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Pre-service teachers' knowledge about classroom management from university studies and own schooling experiences—content and effects of their activation

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We investigated two sources of classroom management knowledge in 93 pre-service teachers. The first research question focused on knowledge from university studies, which is thought to be evidence-based knowledge, and whether its use for problem solving in the classroom can be fostered by means of knowledge activation. The experiment showed that knowledge activation did not lead to higher use of knowledge from university studies and better problem solving. The second research question focused on knowledge from own schooling experiences and its content as compared to knowledge from university studies. The pre-service teachers' knowledge from own schooling was strongly focused on simple reactive strategies, only as compared to knowledge from university studies.

KEYWORDS

classroom management, teacher knowledge, schooling experiences, university studies, research-practice gap, prior knowledge activation

1 Introduction

Effective classroom management is an important aspect of successful teaching in schools (Brophy and Good, 1986; Emmer and Stough, 2001; Gettinger and Kohler, 2006; Seidel and Shavelson, 2007). Classroom management is defined as "the specific ways in which teachers organize and maintain a classroom environment conductive to effective teaching and learning" (Balli, 2011, p. 246). Effective classroom management is positively related to student engagement, motivation, and performance outcomes (Kunter et al., 2007; Oliver et al., 2011; Korpershoek et al., 2016). However, managing a class presents a major challenge for teachers, in particular in the early career phase (Veenman, 1984; Pigge and Marso, 1997; Melnick and Meister, 2008; Dicke et al., 2014). Therefore, it is central that teachers are well-prepared for this task and possess the necessary pedagogical knowledge to manage and organize a classroom (Shulman, 1987; Leinhardt et al., 1995; Voss et al., 2011; Postholm, 2013). Teachers' pedagogical knowledge about effective classroom management includes scientific knowledge (evidence-based knowledge) but also practical knowledge (Shulman, 1987). Formal learning opportunities such as courses and lectures in the context of university studies are considered an important source for the development of scientific knowledge (Fenstermacher, 1994; Morine-Dershimer and Kent, 1999; Hoekstra and Korthagen, 2011; Blomberg et al., 2013). Practical knowledge develops mainly through pre-service teachers' own teaching, the

observation of colleagues or their own (K-12) schooling experiences (Fenstermacher, 1994; Korthagen and Kessels, 1999; Levin and He, 2008; Mellati et al., 2015).

Scientific knowledge about effective classroom management is thought to consist of theories about strategies of classroom management that have been empirically tested and evaluated (Korthagen and Kessels, 1999; Emmer and Stough, 2001; Slavin, 2002). However, pre-service teachers seem to rarely use the scientific knowledge that they have acquired through their formal education in their (later) practice (Korthagen, 2007; Allen, 2009; Riley et al., 2010). This has been described as the research-practice gap (Wubbels, 1992; Blomberg et al., 2013) and triggered substantial research into how (pre-service) teachers' use of their knowledge gained from university studies can be fostered. Measures that have been proposed and investigated are, for example, deliberate practice or case-based learning (Bronkhorst, 2013; Zottmann et al., 2013). However, closing the research-practice gap has remained a major challenge (Rycroft-Smith, 2022). Our first overarching research question starts here. We want to investigate a promising measure, knowledge mobilization, to *increase* pre-service teachers' use of their knowledge from their university studies and thereby help close the research-practice gap. Knowledge mobilization means that individuals are asked to bring to working memory all of the knowledge they have in a certain area so that it is available for use in a subsequent learning or problem-solving task (Wetzels et al., 2011; Crooks and Alibali, 2013; Kostons and van der Werf, 2015). This seems to be a very *economical* way to increase the *ad hoc* use of pre-service teachers' knowledge from their university studies in classroom problem solving.

Over and above this, our study is concerned with (pre-service) teachers' practical knowledge about classroom management and in particular their knowledge from their own (K-12) schooling experiences. (Pre-service) teachers' practical knowledge consists of specific encounters with classroom management in everyday teaching. These encounters shape an understanding of effective strategies of classroom management that is, however, not systematically backed up by scientific evidence (Balli, 2011). Thus, the practical knowledge that is developed from these experiences can be but does not have to be in line with what empirical evidence suggests to be effective teaching (Zeichner, 1980; Krause and Stark, 2006; Leikin and Levav-Waynberg, 2007). Teachers' knowledge from their own teaching or from observing that of colleagues has been found to strongly guide their classroom behavior and has been of great research interest (Levin and He, 2008; Allen, 2009). In contrast, pre-service teachers' practical knowledge derived from their own K-12 schooling experiences has less often been studied systematically; qualitative studies (e.g., Calderhead and Robson, 1991) and theoretical claims about its importance and use predominate the literature (e.g., Lortie, 1975; Zeichner and Tabachnick, 1981; Wubbels, 1992; Hoekstra and Korthagen, 2011). In contrast to these theoretical claims, Levin and He (2008) even showed that knowledge derived from K-12 schooling experiences seems to be less important for classroom management behavior than own teaching experiences and university-studies knowledge. Most importantly, knowledge derived from own K-12 schooling experiences has rarely been systematically investigated in terms of its actual content, that is, what classroom management strategies it comprises (*cf.* Balli, 2011). It has often simply claimed to generally not consist of content that is in line with what evidence suggests to be effective teaching (Wubbels, 1992; Balli, 2011). Thus, it is unclear whether and how strongly teacher educators should take up this knowledge for the purpose of professional reflection. Our second overarching research question starts here. We want to investigate the content of pre-service teachers' knowledge from their own K-12 schooling experiences more deeply and compare it to the content of their knowledge from their university studies.

In summary, the aim of our study is two-fold. First, we seek to explore whether explicitly activating pre-service teachers' knowledge about classroom management from their university studies by means of a brief intervention, that is, knowledge mobilization, is effective in increasing pre-service teachers' use of this knowledge and the quality with which they solve authentic classroom problems. Thus, we seek to provide insights into the effectiveness of a method that tries to help close the research-practice gap. Second, we seek to analyze the content of pre-service teachers' knowledge from their own K-12 schooling experiences more deeply. We do so by employing the pre-service teachers' qualitative products of the knowledge mobilization task. In contrast to knowledge derived from university studies, the content of the knowledge derived from own schooling experiences has remained less clear and has been criticized for being very selective (Balli, 2011). Thus, it seems worthwhile to gain deeper insights into the actual content of this knowledge and provide teacher educators with information about how to deal with it in teacher education.

1.1 Scientific knowledge about classroom management: evidence-based strategies of classroom management

Building on cognitive models of information processing, *knowledge* can be understood as information that is stored in long-term memory after it has actively been processed in working memory (Aamodt and Nygård, 1995; Renkl, 2009). *Scientific* knowledge about classroom management is stored information about what theory and empirical research suggest to be effective classroom management (Emmer and Stough, 2001; Korpershoek et al., 2016). According to scientific theory, classroom management comprises different management areas that teachers should know about. These areas are (1) the *instructional and organizational* management, (2) the *behavioral* management and (3) the *social and interactional* management of the classroom (Marzano et al., 2003; Everton and Poole, 2008; Piwowar, 2014). Across these areas, classroom management strategies can be categorized along a timeline as to when they are taken, namely *preventively* or *reactively* (Everton and Poole, 2008) and as to whether they are acute short-term or long-term actions inside or outside the classroom (Piwowar, 2014).

Scientific knowledge about (1) *instructional and organizational management* entails knowing a great variety of preventive teacher actions that have been backed up by empirical evidence (Kounin, 1970; Marzano et al., 2003). Teachers must know how to mobilize the whole learning group and ensure smooth transitions between working phases (Balli, 2011). They must continuously scan the classroom and monitor each student's learning (withitness, overlapping; Kounin, 1970; Piwowar et al., 2013). Procedures give students safety and help to organize classroom activities (Bohn et al., 2004; Everton and Poole, 2008).

The area of (2) *behavioral management* also comprises *preventive* strategies that teachers should know about such as setting rules and

reinforcing positive behavior (Everton and Poole, 2008; Alter and Haydon, 2017). When disruptive behavior occurs, teachers should first use minimal interventions such as non-verbal actions (e.g., moving closer to the student) before they use *reactive* strategies (e.g., verbal warnings) that directly disrupt the instructional process (Kounin, 1970; Everton and Poole, 2008; Hue and Li, 2008). Teachers should avoid harsh punishment whenever possible and the sanctions they use should be fair (Everton and Poole, 2008).

Research has also provided valuable insights into what teachers should know about (3) *social and interactional management*. To build a positive teacher-student-relationship, teachers must know how to demonstrate an adequate level of dominance and an adequate level of cooperation (Evertson and Weinstein, 2006; Wubbels et al., 2006). Being dominant implies having high expectations and being consequent while being cooperative implies having a concern for the students' needs (Marzano et al., 2003). Teachers should emphasize students' responsibility in classroom management and rely on personal rapport to influence student behavior (e.g., private discussions; Glasser, 1990; Everton and Poole, 2008; Balli, 2011). Furthermore, teachers should avoid opposing behavior, this means being overly authoritarian (e.g., get angry easily) but also *laissez-faire* behavior, this means being overly submissive (e.g., being uncertain; Marzano et al., 2003; Wubbels et al., 2006).

