practice and perceived irrelevance of educational research findings.

We assumed that better access to scientific sources would positively predict appreciation of evidence-based practice and mitigate perceived irrelevance of educational research findings. With more options of access, it is likely that teachers can familiarize themselves with research knowledge, and they may acknowledge its value, which can result in higher appreciation of evidence-based practice and, conversely, lower perceived irrelevance of research findings.

We expected that perceived lack of sourcing skill/time to obtain relevant research knowledge would negatively predict appreciation of evidence-based practice and positively predict perceived irrelevance of educational research findings. Questioning one's own skill and/or time provides a rationale for not engaging with research knowledge, which may, in turn, be buffered by lower appreciation of evidence-based practice and higher perceived irrelevance of research findings.

Moreover, we proposed that greater familiarity with research methods/statistics would be associated with higher appreciation of evidence-based practice and lower perceived irrelevance of educational research findings. When teachers indicate that they are familiar with (at least some) basic concepts of research methods/statistics, they might also be better able to interpret research knowledge and may, thus, benefit more from research findings.

Though not the primary focus of this contribution, we also examined potential correlations between all three predictor variables, as relations seemed obvious. For example, it appeared reasonable that better source access and higher familiarity with research methods/statistics could be associated with less concern about insufficient sourcing skill and time resources. That is, if teachers indicate to have multiple options to access scientific sources and feel capable of interpreting the retrieved contents, it appears likely that they would also assess their sourcing skill and time resources to be less an obstacle in consulting

research knowledge. Since prior research has revealed gender differences in (self-)assessments of one's abilities in understanding research (e.g., Eisenberg, Martin & Fabes, 1996; Marsh & Retali, 2010), we controlled for participants' gender within our analyses.

Methods

Data

To achieve the stated research aims, we used data from the teacher survey embedded in PISA 2012 in Germany (Prenzel, Sälzer, Klieme & Köller, 2013). This was a national extension study that surveyed teachers who had been teaching the primary test domain, mathematics in PISA 2012, in the tested schools. The data came from the field trial as well as from the main study of PISA 2012. We first tested our assumptions with data from the field trial and then replicated the model with the main study data. This design enabled us to cross-validate the findings. The field trial data contained a sample of $N = 674$ secondary education mathematics teachers from 99 schools located in four purposefully selected federal states of Germany (45% male). Within the sampled schools, all mathematics teachers teaching in Grade 5 or higher were selected for participation. Participants in the main study were $N = 2,549$ secondary education mathematics teachers from 272 schools (44% male) across Germany, who were sampled according to the PISA 2012 sampling frame (Prenzel et al., 2013). Detailed background data of the teacher questionnaires are available in Mang et al. (2018).

Measures

Both studies used the scales described below, which were adapted from questionnaires published in medicine (Jette et al., 2003; Johnston, Leung, Fielding, Tin & Ho, 2003; Young & Ward, 2001). The complete item texts are available in Mang et al. (2018).

Access to scientific sources (*source access*), was measured by three items asking for access to sources that present original research, research compiled for practitioners, and relevant databases for searching research-based information. Each source was illustrated with examples. Participants indicated whether they had access to these sources at school or otherwise. Answers were dummy coded (1 = any access; 0 = no access/don't know) and aggregated to a sum score. *Perceived lack of sourcing skill/time* were measured through participants' agreement with three items (e.g., "I don't have the time to search and read research")

on a four-point Likert-scale (1 = don't agree at all, 4 = agree completely). *Familiarity with research methods/statistics* was measured by seven items asking participants to rate their understanding of methodological concepts (e.g., “quasi-experiment”; “correlation”) on a four-point Likert-scale (1 = don't know the concept, 4 = understand the concept and could explain it to somebody else).

Two items measured participants' *appreciation of evidence-based practice* (e.g., “I find it important that education is more evidence-based”; 1 = don't agree at all, 4 = agree completely), while *perceived irrelevance of educational research findings* was captured by three items (e.g., “Most educational research is irrelevant to my teaching practice”; 1 = don't agree at all, 4 = agree completely). Descriptive statistics and reliabilities (McDonald's Ω) can be found in Table 1.¹