1.2 Knowledge about classroom management from university studies

Knowledge about classroom management gained from university courses is thought to be scientific knowledge and thus represent the evidence-based contents described in the previous section (Emmer and Stough, 2001; Slavin, 2002; Merk et al., 2017). However, when it comes to real classroom teaching, beginning teachers often do not act according to what is typically taught at university courses (e.g., Allen, 2009; Franke and Wecker, 2017; Merk et al., 2017). Only individual, specific formal teacher education programs seem to succeed in doing so as shown by longitudinal case studies (e.g., Levin and Ammon, 1996). The general lack of university-studies-knowledge-use in the classroom may have several reasons.

One reason could be that pre-service teachers may neither very frequently encounter scientific information about effective classroom management in their studies (only in a few selected courses) nor repeat already encountered information (Jones, 2006; O'Neill and Stephenson, 2011; Adams et al., 2020). Thus, the evidence-based knowledge they gain throughout their formal studies does not become automated knowledge (De Jong and Ferguson-Hessler, 1996; Renkl et al., 1996). Being automated, however, is an important criterion of high-quality knowledge besides being deep level and well-structured (i.e., information being meaningfully grouped together; De Jong and Ferguson-Hessler, 1996). If knowledge does not become automated knowledge, it has to be consciously and costly retrieved from long-term memory before it can be used in a (real) classroom setting (Gaissmaier et al., 2008).

Another explanation could be the way scientific knowledge is taught at university. University teacher education may not show by means of examples or cases how scientific knowledge translates into actual classroom behavior (Zottmann et al., 2013). This may lead to knowledge compartmentalization. In particular, pre-service teachers are not able to connect what they have learned in formal teacher education about classroom management to real teaching situations because the two aspects are stored in different memory compartments (Renkl et al., 1996).

Besides these gaps in the quality of the knowledge, pre-service teachers may not be motivated to use the scientific knowledge that they acquire through their formal university courses. Possibly, they do not perceive its value for practical classroom teaching when it has not been connected to authentic examples from teaching (Wubbels, 1992; Renkl et al., 1996; Siebert, 2005).

Over and above the described explanations, knowledge about classroom management from university studies has to compete with knowledge derived from other sources when it comes to quick decision making in everyday teaching (Korthagen and Kessels, 1999; Allen, 2009). For example, it has to compete with teachers' practical experiences from their own teaching or from observing that of others.

1.2.1 Activating knowledge from university studies

Different strategies seem suitable to increase pre-service teachers use of their knowledge derived from their university studies. On the one hand, it seems useful to more effectively teach and develop this knowledge by means of effective instructional methods (e.g., case-based learning; Lundeberg et al., 1999) in the first place. On the other hand, it seems useful to explicitly mobilize the already acquired scientific knowledge in relevant situations like everyday teaching and bring it from long-term memory to working memory (Krause and Stark, 2006; Crooks and Alibali, 2013; Kostons and van der Werf, 2015). The latter option seems to be a very economical way to increase the *ad hoc* use of knowledge from university studies. In particular, in knowledge mobilization tasks, individuals are asked to bring to mind all of the knowledge they have in a certain area (Wetzels et al., 2011; Kostons and van der Werf, 2015). Thus, they bring this information from long-term memory to working memory (Gaissmaier et al., 2008). Such memory recall can also have positive effects on the (long-term) accessibility of memory entries (Tempel and Pastötter, 2021).

Research from the area of mathematical problem solving shows that prior knowledge activation is causally linked to how learners encode and solve mathematical problems afterwards (McNeil and Alibali, 2005; McNeil et al., 2010; Crooks and Alibali, 2013). Crooks and Alibali (2013), for example, found that prior knowledge activation of equation patterns influenced how undergraduate students encoded and solved mathematical equivalence problems. Kostons and van der Werf (2015) found that activating prior metacognitive knowledge had a positive effect on text comprehension performance of primary education students whereas prior topic knowledge activation had not. It should be noted that the described activation tasks require that the learners have at least some prior knowledge of a certain quality that they can activate (Kostons and van der Werf, 2015) and that they consider useful.

The presented findings can be transferred to pre-service teachers' ability to encode and solve complex classroom problems. Many tasks of the teaching profession, and in particular tasks of real-world classroom management such as responding to classroom incidents, have been described as problem-solving tasks (Calderhead and Robson, 1991; Feldon, 2007; Choi and Lee, 2009). Thus, explicitly activating pre-service teachers' prior knowledge about classroom management from their university studies could have a positive effect

on how pre-service teachers encode everyday classroom problems (e.g., dealing with student misbehavior) and the degree to which they provide evidence-based solutions to these problems.

1.3 Knowledge about classroom management from own schooling experiences

In contrast to knowledge gained from university studies, knowledge from own (K-12) schooling experiences is knowledge that can be but does not have to be in line with scientific evidence (Zeichner, 1980; Krause and Stark, 2006; Leikin and Levav-Waynberg, 2007). It is knowledge that usually has not systematically been tested or verified by the person who holds it (Fenstermacher, 1994). Real world classroom teaching comprises a great variety of situations that are usually selectively attended to (Balli, 2011). For example, reactive classroom management strategies are more salient than proactive strategies and therefore may more easily be observed and remembered from a student/novice perspective (Balli, 2011; Stahnke and Blömeke, 2021). The actual content of pre-service teachers' knowledge from their own K-12 schooling experiences, that is what they remember and consider useful classroom management strategies based on their experiences as school students, has rarely been investigated in quantitative empirical studies. An exception presents the study by Balli (2011). The author investigated whether pre-service teachers' memories of an excellent teacher (whereby excellent was not further specified) from their own schooling reflect scientific classroom management models [e.g., Assertive Discipline model (Canter and Canter, 1992); Withitness and Group Management model (Kounin, 1970)]. The pre-service teachers had to handwrite their episodic memory on a blank form during an introductory teacher education course. The author showed in their sample of 148 pre-service teachers that own K-12 schooling experiences were most strongly focused on establishing rules (and punishment). Furthermore, they were focused on teachers being firm and strict, partly in an adequate, balanced way. There was a weaker focus on other (preventive) strategies such as smooth transitions or withitness as well as on students' needs and their active role in classroom management. These findings suggest a rather narrow focus of pre-service teachers' own K-12 schooling experiences on behavior management through rules and a lack of consideration of other evidence-based strategies. However, except for this study, there is little research that gives insights into the actual content of pre-service teachers' understanding of classroom management based on their own K-12 schooling experiences.

In contrast to knowledge from university studies, knowledge based on own schooling experiences is claimed to more strongly and implicitly guide (pre-service) teachers' classroom actions (Goodman, 1988; Calderhead and Robson, 1991). This may be explained by the fact that knowledge gained from own experiences is practical knowledge that was built within the context in which it has to be enacted later on (Renkl et al., 1996). Furthermore, it is knowledge that usually has become automated through repeated use or observation (Wubbels, 1992). During their own K-12 education pre-service teachers had plenty of opportunities to observe their teachers dealing with classroom disruptions (Lortie, 1975; Wubbels, 1992). If the assumption is true that knowledge gained from own schooling experiences is rather selective and does not necessarily correspond to scientific evidence, then it would seem problematic if this knowledge strongly guided (per-service) teachers' classroom behavior.

1.4 The present study

In our study, we focus on pre-service teachers' knowledge about classroom management as derived from two different sources: university studies and own K-12 schooling experiences. Knowledge gained from both sources has repeatedly been the focus of research, though partly for different reasons. Knowledge gained from university studies is seldom used in practice by teachers although it is evidence-based (scientific) knowledge (Franke and Wecker, 2017). Thus, research has been concerned with how its use can be fostered. In our study, we draw on a knowledge mobilization task to investigate whether the use of university studies knowledge can be leveraged by means of systematic prior knowledge activation (RQs 1a-c). The underlying assumption is that pre-service teachers have scientific knowledge about effective classroom management stored in their long-term memory but do not automatically use it.

Pre-service teachers' knowledge gained from their own schooling experiences is thought to consist of content that may not be in line with scientific evidence. At the same time, it is thought to be a deeply rooted belief system that implicitly guides teacher action inside the classroom (Wubbels, 1992) although there are also studies that do not support this assumption and show that other sources of knowledge seem more relevant for guiding classroom management behavior (Levin and He, 2008). Exploring the actual content of pre-service teachers' knowledge gained from own K-12 schooling experiences and contrasting it with that of knowledge gained from their university studies seems highly relevant and is another focus of our study (RQs 2a-b). We seek to extend the findings by Balli (2011) as we do not only compare the content of pre-service teachers' own schooling experiences with that of scientific theory but also compare it with the pre-service teachers' individual university-based knowledge. We focus on an early phase in pre-service teachers' university studies, that is, a phase when they still remember events from their own schooling but at the same time have already acquired some scientific knowledge. It seems sensible to investigate the two knowledge sources at a time point when they both may guide behavior and therefore can fruitfully be taken up for reflection and contrasted with each other by teacher educators.

The two clusters of research questions (RQs 1a-c and RQs 2a-b) will be investigated in the context of a joint experimental study design. By means of a knowledge mobilization task, pre-service teachers will be either asked to activate knowledge about an effective classroom manager from their university studies, their own schooling experiences or they will not be asked to explicitly activate any knowledge prior to being confronted with written classroom problems. The effects of activating knowledge from university studies (vs. no knowledge activation) on its subsequent use to solve the written classroom problems and the quality of solutions provided to these problems will be investigated to answer RQs 1a-b. We will also investigate whether having activated knowledge from own schooling experiences negatively affects the use of knowledge from university studies (RQ1c). To answer RQ2, the products of the knowledge activation task will be examined. In particular, pre-service teachers'

descriptions of an effective classroom manager based on their own schooling experiences will be contrasted with scientific theory (RQ2a) and with descriptions of an effective classroom manager based on knowledge gained from university studies (RQ2b).

1.5 Research questions

We investigate the two described clusters of research questions, which we formulate as follows.

1.5.1 Cluster 1: use and potential of knowledge from university studies

> *RQ1*: What are the effects of knowledge activation on pre-service teachers' university studies knowledge use and evidence-based problem solving?
>
> *RQ1a*: Does activating knowledge from university studies have a positive effect on the subsequent use of this knowledge source when solving classroom problems?
>
> *RQ1b*: Does activating knowledge from university studies have a positive effect on subsequently providing evidence-based solutions to classroom problems?
>
> *RQ1c*: Does activating knowledge from own K-12 schooling experiences have a negative effect on the subsequent use of knowledge from university studies when solving classroom problems?

1.5.2 Cluster 2: content of knowledge from own schooling experiences

> *RQ2*: What content does pre-service teachers' knowledge from their own K-12 schooling experiences consist of (at an early time point during their university studies)?
>
> *RQ2a*: Is knowledge from own K-12 schooling experiences in line with what scientific evidence suggests to be effective classroom management?
>
> *RQ2b*: Does the content of knowledge from own K-12 schooling experiences differ from the content of knowledge derived from university studies?

2 Materials and methods

2.1 Sample

The sample consisted of 93 German pre-service teachers (74% female, 2% diverse). Participants prepared for different school types: 35.48% prepared for primary school, 36.56% prepared for lower and middle secondary track, 17.20% prepared for the highest secondary track and 10.75% prepared for special education. Most participants were enrolled in their third or fourth semester of their university studies ($M = 3.47$, $SD = 1.72$). At this point in their studies, the pre-service teachers have already attended a lecture that covers classroom management as one topic among others. Participation in this lecture is obligatory and the lecture must be completed with a written exam. Thus, as the participants study for the exam and attend the lecture they already acquire a fair amount of scientific knowledge about classroom management although they may not have comprehensive knowledge at this stage of their studies.

Participants rated their prior knowledge about classroom management on average to be 41.38% ($SD = 22.46\%$) on a scale ranging from 0 to 100%. In terms of own practical teaching experiences, 15.1% of the participants reported having no prior practical teaching experience, 39.8% reported having teaching experience from school internships, 36.6% reported having both teaching experiences from school internships and a teaching side job (substitute teaching) and 8.6% reported having teaching experiences from a teaching side job (substitute teaching), only.

Data collection consisted of two waves due to organizational reasons. The larger part of the sample ($n = 76$) was recruited from a course in the context of initial teacher education in a German university in April 2019 (wave 2). The other part of the sample ($n = 17$) was recruited from the same German university in November and December 2017 but not within the context of a specific teacher education course (wave 1). The study was implemented fully online and took about 30 min. Participants of wave 2 filled in the questionnaire during a session of the mentioned course; participants of wave 1 filled in the questionnaire in a laboratory at the university. Participants taking part in these two different waves of data collection did not differ in terms of their gender: $\chi^2(2) = 0.95$, $p = 0.62$, semester of university study: $t(91) = -0.63$, $p = 0.53$, school type: $\chi^2(3) = 0.50$, $p = 0.92$ and their self-rated prior knowledge about classroom management: $t(91) = 1.59$, $p = 0.12$.

2.2 Design and procedure

A between-subject experimental design was used to investigate the effects of knowledge mobilization on subsequent university studies knowledge use and the provision of evidence-based solutions to authentic classroom problems (RQs 1a-c). Participants were randomly assigned to one of three different conditions. The pre-service teachers had to activate their knowledge about an effective classroom manager from either what they had learned at their university studies (n = 27), from what they remembered about a specific teacher who had been an effective classroom manager during their own K-12 schooling ($n = 37$) or they did not activate any kind of knowledge prior to being confronted with text-based classroom problems (control group; $n = 29$; Figure 1). In order to keep testing time equal between the groups, the control group was asked to activate their knowledge acquired during their university studies at the end of the experiment (see Figure 1). The activation task was implemented in such a way that the pre-service teachers had to write down all of the aspects they remembered about the appearance of an effective classroom manager, the general teaching methods of an effective classroom manager and the way they dealt with classroom disruptions. Afterwards, the pre-service teachers were asked to write down solutions to five text-based authentic classroom situations describing classroom management problems. After this

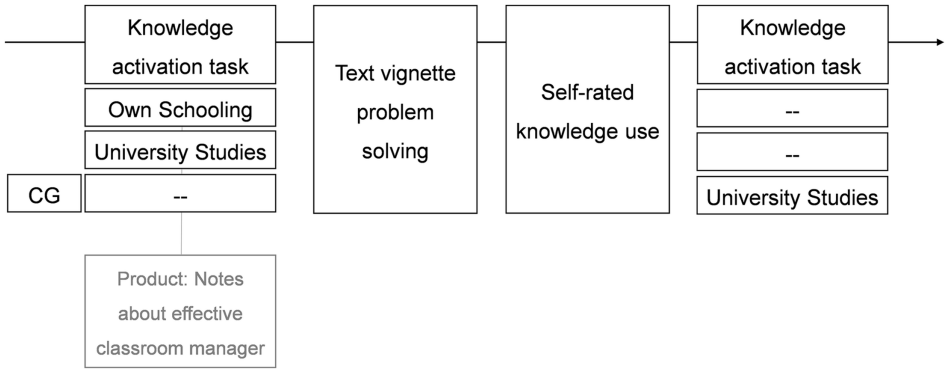

FIGURE 1
Overview of study design. CG, control group.

task, participants were asked to self-report what kind of knowledge source they had drawn upon to solve the problems.

To answer the research questions in cluster 2 (RQs 2a-b), the products of the knowledge mobilization task (written descriptions of effective classroom manager) were analyzed by means of content analysis and compared between the university-knowledge-activation group and the own-schooling-experiences-activation group. In particular, participants' descriptions of the way a classroom manager deals with disruptions was analyzed as it is concerned with classroom management in a narrower sense (see Supplementary material 1.1). Figure 1 gives an overview of the study design.

2.3 Measures

2.3.1 Difficulty of knowledge activation task (implementation check)

The participants were asked directly after the knowledge mobilization task how easy they had found it to activate the respective kind of knowledge. The purpose of this question was to obtain information on whether the knowledge activation task was successful and participants were able to activate the relevant knowledge (implementation check). Furthermore, the question was intended to show whether it was similarly easy to activate knowledge from one's own schooling experiences and from university studies. Participants rated on a six-point Likert scale ranging from 1-very easy to 6-very difficult the following item: "How easy did you find remembering/activating knowledge about how an effective classroom manager deals with disruptions from your own schooling experiences/university studies?"

2.3.2 Knowledge source used to solve the text vignettes

Participants rated on Likert-scale items (1-strongly disagree to 6-strongly agree) which knowledge source they had drawn upon to generate their answers to the text vignettes. The rated knowledge sources were: university studies, practical teaching experiences: internships, practical teaching experiences: side job, own schooling experiences. Of particular interest is the single item that asked whether they had relied on their knowledge from their university studies: "I have solved the text vignettes based on my knowledge from my university studies."

2.3.3 Evidence-based solutions to text vignettes

In order to measure in how far pre-service teachers' used evidence-based strategies to solve classroom problems, a vignette test was used (Baier et al., 2021). Answers were analyzed using quantitative content analysis (Berelson, 1952; Krippendorff, 1989). The test was comprised of five text vignettes describing typical classroom situations from the area of classroom management, such as dealing with classroom disruptions, off-task behavior or aggression (Khasinah, 2017). Examples of these vignettes can be found in Baier et al. (2021). The coding scheme for each vignette included adequate and inadequate options for teacher action according to scientific theory and guidebooks [e.g., Kounin's theory on group management (1970), strategies on how to manage student misbehavior and strategies on how to build a positive relationship (e.g., Emmer et al., 2003; Marzano et al., 2003; Wubbels et al., 2006)]. As the classroom situations were complex, there were always several useful options of teacher action that could be taken in parallel.

A trained master coder segmented the participants' answers into meaningful chunks and subsequently coded them based on the coding scheme. A second trained coder (reliability coder) independently coded 20% of the material to establish interrater-reliability (Syed and Nelson, 2015). Inter-rater reliabilities (Cohen's kappa coefficient) were satisfactory to good for all vignettes: $\kappa_{cv1} = 0.85$, $\kappa_{cv2} = 0.72$, $\kappa_{cv3} = 0.86$, $\kappa_{cv4} = 0.83$, $\kappa_{cv5} = 0.87$. Participants' answers were evaluated based on the coding scheme and subsequently quantified. Participants received one point for each (qualitatively different) correct answer. Participants received half a point for answers that were generally correct, but were not specific to the classroom situation under consideration, slightly less adequate or less elaborated. Participants received no points for wrong answers, i.e., answers that either contradicted scientific theory or answers that were in line with scientific theory but inadequate in the classroom situation under consideration (thus being the wrong application of theory). An excerpt of the coding scheme for one of the vignettes can be found in Baier et al. (2021). For each participant, a sum score was calculated across the five text vignettes ($\alpha = 0.60$).