Analyses

We used structural equation modeling to analyze the data using Mplus (Version 8; Muthén & Muthén, 2017). Model specification was identical for the field trial and main study data. Access to scientific sources, perceived lack of sourcing skill/time, and familiarity with research methods/statistics were latent predictor variables of appreciation of evidence-based practice and perceived irrelevance of educational research findings, respectively, as latent outcomes. Items were treated as categorical indicators (Brown, 2015). The latent variable of familiarity had a hierarchical structure encompassing research methods/statistics (Mang et al., 2018) and, thus, these subdimensions were included as item parcels (Little, Cunningham, Shahar & Widaman, 2002). Owing to the multilevel structure

of the data (teachers nested in schools), we inspected intraclass correlations (ICCs) as a preparatory step. ICCs ranged between .021 and .225 ($M = .082$) in the field trial and between .018 and .083 ($M = .044$) in the main study. In subsequent analyses, we corrected standard errors for the multilevel structure in Mplus (type = complex; Heck & Thomas, 2015). To account for categorical indicator variables and missing data, we used the WLSMV estimator (Asparouhov & Muthén, 2010; Brown, 2015). We judged effect sizes according to Cohen's criteria (Cohen, 1988; overall R^2 : .02 = small, .13 = medium, .26 = large; β : .1 = small, .3 = medium, .5 = large).

Results

Descriptive statistics

The descriptive statistics (Table 1) suggest that, in this sample, there was no general negative or positive trend in participants' appreciation of evidence-based practice and perceived irrelevance of educational research findings. Yet, there was variability in both assessments as indicated by their standard deviations. Moreover, it appears that participants' appreciation of evidence-based practice was slightly higher than their judgment of educational research findings as irrelevant.

Participants in both the field trial and main study reported having access to at least one or two scientific sources. However, standard deviations suggest that source access varied by plus/minus one source. Thus, some participants indicated having three different options for accessing research findings, while others indicated having just one option.

Table 1. Descriptive statistics of predictors and dependent variables

	Number of items	Range	Field trial				Main study			
			<i>M</i>	<i>SE</i>	<i>SD</i>	Ω	<i>M</i>	<i>SE</i>	<i>SD</i>	Ω
Predictor										
Source access	3	0–3	1.78	0.04	0.95	.85	1.84	0.02	0.97	.85
Perceived lack of sourcing skill/time	3	1–4	2.75	0.03	0.62	.81	2.66	0.01	0.66	.81
Familiarity with research methods/statistics	7	1–4	2.77	0.03	0.66	.89	2.71	0.02	0.69	.89
Dependent variable										
Appreciation of evidence-based practice	2	1–4	2.70	0.02	0.56	.77	2.68	0.01	0.57	.83
Perceived irrelevance of research	3	1–4	2.29	0.03	0.62	.77	2.26	0.02	0.64	.78

Note: Ω = McDonald's Ω .

¹ Slight differences in descriptive statistics presented here and in Mang et al. (2018) are due to different handling of missing data.

On average, participants reported being familiar with basic concepts of research methods and statistics. More than half of participants assessed their familiarity to be above the midpoint of the scale. Concurrently, participants indicated to perceive a lack of sourcing skill/time to search for research findings, with more than the half of them rating their skill/time resources as being rather limited (above the midpoint of the scale). In sum, while participants' assessments of their appreciation of evidence-based practice, perceived irrelevance of educational research findings, and source access did not reflect a clear trend in one direction or the other, participants seemed to assess themselves as being familiar with research methods/statistics and were critical of their sourcing skill and time resources to engage effectively with educational research knowledge.

Effects of predictors on teachers' appreciation of evidence-based practice and perceived irrelevance of research findings

This study sought to explore teachers' source access, perceived lack of sourcing skill/time and familiarity with research methods/statistics as potential predictors of their appreciation of evidence-based practice and perceived irrelevance of educational research findings. Figure 1 displays the results from the structural equation models. Both models (field trial and main study) fitted the data well, according to existing standards (Brown, 2015; field trial: $\chi^2(63) = 125.36, p < .001$; CFI = .983; TLI = .975; RSMEA = .038, 90% C.I. [.028, .048]; main study: $\chi^2(63) = 389.30, p < .001$; CFI = .977; TLI = .967; RSMEA = .045, 90% C.I.

[.041, .049]; see Figure 1). All factor loadings were sufficiently large ($> .5$; field trial: $M = .76, SD = .14$; main study: $M = .78, SD = .14$); thus, the factors were well defined. Explained variance indicated a small to medium effect size for appreciation of evidence-based practice and a medium to large effect size for perceived irrelevance of educational research findings. As the findings are largely consistent across both studies, we present them jointly and highlight occurring differences.

The analyses revealed that better source access had a positive effect on the appreciation of evidence-based practice with a small to medium effect size. However, contrary to our expectation, there was no significant effect on perceived irrelevance of educational research findings.

Although a perceived lack of sourcing skill/time was not associated with lower appreciation of evidence-based practice, it predicted increased perceived irrelevance of educational research findings (medium to large effect size), indicating partial support for our assumption.

The effect of familiarity with research methods/statistics on both appreciation of evidence-based practice and perceived irrelevance of educational research findings was not significant in the field trial. However, in the main study, it had a positive (though small) effect on participants' appreciation of evidence-based practice and a negative (small to medium) effect on perceived irrelevance of educational research findings.

Effects of gender were small and inconsistent across the two studies. The only two effects that proved consistent indicated that male teachers tended to express less appreciation of evidence-based practice than female teachers and made higher judgments of irrelevance of educational research findings.

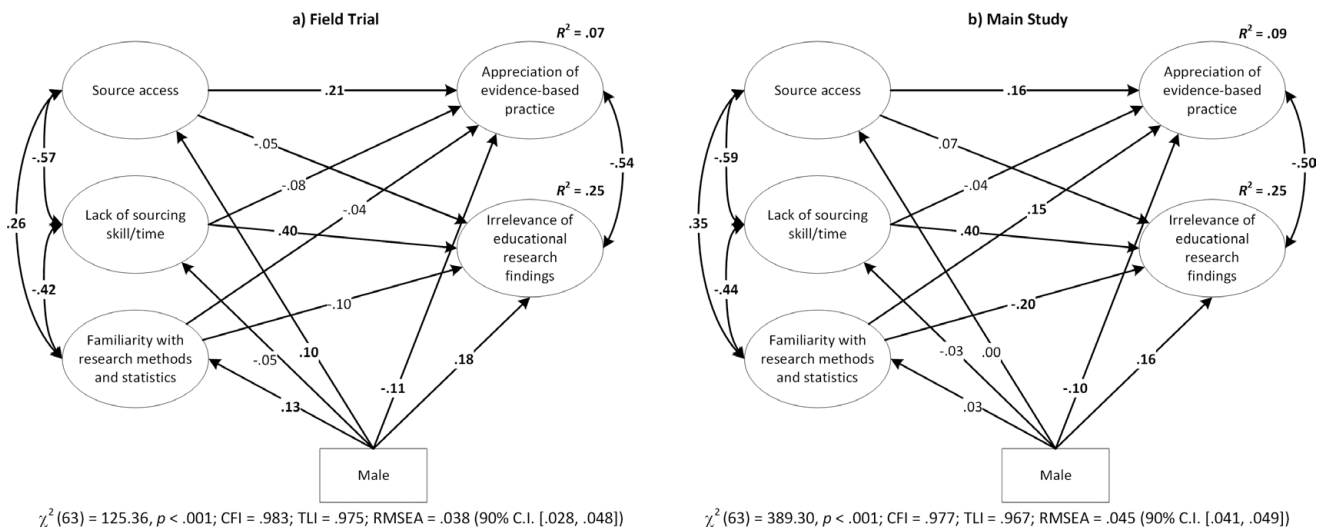


Figure 1. Standardized estimates and model fit for the structural equation models of teachers' appreciation of evidence-based practice and perceived irrelevance of educational research findings onto source access, perceived lack of sourcing skill/time and familiarity with research methods and statistics (measurement models omitted; boldface = $p < .05$): a) $N = 674$ teachers from 99 schools; b) $N = 2549$ teachers from 272 schools).

As expected, we found large negative correlations between perceived lack of sourcing skill/time and both familiarity with research methods/statistics and source access, and a small to medium positive correlation between source access and familiarity with research methods/statistics. Moreover, correlations among the dependent variables (controlling for the predictors) indicated a large negative relationship between appreciation of evidence-based practice and the perceived irrelevance of educational research findings. However, it is to note that the size of the correlation coefficient still suggested both ratings to cover distinct constructs.

Discussion

Summary of the results

Educational research findings are considered an important resource for improving teaching and supporting teachers' professional development (Darling-Hammond & Bransford, 2005; Davies, 1999; EC, 2007; Kwakman, 2003; Niemi, 2008; OECD, 2005; Richter, Kunter, Klusmann, Lüdtke & Baumert, 2011). However, purportedly, teachers rarely consult research findings (e.g., Hemsley-Brown & Sharp, 2003; van Schaik et al., 2018), which raises questions about the value and relevance they assign to educational research knowledge. In this study, we used two large samples of mathematics teachers from PISA 2012, first, to describe the degree to which teachers appreciate evidence-based practice and consider research findings as relevant to their professional practice, and, second, to model relationships between teachers' source access, their perceived lack of sourcing skill/time, and familiarity with research methods/statistics as potential predictors.