2.3.4 Content of activated knowledge (own schooling experiences and university studies)

The pre-service teachers' descriptions of an effective classroom manager (i.e., their products of the knowledge activation task) were analyzed using quantitative content analysis (Berelson, 1952;

Krippendorff, 1989) to answer RQ2. The first author developed a coding scheme to classify the pre-service teachers' answers of how a good classroom manager deals with disruptive behavior in the classroom. As participants had either relied on knowledge from university studies to answer this question or on their own schooling experiences, the categories of possible teacher actions were deductively derived from evidence-based guidebooks that also included reports of students about what makes an effective classroom manager (e.g., Emmer and Stough, 2001; Marzano et al., 2003; Kounin, 2006; Wubbels et al., 2006). Based on this literature, the coding scheme mainly included preventive and reactive strategies and acute vs. long-term strategies concerning behavioral management and strategies that emphasize the teacher-student-relationship when dealing with disruptive behavior (social and interactional management). The coding scheme was inductively revised based on the answers of 100 pre-service teachers from another previous university course not related to the sample of the present study. In sum, nine different main categories were developed plus an additional category for answers that lacked any concrete rationale. The nine categories were: 1 = preventive strategies including acute minimal intervention (e.g., non-verbal), 2 = acute reactive strategies: verbal warning, 3 = acute reactive strategies: punishment, 4 = long-term interventions (outside instruction) 5 = cooperative behavior, 6 = dominant/consequent behavior, 7 = fair behavior, 8 = opposing behavior, 9 = *laissez-faire*/submissive behavior, 998 = too vague/not codable.

A trained master coder segmented the material into meaningful chunks. Based on the coding scheme, the participants' answers were independently coded by two trained raters and consensus discussed afterwards. The inter-rater reliability (Cohen's kappa coefficient) was good: $\kappa = 0.81$. The frequency with which each category was named by the pre-service teachers presents the unit of analysis in the further analyses.

2.4 Statistical analyses

In order to analyze the effects of university study knowledge activation on the subsequent self-reported use of this knowledge (RQ1a), an independent samples t-test was conducted that compared the knowledge-activation-from-university-studies group with the control group (no prior activation of knowledge). To analyze the effects of university study knowledge activation on evidence-based solutions to the text vignettes (RQ1b), an independent samples t-test was used that compared the knowledge-activation-from-university-studies group with the control group (no prior activation of knowledge). To analyze potential negative effects of activating knowledge from own schooling experiences on the self-reported use of knowledge from university studies (RQ1c) an independent samples *t*-test was used that compared the knowledge-activation-form-own-schooling group with the control group (no prior activation of knowledge).

Descriptive statistics (category frequencies) and multinomial logistic regression, that compared category frequencies of descriptions of an effective classroom manager between the own-schooling-knowledge-activation group and the university-studies-knowledge-activation group, were used to investigate RQ2a and 2b.

Analyses of variance, chi-squared tests, multinomial logistic regression, an independent samples *t*-test and a Welch-test were used for the preliminary analyses, that is, randomization and implementation check. We set the significance level (alpha) at 0.05.

3 Results

3.1 Randomization and implementation check

The preliminary analyses reported in this chapter serve to rule out potential confounding factors that may limit the valid interpretation of the study's main results. First of all, the three groups did not differ significantly in their self-reported knowledge (self-efficacy) about classroom management prior to the knowledge activation task: $F(2, 90) = 0.08$, $p = 0.92$. Furthermore, the groups did not significantly differ in gender: $\chi^2(4) = 4.64$, $p = 0.33$, semester of university study: $F(2, 90) = 1.09$, $p = 0.34$, school type: $\chi^2(6) = 2.58$, $p = 0.86$ and high-school GPA: $F(2, 88) = 0.61$, $p = 0.55$.

For RQ1a and RQ1b it seemed important to establish that the university-studies-activation group and the control group had the same amount of university-based knowledge about classroom management. If the university-studies-activation group, for example, had more knowledge, then potential positive effects of the manipulation could also be due to that group generally having more knowledge and not due to the activation of this knowledge. We indirectly checked this by inspecting the content of the descriptions of an effective classroom manager generated in the activation task in the two groups. The control group had filled out the activation task after the experiment so that it could not influence their problem solving in the vignette test but also provided us with some insights into their university-studies knowledge about effective classroom management (see Figure 1). A multinomial logistic regression (with 998 as reference category) showed that the groups did not differ in their answers across categories (model fit, $\chi^2(9) = 8.10$, $p = 0.52$) and in the individual categories. In particular, both groups most often named categories 5 (cooperative behavior) and 6 (dominant behavior) which are important aspects of effective classroom management from a scientific perspective (see Supplementary Table 2.1 for more detailed information). Last, we also checked whether either of the two groups seemed to be more committed/motivated to solve the text vignettes by comparing the total number of words the participants wrote in the vignette test. An independent samples *t*-test revealed that there was no difference in the number of written words between the university-studies knowledge-activation group and the control group, $t(54) = -0.28$, $p = 0.78$.

For RQ2b, it seemed important to establish that the activation task had the same difficulty for the own-schooling-experiences-activation group and the university-studies-activation group. An independent samples *t*-test revealed that there was no significant difference between the groups in terms of how difficult they found activating the respective kind of knowledge, $t(61) = 1.23$, $p = 0.23$. Participants in the own-schooling-experiences-activation group as well as those in the university-studies-activation group found it fairly easy to describe how an effective classroom manager/the specific teacher they remembered deals/dealt with classroom interruptions ($M_{own\ schooling} = 3.28$, $SD_{own\ schooling} = 1.09$; $M_{university\ studies} = 2.96$, $SD_{university\ studies} = 0.90$). Furthermore, a Welch-test revealed no

statistically significant difference between the two groups in terms of how many classroom management strategies of an effective classroom manager/their former teacher they listed, $t(43.42) = -1.85$, $p = 0.07$. Participants in the own-schooling-experiences-activation group named on average 2.03 ($SD = 0.92$) different strategies to deal with classroom disruptions and participants in the university-studies-activation group on average 2.59 ($SD = 1.37$) strategies.

3.2 Effect of university study knowledge activation on the use of knowledge from university studies to solve text vignettes (RQ1a)

The results of an independent samples *t*-test revealed that the two groups (activation of knowledge from university studies vs. no prior activation of knowledge) did not significantly differ in their self-reported use of their knowledge from university studies when solving classroom problems, $t(54) = 0.14$, $p = 0.89$, $d = 0.04$. Thus, despite its activation, the university-studies-knowledge-activation group did not report using this knowledge more intensively to solve the problems from everyday classroom teaching (RQ1a). The descriptive results (means and standard deviations) are presented in Table 1. Supplementary Table 2.2 gives an overview of the other knowledge sources that the participants reported having used.

3.3 Effect of university studies knowledge activation on evidence-based solutions to text vignettes (RQ1b)

An independent samples *t*-test was used to test whether the university-studies-knowledge-activation group provided more evidence-based strategies as solutions to the classroom management problems (vignette test) than the no-prior-activation-of-knowledge group (control group; RQ1b). Prior testing revealed two extreme outliers on the sum score in the vignette test in the control group. Therefore, the *t*-test was conducted with and without the two outliers. The analysis with the two outliers showed that the sum score in the vignette test did not statistically significantly differ between the two groups, $t(54) = -0.91$, $p = 0.37$, $d = -0.244$. The descriptive results (means and standard deviations) are presented in Table 1. The results did not change when the two outliers were excluded from the analysis, $t(52) = -0.11$, $p = 0.92$, $d = -0.03$. The results did also not change when the individual vignettes (1–5) were each used as outcome variable and not the sum score in the vignette test (see Supplementary material 1.2). Thus, activating what was learned about classroom management at university did not lead to employing more evidence-based strategies to solve classroom problems.

However, a further multiple regression analysis revealed that, independent of group membership and the number of words written in the vignette test, self-reported university studies knowledge *use* predicted higher sum scores in the vignette test, $\beta = 0.26$, $t = 2.27$, $p = 0.03$, and thus more evidence-based problem solving. This underlines the importance of university studies knowledge for taking evidence-based actions in the face of classroom problems.

3.4 Effects of own schooling experiences knowledge activation on the use of knowledge from university studies to solve text vignettes (RQ1c)

An independent samples *t*-test was used to test whether activating knowledge from own K-12 schooling experiences led to a reduced use of knowledge from university studies as compared to no prior activation of knowledge (RQ1c). In other words, it was tested whether activating a more practical kind of knowledge that has been acquired from everyday classroom situations (own schooling) negatively affects the use of a more scientific kind of knowledge that has been acquired in a formal setting, namely university studies. The results showed no significant differences between the two groups, $t(54) = 0.09$, $p = 0.93$, $d = 0.02$. Thus, activating knowledge from own schooling did not negatively affect the use of knowledge from university studies. The descriptive results are presented in Table 1.