Prior research suggests that teachers often possess reservations about findings from educational research (e.g., van Schaik et al., 2018). Surprisingly, the surveyed teachers did not seem to have an overly negative view of evidence-based practice and educational research findings. Scores on appreciation of evidence-based practice as well as perceived irrelevance of educational research findings were located around the midpoints of the respective answer scales, indicating a moderate level of appreciation. Moreover, both ratings were related such that higher levels of appreciation of evidence-based practice corresponded to lower perceived irrelevance of research findings, and vice versa.

Regarding effects of source access, perceived lack of sourcing skill/time, and familiarity with research methods/statistics, the results partly corroborated our expectations. Strikingly, source access affected only teachers' ap-

preciation of evidence-based practice, while perceived lack of sourcing skill/time predicted specifically (but substantially) perceived irrelevance of educational research findings. Participants who indicated better access to scientific sources reported greater appreciation of evidence-based practice. However, contrary to our expectations, participants' perceptions of irrelevance of research findings remained untouched by source access. Hence, it does not seem that better availability and potential exposure to research reduces skepticism about its relevance. In contrast, perceived lack of sourcing skill/time did not affect participants' appreciation of evidence-based practice but did influence their perceptions of irrelevance. The more participants felt their skill and time to search for relevant research findings were constrained, the more they judged them as irrelevant to their practice.

Possibly, this result pattern could be explained by measure characteristics. To measure appreciation of evidence-based practice, participants were asked to make general assessments of whether they consider evidence-based practice important, whereas to measure perceived irrelevance, participants were instructed to assess, for example, whether they would prefer to rely on their own experience or on research findings. In contrast to the former, the latter alluded directly to reception of research findings. If scientific sources were accessible, participants might have valued them as an additional resource for informing evidence-based practice without feeling obliged to actually use them. Therefore, this might have affected participants' general appreciation while not influencing irrelevance perceptions (Martinovic et al., 2012). Yet, when assessing their skill and time resources to find and *actually* engage with research knowledge, participants might have become more critical. Judging research findings to be irrelevant might have then provided a rationale to refrain from reception. That said, judgments of perceived irrelevance might gain additional importance. That is, as the assessment of irrelevance might already imply the *handling* of research findings, it might be more closely related to research reception, a condition shown to strengthen the predictive power for actual behavior (Glasman & Albarracín, 2006; Rousseau & Gunia, 2016).

Participants' familiarity with research methods/statistics affected both their appreciation of evidence-based practice and perceived irrelevance of educational research findings. When participants indicated higher levels of familiarity with basic concepts of research methods/statistics, they expressed more appreciation of evidence-based practice and less perceived irrelevance of research findings. However, the findings must be considered with caution, as significant (small to moderate) effects were observed only in the main study. Moreover, one should keep in mind that the sample consisted solely of

mathematics teachers, who could be expected to have fundamental training in statistics. On average, participants indeed reported high familiarity with research methods/statistics. Therefore, statistics might be less of an obstacle for this specific group of teachers. Nevertheless, the application of research findings to their practice might remain a critical challenge.

In addition, our analyses revealed plausible interrelations between the predictors. The significant correlation between perceived lack of skill and time to find research findings and both source access and familiarity with research/methods might be of particular interest. Both better source access and greater familiarity with research methods/statistics were associated with less concerns about insufficient skill and time resources to search and read research findings.

More research is needed to shed light on the interplay of these variables. Nonetheless, we believe that our results bear the first relevant implications that can inform teacher education and inspire future research. In the following, we will discuss our findings in light of this special issue's scope.

Implications for teacher education

Enabling teachers to access educational research knowledge carries three implications: First, there are opportunities to access scientific sources and teachers are aware of these; second, they have the skill and time resources to refer to relevant research findings; and third, they are able to make use of the retrieved contents (Niemi, 2008; Rousseau & Gunia, 2016; van Schaik et al., 2018). Drawing on our data, one's perceived lack of skill and time to exhaust scientific sources and to find relevant research findings plays a particularly crucial role. Participants who perceived a lack of sourcing skill/time were more inclined to judge research findings as irrelevant and, consequently, might be less willing to engage in research reception (Dagenais et al., 2012; Hemsley-Brown & Sharp, 2003; van Schaik et al., 2018). Concurrently, source access and familiarity with research methods/statistics were strongly correlated with a perceived lack of sourcing skill/time. Though both may have only small direct effects on teachers' appreciation of evidence-based practice and research findings, they may help to mitigate such concerns. In future research, it would be interesting to examine to what degree improved access and familiarity with research methods can help to remedy perceived time constraints.