3.5 Content of knowledge from own schooling experiences (as compared to knowledge from university studies; RQ2a-b)

Table 2 shows the category frequencies for the descriptions of an effective classroom manager by the pre-service teachers. The results of the own-schooling-experiences group are of particular interest here (RQ2a). The category, which was most frequently named in this group, was *verbal warning* as an acute reactive strategy to classroom disruptions (36.6% of all answers). This was followed by the category *punishment* comprising 16.9% of all answers. 9.9% of all answers were concerned with some kind of *preventive strategy* to classroom management and 7% with some kind of *opposing behavior*. Thus, the answers of the own-schooling-experiences group had a rather strong focus on reactive, opposing and punishing teacher classroom behavior. The answers were less focused on behaviors that are expected to

TABLE 1 Means and standard deviations of the outcome variables: university studies knowledge use and evidence-based solutions to vignettes (RQ1).

Group (prior activation of knowledge from...)	University studies knowledge use		Evidence-Based solutions to vignettes (sum score)	
	M	*SD*	*M*	*SD*
Own schooling	3.65	1.14	6.03	2.47
University studies	3.67	1.14	5.69	2.79
No prior activation (CG)	3.62	1.35	6.45	3.43

CG, control group.

TABLE 2 Category frequencies of descriptions of effective classroom manager (RQ2).

Group	Frequencies of answers in each category (in %)									
	1	2	3	4	5	6	7	8	9	998
Own schooling	9.9	36.6	16.9	2.8	5.6	4.2	0.0	7.0	2.8	14.1
University studies	11.4	2.9	11.4	7.1	17.1	22.9	8.6	2.9	4.3	11.4

Categories: 1, preventive strategies including acute minimal intervention (e.g. non-verbal); 2, acute reactive strategies: verbal warning; 3, acute reactive strategies: punishment; 4, long-term interventions (outside instruction); 5, cooperative behavior; 6, dominant/consequent behavior; 7, fair behavior; 8, opposing behavior; 9, laissez-faire/submissive behavior; 998, too vague/not codable (e.g., take measures; find a solution).

be particularly effective from a scientific theory perspective, that is, preventive strategies of behavioral management including minimal intervention (Korpershoek et al., 2016) and strategies that communicate an adequate level of dominance and cooperation (social and interactional management; Wubbels et al., 2006).

In a further step, the descriptions of an effective classroom manager of the own-schooling-experiences group were compared to those of the knowledge-from-university-studies group (RQ2b). A multinomial logistic regression, in which the two groups were compared (and 998 was used as reference category), showed that the groups differed significantly in their answers (model fit, $\chi^2(9) = 50.62$, $p = 0.00$). Among the different strategies to deal with classroom disruptions significant group differences occurred for the codes *verbal warning* and *dominance*. The university-studies group named *verbal warning* less often ($B = -2.34$, SE = 0.87, *Wald*(1) = 7.18, $p = 0.01$), OR = 0.096 (95%-CI[0.02, 0.53]) and *dominance* more often ($B = 1.90$, SE = 0.79, *Wald*(1) = 5.80, $p = 0.02$), OR = 6.67 (95%-CI[1.42, 31.23]) than the own-schooling-experiences group. There was no statistically significant difference in any of the other categories between the two groups. For *cooperation*, the difference between the two groups was only slightly above the significance level, $B = 1.32$, SE = 0.75, *Wald*(1) = 3.13, $p = 0.08$, OR = 3.75 (95%-CI[0.87, 16.22]) with the university-studies group descriptively naming this category more often. The comparison in terms of the category *fairness* could not be calculated as this category was not mentioned in the own-schooling-experiences group.

In a last step, we wanted to rule out the possibility that the pre-service teachers' descriptions of an effective classroom manager from what they remembered from their own schooling or their university studies were confounded by their more recent practical teaching experiences (e.g., internships in schools, side jobs). Therefore, we descriptively inspected and contrasted the category frequencies of only those participants who did not report having had any prior practical teaching experiences ($n = 13$). The results are presented in Supplementary Table 2.3. They align well with the results of the whole sample. The largest descriptive differences between the own-schooling-experiences-group and the university-studies-group showed up in category 2 (verbal warnings) and category 6 (dominant behavior).

4 Discussion

The first aim of the study was to gain insights into how the research-practice gap can be closed and pre-service teachers' use of their scientific knowledge from university studies can be fostered by means of a brief intervention, that is, a knowledge activation task (RQ1). The second aim of the study was to gain new insights into the actual content of pre-service teachers' knowledge derived from their own schooling experiences (RQ2). The content of this knowledge had been less clear and criticized for not comprising evidence-based strategies while at the same time implicitly guiding (pre-service) teachers' behavior (Goodman, 1988; Calderhead and Robson, 1991; Balli, 2011).

The results showed that activating knowledge from university studies neither enhanced the self-reported use of this knowledge source when solving authentic classroom situations nor the scientific quality of solutions provided to these situations. The results for RQ2 showed that pre-service teachers' knowledge from own schooling experiences (at an early time point during their university studies) concentrates on easily observable reactive strategies like verbal warnings (and punishment). This contrasts with scientific knowledge from university studies which has a significantly stronger focus on showing dominant (consequent, determined) and cooperative (e.g., empathic, respectful) behavior when dealing with disruptions.

4.1 Interpretation of findings

4.1.1 Effectiveness of knowledge activation task

The results concerning RQ1a showed that the knowledge mobilization task did not lead to higher self-reported knowledge use from university studies when solving authentic text-based classroom problems. This could have several reasons. First, the pre-service teachers might simply not have had sufficient prior scientific knowledge that they could have brought to their mind (Kostons and van der Werf, 2015) as they were on average in the 3rd to 4th semester of their university studies. The participants had named on average two to three strategies an effective classroom manager could apply when dealing with classroom disruptions. These might not have been sufficient to solve all of the complex problems described in the vignettes. Another explanation could be that the pre-service teachers did not perceive their knowledge from their university studies to be helpful for the classroom problems at hand (Korthagen, 2007; Merk et al., 2017). Hence, they did not fully apply their knowledge although it had been activated. Moreover, pre-service teachers might not have known how to translate their scientific knowledge into concrete classroom actions because the two aspects were stored in different memory compartments (Renkl et al., 1996). Another explanation could be that the scientific knowledge was not well-structured into hierarchically organized schemata that would have made it useful for application in complex classroom situations (De Jong and Ferguson-Hessler, 1996). These two latter explanations suggest more profound knowledge quality problems (De Jong and Ferguson-Hessler, 1996) that are not addressed by simply activating the existing knowledge and bringing it from long-term memory to working memory in acute situations (Gaissmaier et al., 2008).

In line with the results of RQ1a, the results of RQ1b showed that mobilizing prior scientific knowledge did not lead to higher quality (evidence-based) solutions to the classroom problems. This is consistent with results from Kostons and van der Werf (2015), who also did not find a positive effect of prior knowledge mobilization on subsequent task performance (text comprehension). However, Crooks and Alibali (2013) revealed a positive effect of prior pattern activation on mathematical equation solving. In contrast to the present study, the authors had activated knowledge about equations that seemed to be deeply rooted in students' early mathematical experiences. This knowledge can be considered deep-level, compiled knowledge that is likely to be activated more easily.

Over and above the knowledge mobilization task, the present study revealed that those pre-service teachers, who reported using their knowledge from university studies more intensively, were better in solving the authentic classroom situations. This underlines that knowledge about classroom management from university studies seems to be scientific knowledge that is relevant for evidence-based strategy implementation in the classroom (Emmer and Stough, 2001; Slavin, 2002; Levin and He, 2008).

The results for RQ1c showed that activating knowledge from own schooling experiences did not have a negative effect on the use of knowledge from university studies to solve complex classroom situations. Thus, activating a more practical kind of knowledge did not reduce the use of scientific knowledge. This could be explained by the fact that knowledge from own schooling experiences was not helpful to solve the concrete classroom problems at hand and thus did not interfere with the use of other knowledge sources. Another explanation could be that different knowledge sources are used rather independently of each other and can be perceived as being equally useful and complementing each other (Levin and He, 2008; Mellati et al., 2015). However, during the course of their studies, pre-service teachers' may also increasingly integrate valid knowledge from different sources (Goodman, 1988).

4.1.2 Content of knowledge from own schooling experiences

The results concerning RQ2a revealed that pre-service teachers' knowledge from their own schooling experiences of how an effective teacher deals with disruptions (as remembered at an early time point during their university studies) is focused on acute reactive strategies like verbal warnings. Verbal warnings and punishment made up over 50% of the answers in this group. These results suggest that knowledge about effective classroom management from own schooling experiences is rather selective and somewhat deviates from what scientific theory proposes to be adequate strategies to behavior management. From a scientific perspective, a stronger emphasis should be placed on preventive strategies including minimal intervention such as non-verbal warnings before verbal reactions are taken in a next step (Kounin, 1970; Hue and Li, 2008; Korpershoek et al., 2016). Overall, the present study seems to support the claims that the content of pre-service teachers' knowledge from their own schooling experiences does not fully align with what scientific evidence suggests to be effective teaching (Wubbels, 1992; Balli, 2011). The strong focus on reactive strategies like verbal warnings in the present study can be interpreted in such a way that this a very easily observable and automatic behavior that seems to be used by teachers in practice quite often when dealing with student misbehavior (Çoban, 2015; Korpershoek et al., 2016; Heikonen et al., 2017). Minimal, non-verbal intervention may remain unnoticed by students, in particular when they are not involved in the disruptive behavior themselves.

In comparison to the study by Balli (2011), which also investigated the content of pre-service teachers' own schooling memories, the present study does not imply a very strong focus on setting rules. It should be noted, however, that the reflection task in Balli (2011) was focused on an excellent teacher more generally and not on how this respective teacher dealt with classroom disruptions. This could explain why the results of the two studies differ to some extent.

In contrast to knowledge from university studies, pre-service teachers' knowledge from their own schooling experiences was less focused on teachers being dominant (being consequent) and cooperative (being empathic) when dealing with disruptions (RQ2b). Showing an adequate level of dominance and cooperation is important for teachers in order to build a positive teacher-student relationship and to influence student behavior positively in the long run (Evertson and Weinstein, 2006; Wubbels et al., 2006; Everton and Poole, 2008). Observing a teacher being consequent when addressing disruptions may require repeated observation and thus seems to be more difficult to observe and interpret. This could explain why the own schooling-experience group named this behavior less often.

Surprisingly, pre-service teachers in both knowledge activation groups did not very frequently mention preventive strategies to behavior management, although prevention of disruptions constitute important aspects of evidence-based classroom management (Emmer and Stough, 2001). This finding may partly be explained by the way the knowledge activation task was constructed. The fact that pre-service teachers were asked to reflect on how an effective classroom manager deals with disruptions may have drawn their attention away from more holistic preventive strategies that include aspects of how to organize the classroom environment and instruction (Everton and Poole, 2008). This may have limited the mention of preventive strategies even in the group that activated knowledge from university studies. Furthermore, not all pre-service teachers may already have had acquired enough knowledge about preventive strategies that they could have activated when asked to remember what they have learned had university. In the own-schooling experiences-activation group, classroom management is implied to be viewed from a learner perspective rather than a teacher perspective. This may make it more generally difficult to come up with preventive actions that usually happen outside of the students' attention like lesson planning and classroom preparation.

4.2 Strengths and limitations

A strength of the present study is the application of a knowledge mobilization task to the field of teacher education and testing it in an experimental design. To our knowledge, the suitability of knowledge mobilization tasks to boost performance outcomes (and not the learning process) has so far not been tested in the field of teacher education. Furthermore, the present study is one of the first to investigate the content of pre-service teachers' knowledge from their own schooling experiences more systematically in a quantitative study. To our knowledge, it is the first study that compares this content with the content of knowledge from university studies.

Despite its strengths, the study has some limitations. First, we did not explicitly assess pre-service teachers' actual prior knowledge from their university studies, which contrasts with other, related studies (e.g., Kostons and van der Werf, 2015). The pre-service teachers' knowledge could only be estimated from their answers to the university-studies-knowledge activation task. However, the control group did not work on the activation task until after the vignette task. Thus, their answers might have been influenced by information from the text vignettes.

Another limitation is that the knowledge mobilization task was slightly conceptually different in the two groups. Participants in the own-schooling-experiences-activation group were asked to remember a concrete teacher and their concrete behavior and not a stereotyped image of an effective classroom manager. As there are many different strategies to effectively manage a classroom, this one teacher does not necessarily have to have used all of them. In contrast, describing a generic classroom manager from what was learned at university makes it easier to assemble all aspects of effective classroom management into a complete picture. This should be kept in mind when interpreting the results of the group comparison (RQ2b).

It should be further noted that only the content of pre-service teachers' knowledge about classroom management was studied and not the type and quality of this knowledge (De Jong and Ferguson-Hessler, 1996). However, different types (e.g., conceptual, procedural, strategic) and qualities (e.g., surface-level, deep-level, declarative, compiled; De Jong and Ferguson-Hessler, 1996) of knowledge may also influence whether the activated piece of knowledge content can productively be applied to a given classroom problem.

Last, the study took place in a university setting. This could have generally increased the use of university studies knowledge in all groups and thus made it more difficult to identify differences between the groups.

4.3 Implications

The present study revealed that a simple knowledge mobilization task was not effective in increasing pre-service teachers' use of their knowledge from university studies to solve authentic classroom problems as compared to a control group. As already discussed, one explanation could be that the pre-service teachers may not have had enough knowledge at this point in their studies. Therefore, future research should try to replicate the present study's findings in a sample of pre-service teachers with a deeper and broader scientific knowledge base and directly assess their degree of prior knowledge some weeks prior to the mobilization task (Kostons and van der Werf, 2015).

Furthermore, future research should find out whether knowledge mobilization is an economic way to increase the *ad-hoc* use of scientific knowledge in a later stage of teacher training, that is, a teacher's first weeks of teaching as a full teacher. At this time point, teachers should have already acquired enough scientific knowledge that can be activated but that at the same time can easily become washed out again by forthcoming intensive practical experiences (Allen, 2009). In general, repeated retrieval of university-studies knowledge from memory by means of knowledge activation may possibly increase the use of this knowledge in the long run as the respective information gets consolidated through repeated recall (Tempel and Pastötter, 2021). Furthermore, knowledge mobilization tasks could be investigated as a tool to not only increase pre-service teachers' use of their classroom management knowledge but also to enhance their learning of new classroom management strategies from texts throughout teacher education. Prior knowledge activation has been demonstrated to increase students' learning from texts and their acquisition of new knowledge (Renkl, 2009; Gurlitt and Renkl, 2010; Hattan et al., 2023).

The present study has further revealed that pre-service teachers' knowledge from their own schooling experiences has a rather strong focus on easily observable reactive strategies. Hence, teacher education programs should broaden and complement these strategies by other strategies. A knowledge activation task could, for example, be used in teacher education to make explicit to pre-service teachers the knowledge that they have and compare it to and contrast it with what is learned at university (Goodman, 1988; Balli, 2011). The fact that the pre-service teachers found the knowledge mobilization task easy enough and that it triggered different descriptions based on which kind of knowledge source was activated shows that such a task may principally be used in teacher education to make pre-service teachers reflect upon their activated knowledge.

In order to train pre-service teachers to more strongly focus on preventive classroom management strategies, classroom videos seem suitable (Gaudin and Chaliès, 2015) as they mimic the way in which pre-service teachers have acquired their knowledge during their own schooling, that is through observation. Such videos can be used to explicitly instruct pre-service teachers to either focus on what the teacher in the video did prior to a disruption (preventive strategies) and what they did afterwards (reactive strategies; Kounin, 2006). Thus, an overly strong focus on reactive strategies that may have been built through observation habits during pre-service teachers' own schooling could be replaced by a professional vision on classroom teaching that more strongly focuses on preventive strategies (Emmer and Stough, 2001; Stahnke and Blömeke, 2021; Wolff et al., 2021). More generally, such videos may help to train the pre-service teachers' ability to *notice* and *interpret* important events in the classroom from an expert perspective (Wolff et al., 2021). They learn to understand and predict how classroom events develop over time and to keep track of multiple events at the same time. In other words, their focus becomes shifted away from single cases of student misbehavior and simply reacting to them (Wolff et al., 2017).

4.4 Conclusion

The present study shows that a knowledge mobilization task is not sufficient to increase pre-service teachers' use of their knowledge from their university studies in critical classroom situations in an early phase of teacher education. However, future research may investigate the suitability of such a knowledge mobilization task to increase scientific knowledge use of (pre-service) teachers that have already acquired a broader knowledge base but that find themselves in critical career phases (e.g., career entry) where knowledge from university studies can easily become washed out again. Furthermore, the present study shows that pre-service teachers' knowledge about classroom management from their own schooling experiences is rather narrowly focused on easily observable reactive strategies. Therefore, pre-service teachers should critically reflect on it and

integrate it with scientific knowledge or other sources of practical knowledge (e.g., own teaching experiences). A better understanding of the actual content of pre-service teachers' knowledge about classroom management and how the productive use of this knowledge can be fostered holds great potential for increasing future teachers' classroom management performance.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The study was conducted in accordance with the local legislation and institutional requirements. Data collection followed the standards of the German Psychological Society (DGPs). Given the type of data collected (i.e. participation did not cause any conceivable harm or discomfort for the participants that exceed their everyday experiences), no ethical approval was considered necessary according to the guidelines at the time when the study started (2017). Participation was voluntary and participants gave written informed consent to participate in the study.

Author contributions

FB-M: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft. MK: Conceptualization, Resources, Supervision, Writing – review & editing.