Prior research has already focused on developing future teachers' competence to reason about scientific evidence and, hence, steps have been made to train individual capacities for research reception (e.g., Trempler et al., 2015;

Wenglein et al., 2015). This study may encourage such efforts by showing that at least some familiarity with basic concepts of research methods/statistics can have positive effects on teachers' perceptions of the value and relevance of educational research findings. Moreover, once such capacities are strengthened, teachers may also feel more competent in research reception and consider it to be less of a burden, which could also increase the chances of them turning to research knowledge now and then.

So far, scant attention has been paid to teachers' skills to actually find and retrieve scientific evidence and their access options. Training student teachers in how to use research findings should go hand in hand with training them in competent sourcing skills. Such knowledge is of high importance because opportunities to consult scientific sources may be very different when one is a teacher student at university versus an in-service teacher at school. At university, teacher students commonly have access to a broad range of scientific sources and are expected to use them. Sourcing activities during teacher training often occur in a setting in which scientific resources are not only more available but are also more preselected (e.g., through coursework). After leaving university, it may be difficult for teachers to access sources of primary scientific evidence. Sourcing activities then become even more important, but also more demanding and more time-consuming, since teachers need to invest greater efforts to identify and carefully select relevant sources. Consequently, future teachers need to be equipped to not only evaluate and use educational research findings but also to *effectively* search and derive them from relevant sources *beyond* university. To this end, improving the accessibility of research knowledge remains an important measure to lower the bar. Simplified source access can mitigate the problem of scarce time resources and additional efforts to approach research knowledge. This also underlines the importance of initiatives to make research findings more accessible for teachers and to present them in a way that facilitates their interpretation (Hattie, 2011; Petty, 2009; WWC, 2020). Furthermore, it may stress the significance of school-related factors that potentially promote evidence-based practice, such as support and a culture for using evidence to improve practice (e.g., enabling access to research resources; Niemi, 2008; van Schaik et al., 2018).

In this study, we aimed to illuminate very basic conditions that precede research reception. It may not be too surprising that one's subjective perceptions of accessibility in terms of skill and time proved to be an important issue regarding research reception. However, our results underline not only its negative effect on teachers' perception of educational research but also ways in which such concerns could be mitigated (even though they may not

be fully resolved). More research is certainly needed to follow up on our considerations. Nonetheless, our findings can contribute to theory building by empirically showing that both necessary affordances in the teachers' environment and individual characteristics must be addressed when modeling teachers' research reception (e.g., Niemi, 2008; van Schaik et al., 2018).

Limitations

Several limitations must be acknowledged. First, on the basis of theoretical assumptions and empirical findings, we modeled source access, perceived lack of sourcing skill and time, and familiarity with research methods/statistics to be predictors of teachers' appreciation of evidence-based practice and perceived irrelevance of educational research findings. Yet, we must note that the cross-sectional design prevents causal inferences and modeling reciprocal effects that may exist between the variables of interest. Therefore, we sought to interpret relationships with due caution and would like to stress the exploratory character of this study. We do not exclude the possibility that different and even reciprocal relationships are thinkable. For example, it could be that teachers judging educational research as useful and relevant, in turn, will know how to access sources of research knowledge (see Cousins & Walker, 2000). More research must be done to clarify potential relations and interactions.

Second, the self-report nature of our measures and the limited number of items that could be administered in the PISA context are problematic. Therefore, we used them mainly for exploratory purposes in this study. At the same time, we must note that the survey data allowed us to base our analyses on samples of considerable size. Though not exhaustive, the data can provide a basis for advancing the theoretical modeling of factors that may affect teachers' reception of educational research. However, in future research, it would be important to validate and complement our findings by also considering process data that mirrors teachers' actual behavior when engaging with educational research (e.g., actual sourcing activities).

Finally, we consider it important to point out yet again that our sample comprised mathematics teachers in secondary education. Therefore, the extent to which our findings can be generalized to teachers of other subjects or school types remains an open empirical question.

These limitations notwithstanding, we believe that our study extends prior research by bringing together relevant conditions that each have received attention but have been infrequently examined in relation to each other. We hope our results will inspire more in-depth studies into the complex interplay of factors contributing to teachers' sourcing and reception of educational research.

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