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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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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1365005/full#supplementary-material

References

Aamodt, A., and Nygård, M. (1995). Different roles and mutual dependencies of data, information, and knowledge – an AI perspective on their integration. *Data Knowl. Eng.* 16, 191–222. doi: 10.1016/0169-023X(95)00017-M

Adams, T., Koster, B., and Brok, P. D. (2020). Student teachers' classroom management during the school internship. *Eur. J. Teach. Educ.* 45, 727–745. doi: 10.1080/02619768.2020.1860011

Allen, J. M. (2009). Valuing practice over theory: how beginning teachers re-orient their practice in the transition from the university to the workplace. *Teach. Teach. Educ.* 25, 647–654. doi: 10.1016/j.tate.2008.11.011

Alter, P., and Haydon, T. (2017). Characteristics of effective classroom rules: a review of the literature. *Teach. Educ. Spec. Educ. J. Teach. Educ. Div. Coun. Except. Child.* 40, 114–127. doi: 10.1177/0888406417700962

Baier, F., Maurer, C., Dignath, C., and Kunter, M. (2021). Fostering pre-service teachers' theoretical knowledge application: studying with and without text-based cases. *Instruct. Sci.* 49, 855–876. doi: 10.1007/s11251-021-09560-7

Balli, S. J. (2011). Pre-service teachers' episodic memories of classroom management. *Teach. Teach. Educ.* 27, 245–251. doi: 10.1016/j.tate.2010.08.004

Berelson, B. (1952). *Content analysis in communication research.* Glencoe, Ill: Free Press.

Blomberg, G., Renkl, A., Sherin, M. G., Borko, H., and Seidel, T. (2013). Five research-based heuristics for using video in pre-service teacher education. *J. Educ. Res. Online* 5, 90–114. doi: 10.25656/01:8021

Bohn, C. M., Roehrig, A. D., and Pressley, M. (2004). The first days of school in effective and less effective primary-grades classrooms. *Elem. Sch. J.* 104, 269–287. doi: 10.1086/499753

Bronkhorst, L.H. (2013). Research-based teacher education: Interactions between research and teaching [Doctoral dissertation, Dutch Interuniversity Center for Educational Sciences, the Netherlands]. Available at: https://dspace.library.uu.nl/bitstream/handle/1874/282740/bronkhorst.pdf?sequence=1

Brophy, J. E., and Good, T. L. (1986). "Teacher behavior and student achievement" in *Handbook of research on teaching (3rd edn.)*. Ed. M. C. Wittrock (New York, NY: Macmillan), 376–391.

Calderhead, J., and Robson, M. (1991). Images of teaching: student teachers' early conceptions of classroom practice. *Teach. Teach. Educ.* 7, 1–8. doi: 10.1016/0742-051X(91)90053-R

Canter, L., and Canter, M. (1992). *Assertive discipline: Positive behavior management for today's classroom.* Santa Monica, CA: Canter & Associates.

Choi, I., and Lee, K. (2009). Designing and implementing a case-based learning environment for enhancing ill-structured problem solving: classroom management problems for prospective teachers. *Educ. Technol. Res. Dev.* 57, 99–129. doi: 10.1007/s11423-008-9089-2

Çoban, A. (2015). Teachers' reactions towards misbehavior in the classroom. *Egitim ve Bilim* 40, 89–102. doi: 10.15390/EB.2015.4520

Crooks, N. M., and Alibali, M. W. (2013). Noticing relevant problem features: activating prior knowledge affects problem solving by guiding encoding. *Front. Psychol.* 4:884. doi: 10.3389/fpsyg.2013.00884

De Jong, T., and Ferguson-Hessler, M. G. (1996). Types and qualities of knowledge. *Educ. Psychol.* 31, 105–113. doi: 10.1207/s15326985ep3102_2

Dicke, T., Parker, P. D., Marsh, H. W., Kunter, M., Schmeck, A., and Leutner, D. (2014). Self-efficacy in classroom management, classroom disturbances, and emotional exhaustion: a moderated mediation analysis of teacher candidates. *J. Educ. Psychol.* 106, 569–583. doi: 10.1037/a0035504

Emmer, E. T., Evertson, C. M., and Worsham, M. E. (2003). *Classroom management for secondary teachers. 6th* Edn. Boston: Allyn and Bacon.

Emmer, E. T., and Stough, L. M. (2001). Classroom management: a critical part of educational psychology, with implications for teacher education. *Educ. Psychol.* 36, 103–112. doi: 10.1207/S15326985EP3602_5

Everton, C., and Poole, I. (2008). "Proactive classroom management" in *21st century education: A reference handbook*. ed. T. Good (Thousand Oaks: SAGE Publication)

Evertson, C. M., and Weinstein, C. S. (2006). "Classroom management as a field of inquiry" in *Handbook of classroom management. Research, practice and contemporary issues*. eds. C. M. Evertson and C. S. Weinstein (Mahwah, NJ: Lawrence Erlbaum Associates)

Feldon, D. F. (2007). Cognitive load and classroom teaching: the double-edged sword of automaticity. *Educ. Psychol.* 42, 123–137. doi: 10.1080/00461520701416173

Fenstermacher, G. D. (1994). The knower and the known: the nature of knowledge in research on teaching. *Rev. Res. Educ.* 20, 3–56. doi: 10.3102/0091732X020001003

Franke, U., and Wecker, C. (2017). The role of experience-based and research-based knowledge in teachers' instructional decision-making. Paper presented at the 17th Biennial Conference of the European Association for Research on learning and instruction (EARLI), Tampere, Finnland.

Gaissmaier, W., Schooler, L. J., and Mata, R. (2008). An ecological perspective to cognitive limits: modeling environment-mind interactions with ACT-R. *Judgm. Decis. Mak.* 3, 278–291. doi: 10.1017/S1930297500002461

Gaudin, C., and Chaliès, S. (2015). Video viewing in teacher education and professional development: a literature review. *Educ. Res. Rev.* 16, 41–67. doi: 10.1016/j.edurev.2015.06.001

Gettinger, M., and Kohler, K. M. (2006). "Process-outcome approaches to classroom management and effective teaching" in *Handbook of classroom management. Research, practice and contemporary issues*. eds. C. M. Evertson and C. S. Weinstein. (Mahwah, New Jersey: Lawrence Erlbaum Associates)

Glasser, W. (1990). *The quality school: Managing students without coercion*. NewYork: Harper & Row.

Goodman, J. (1988). Constructing a practical philosophy of teaching: a study of preservice teachers' professional perspectives. *Teach. Teach. Educ.* 4, 121–137. doi: 10.1016/0742-051X(88)90013-3

Gurlitt, J., and Renkl, A. (2010). Prior knowledge activation: how different concept mapping tasks lead to substantial differences in cognitive processes, learning outcomes, and perceived self-efficacy. *Instr. Sci.* 38, 417–433. doi: 10.1007/s11251-008-9090-5

Hattan, C., Alexander, P. A., and Lupo, S. M. (2023). Leveraging what students know to make sense of texts: what the research says about prior knowledge activation. *Rev. Educ. Res.* 94, 73–111. doi: 10.3102/00346543221148478

Heikonen, L., Toom, A., Pyhältö, K., Pietarinen, J., and Soini, T. (2017). Student-teachers' strategies in classroom interaction in the context of the teaching practicum. *J. Educ. Teach.* 43, 534–549. doi: 10.1080/02607476.2017.1355080

Hoekstra, A., and Korthagen, F. (2011). Teacher learning in a context of educational change: informal learning versus systematically supported learning. *J. Teach. Educ.* 62, 76–92. doi: 10.1177/0022487110382917

Hue, M., and Li, W. (2008). *Classroom management: Creating a positive learning environment*. Hong Kong: Hong Kong University Press.

Jones, V. (2006). "How do teachers learn to be effective classroom managers?" in *Handbook of classroom management. Research, practice, and contemporary issues*. eds. C. M. Evertson and C. S. Weinstein. (Mahwah, New Jersey: Lawrence Erlbaum)

Khasinah, S. (2017). Managing disruptive behavior of students in language classroom. *Englisia J. Lang. Educ. Human.* 4, 79–89. doi: 10.22373/ej.v4i2.1661

Korpershoek, H., Harms, T., de Boer, H., van Kuijk, M., and Doolaard, S. (2016). A meta-analysis of the effects of classroom management strategies and classroom management programs on students' academic, behavioral, emotional, and motivational outcomes. *Rev. Educ. Res.* 86, 643–680. doi: 10.3102/0034654315626799

Korthagen, F. (2007). The gap between research and practice revisited. *Educ. Res. Eval.* 13, 303–310. doi: 10.1080/13803610701640235

Korthagen, F., and Kessels, J. (1999). Linking theory and practice: changing the pedagogy of teacher education. *Educ. Res.* 28, 4–17. doi: 10.2307/1176444

Kostons, D., and van der Werf, G. (2015). The effects of activating prior topic and metacognitive knowledge on text comprehension scores. *Br. J. Educ. Psychol.* 85, 264–275. doi: 10.1111/bjep.12069

Kounin, J. S. (1970). *Discipline and group management in classrooms*. New York: Holt, Rinehart & Winston.

Kounin, J. S. (2006). *Techniken der Klassenführung [Classroom management techniques]*. Münster: Waxmann.

Krause, U. M., and Stark, R. (2006). "Vorwissen aktivieren" in *Handbuch Lernstrategien*. eds. H. Mandl and H. F. Friedrich (Göttingen u.a.: Hogrefe)

Krippendorff, K. (1989). "Content analysis" in *International encyclopedia of communication Vol. 1*. eds. E. Barnouw, G. Gerbner, W. Schramm, T. L. Worth and L. Gross. (New York: Oxford University Press), 403–407.

Kunter, M., Baumert, J., and Köller, O. (2007). Effective classroom management and the development of subject-related interest. *Learn. Instr.* 17, 494–509. doi: 10.1016/j.learninstruc.2007.09.002

Leikin, R., and Levav-Waynberg, A. (2007). Exploring mathematics teacher knowledge to explain the gap between theory-based recommendations and school practice in the use of connecting tasks. *Educ. Stud. Math.* 66, 349–371. doi: 10.1007/s10649-006-9071-z

Leinhardt, G., Young, K. M., and Merriman, J. (1995). Integrating professional knowledge: the theory of practice and the practice of theory. *Learn. Instr.* 5, 401–408. doi: 10.1016/0959-4752(95)00025-9

Levin, B. B., and Ammon, P. (1996). A longitudinal study of the development of teachers' pedagogical conceptions: the case of Ron. *Teach. Educ. Q.* 23, 5–25.

Levin, B., and He, Y. (2008). Investigating the content and sources of teacher candidates' personal practical theories (PPTs). *J. Teach. Educ.* 59, 55–68. doi: 10.1177/0022487107310749

Lortie, D. C. (1975). *Schoolteacher*. Chicago, Ill: University of Chicago Press.

Lundeberg, M., Levin, B., and Harrington, H. (1999). *Who learns what from cases and how? The research base for teaching and learning with cases*. Mahwah: Lawrence Erlbaum.

Marzano, R. J., Marzano, J. S., and Pickering, D. (2003). *Classroom management that works: Research-based strategies for every teacher*. Alexandria, Virginia USA: Association for Supervision and Curriculum Development.

McNeil, N. M., and Alibali, M. W. (2005). Why won't you change your mind? Knowledge of operational patterns hinders learning and performance on equations. *Child Dev.* 76, 883–899. doi: 10.1111/j.1467-8624.2005.00884.x

McNeil, N. M., Rittle-Johnson, B., Hattikudur, S., and Petersen, L. A. (2010). Continuity in representation between children and adults: arithmetic knowledge hinders undergraduates' algebraic problem solving. *J. Cogn. Dev.* 11, 437–457. doi: 10.1080/15248372.2010.516421

Mellati, M., Khademi, M., and Shirzadeh, A. (2015). The relationships among sources of teacher pedagogical beliefs, teaching experiences, and student outcomes. *Int. J. Appl. Linguist. Eng. Lit.* 4, 177–185. doi: 10.7575/aiac.ijalel.v.4n.2p.177

Melnick, S. A., and Meister, D. G. (2008). A comparison of beginning and experienced teachers' concerns. *Educ. Res. Q.* 31, 39–56.

Merk, S., Rosman, T., Rueß, J., Syring, M., and Schneider, J. (2017). Pre-service teachers' perceived value of general pedagogical knowledge for practice: relations with epistemic beliefs and source beliefs. *PLoS One* 13:e0193632. doi: 10.1371/journal.pone.0193632

Morine-Dershimer, G., and Kent, T. (1999). "The complex nature and sources of Teachers' Pedagocial knowledge" in *Examining pedagogical content knowledge: The construct and its implications for science education*. eds. J. Gess-Newsome and N. G. Lederman (Netherlands: Springer)

Oliver, R. M., Wehby, J. H., and Reschly, D. J. (2011). Teacher classroom management practices: effects on disruptive or aggressive student behavior. *Campbell Syst. Rev.* 7, 1–55. doi: 10.4073/csr.2011.4

O'Neill, S. C., and Stephenson, J. (2011). Classroom behaviour management preparation in undergraduate primary teacher education in Australia: a web-based investigation. *Aust. J. Teach. Educ.* 36, 35–52. doi: 10.14221/ajte.2011v36n10.3

Pigge, F. L., and Marso, R. N. (1997). A seven-year longitudinal multi-factor assessment of teaching concerns development through preparation and early years of teaching. *Teach. Teach. Educ.* 13, 225–235. doi: 10.1016/S0742-051X(96)00014-5

Piwowar, V. (2014). *Konzeptualisierung, Erfassung und Entwicklung von Kompetenzen im Klassenmanagement [conceptualization, assessment and development of classroom management competence]* (Doctoral dissertation, Berlin: Freie Universität).

Piwowar, V., Thiel, F., and Ophardt, D. (2013). Training inservice teachers' competencies in classroom management. A quasi-experimental study with teachers of secondary schools. *Teach. Teach. Educ.* 30, 1–12. doi: 10.1016/j.tate.2012.09.007

Postholm, M. B. (2013). Classroom management: what does research tell us? *Euro. Educ. Res. J.* 12, 389–402. doi: 10.2304/eerj.2013.12.3.389

Renkl, A. (2009). "Wissenserwerb," in *Pädagogische Psychologie*. eds. E. Wild and J. Möller (Berlin, Heidelberg: Springer-Lehrbuch, Springer).

Renkl, A., Mandl, H., and Gruber, H. (1996). Inert knowledge: analyses and remedies. *Educ. Psychol.* 31, 115–121. doi: 10.1207/s15326985ep3102_3

Riley, P., Lewis, R., and Brew, C. (2010). Why did you do that? Teachers explain the use of legal aggression in the classroom. *Teach. Teach. Educ.* 26, 957–964. doi: 10.1016/j.tate.2009.10.037

Rycroft-Smith, L. (2022). Knowledge brokering to bridge the research-practice gap in education: where are we now? *Rev. Educ.* 10:e3341. doi: 10.1002/rev3.3341

Seidel, T., and Shavelson, R. J. (2007). Teaching effectiveness research in the past decade: the role of theory and research design in disentangling meta-analysis results. *Rev. Educ. Res.* 77, 454–499. doi: 10.3102/0034654307310317

Shulman, L. S. (1987). Knowledge and teaching: foundations of the new reform. *Harv. Educ. Rev.* 57, 1–23. doi: 10.17763/haer.57.1.j463w79r56455411

Siebert, C. J. (2005). Promoting preservice teachers' success in classroom management by leveraging a local union's resources: a professional development school initiative. *Education* 125, 385–393.

Slavin, R. E. (2002). Evidence-based education policies: transforming educational practice and research. *Educ. Res.* 31, 15–21. doi: 10.3102/0013189X031007015

Stahnke, R., and Blömeke, S. (2021). Novice and expert teachers' situation-specific skills regarding classroom management: what do they perceive, interpret and suggest? *Teach. Teach. Educ.* 98:103243. doi: 10.1016/j.tate.2020.103243

Syed, M., and Nelson, S. C. (2015). Guidelines for establishing reliability when coding narrative data. *Emerg. Adulthood* 3, 375–387. doi: 10.1177/2167696815587648

Tempel, T., and Pastötter, B. (2021). Abrufeffekte im Gedächtnis: Ein Überblick zur aktuellen Grundlagenforschung [Retrieval Effects on Memory: Overview of Current Basic Research]. *Psychol. Rundsch.* 72, 249–258. doi: 10.1026/0033-3042/a000517

Veenman, S. (1984). Perceived problems of beginning teachers. *Rev. Educ. Res.* 54, 143–178. doi: 10.3102/00346543054002143

Voss, T., Kunter, M., and Baumert, J. (2011). Assessing teacher candidates' general pedagogical and psychological knowledge: test construction and validation. *J. Educ. Psychol.* 103, 952–969. doi: 10.1037/a0025125

Wetzels, S. A., Kester, L., and van Merriënboer, J. J. (2011). Adapting prior knowledge activation: mobilisation, perspective taking, and learners' prior knowledge. *Comput. Hum. Behav.* 27, 16–21. doi: 10.1016/j.chb.2010.05.004

Wolff, C. E., Jarodzka, H., and Boshuizen, H. P. (2017). See and tell: differences between expert and novice teachers' interpretations of problematic classroom management events. *Teach. Teach. Educ.* 66, 295–308. doi: 10.1016/j.tate.2017.04.015

Wolff, C. E., Jarodzka, H., and Boshuizen, H. P. (2021). Classroom management scripts: a theoretical model contrasting expert and novice teachers' knowledge and awareness of classroom events. *Educ. Psychol. Rev.* 33, 131–148. doi: 10.1007/s10648-020-09542-0

Wubbels, T. (1992). Taking account of student teachers' preconceptions. *Teach. Teach. Educ.* 8, 137–149. doi: 10.1016/0742-051X(92)90004-M

Wubbels, T., Brekelmans, M., den Brok, P., and van Tartwijk, J. (2006). "An interpersonal perspective on classroom management in secondary classrooms in the Netherlands" in *Handbook of classroom management: Research, practice, and contemporary issues*. eds. C. Evertson and C. Weinstein (Mahwah, New Jersey: Lawrence Erlbaum Associates)

Zeichner, K. (1980). Myths and realities: field-based experiences in pre-service teacher education. *J. Teach. Educ.* 31, 45–55. doi: 10.1177/002248718003100620

Zeichner, K. M., and Tabachnick, B. R. (1981). Are the effects of university teacher education 'washed out' by school experience? *J. Teach. Educ.* 32, 7–11. doi: 10.1177/002248718103200302

Zottmann, J. M., Stegmann, K., Strijbos, J. W., Vogel, F., Wecker, C., and Fischer, F. (2013). Computer supported collaborative learning with digital video cases in teacher education: the impact of teaching experience on knowledge convergence. *Comput. Hum. Behav.* 29, 2100–2108. doi: 10.1016/j.chb.2013.04.014