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Integrating Information from Multiple Texts Relates to Pre-Service Teachers' Epistemic Products for Reflective Teaching Practice

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Integrating Information from Multiple Texts Relates to Pre-Service Teachers' Epistemic Products for Reflective Teaching Practice

Abstract

Integrating information from multiple texts is a core aspect of pre-service teachers' preparation for reflective teaching practice. This study connects research on multiple text use with teachers' epistemic reflexivity. Using qualitative content analysis, we investigate how information is integrated to explain real pedagogical situations in essays by 87 pre-service teachers. Competent text integration was related to a higher number of reflexive statements. These analyses are supplemented with an expert rating, showing that essays with competent text integration were rated higher on the quality of their conclusions for professional teaching practice than those without substantial text integration.

In teacher education in many countries around the world, a combination of university courses and field practice in schools is designed to enhance teachers' reflective abilities to successfully manage the complexities of their professional practice (Korthagen, 1985; Leonhard & Rihm, 2011; McNamara, 1990; Schön, 1983). Such a reflective practice has become a dominant paradigm for the development and improvement of pre-service teachers' professional competencies (Collin et al., 2013). In Germany, the context of this study, reflective practice as part of teacher education has become more popular over the course of the teacher education reform of the last years. Pre-service teachers have to spend a period of several months in schools during their master's program. During this kind of practical placement, they experience classroom situations under real-life conditions that may provide possible entry points for reflection on pedagogical practice. Under the supervision of their university instructors, the goal

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is for pre-service teachers to acquire reflective competencies that scholars believe to be important for their professional development.

However, research has shown that reflective practice in teacher education remains an umbrella term for many different theoretical ideas, making this concept rather ambiguous and contentious (Beauchamp, 2015; Collin et al., 2013). Reflective teaching, according to Beauchamp's (2006) in-depth theoretical analysis, incorporates (among other things) processes of examining, understanding, analyzing, and evaluating certain objects (e.g., practice, experience, or information) with the goal of thinking more clearly, altering strategies, and improving action plans.

Accordingly, pre-service teachers' reflective practices will depend on various cognitive skills and expertise, e.g., teachers' professional knowledge (Shulman, 1986), as well as their ability to retrieve additional relevant information to explain a practical situation. Subsequently, their success in the classroom will depend on their skill in integrating different pieces of information into a more complete picture of the situation, and to draw conclusions from this reflection for their future professional practice (e.g., Cramer et al., 2019; Wubbels & Korthagen, 1990). We have learned from recent educational research that novice teachers face substantial difficulties when they perform such tasks (Hennissen et al., 2017; Kim & Klassen, 2018; Van den Bogert et al., 2014).

With our empirical study, we illustrate how integration of information from multiple sources relates to pre-service teachers' reflective practices. In order to investigate this relation, we propose that many of the cognitive components of reflective practice can be studied through research on multiple text use. The documents model framework (Perfetti et al., 1999) provides the theoretical background for our empirical work. We refer to List et al. (2019) to describe how prospective teachers integrate various types of information when they reflect on pedagogical situations. In so doing, we expand the scope of multiple text integration research to the more

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practical setting of teacher education. This practical context is associated with several features that haven't been the primary focus of multiple text research before. Thus, after presenting key psychological models of and assumptions regarding multiple text use, we introduce the concept of epistemic reflexivity as a key perspective within teacher education. This concept rests on the assumption that teachers are asked to ground their decisions in scientific theories and evidence, as well as in their own experiences and observations (Bromme et al., 2010; Brown & Zhang, 2016; Cochran-Smith & Lytle, 1999; Lunn Brownlee et al., 2017). Hence, epistemic reflexivity, as one specific instance of the broad concept of reflective practice, requires teachers to merge their own practices and experiences with reliable processes to evaluate different sources of information, in order to gain new insights to use in the classroom.

Integration of Information from Multiple Sources

Researchers have described the process of dealing with multiple texts from different sources in studies on multiple text comprehension (List & Alexander, 2017, 2018). One classical model in particular has been widely referred to and expanded in recent years: the documents model of multiple texts (Perfetti et al., 1999). It assumes that when people read multiple texts, they construct two separate mental representations: an integrated mental model, or situation model, representing the core content of the individual texts, and an inter-text model for the contextual components and relations between texts (Who wrote what? Where do sources agree or disagree?). Together, these two representations constitute a *documents model* that provides readers with sufficient information on content, sourcing, and inter-text connections. Britt et al. (1999) describe the establishment of a documents model as one of at least four potential cognitive outcomes of multiple text use. The authors distinguish it from a *separate representations model* (regarding each text in an isolated way), a *mush model* (integrating the content of multiple texts, but omitting sourcing aspects), and a *tag-all model* (the expert version of the documents model in which each source is meticulously referenced; Britt et al., 1999; List et al., 2019). Scholars agree

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that constructing a documents model is challenging since significant effort is required to navigate across various information sources, build connections across texts, and evaluate texts of different quality and trustworthiness (e.g., Bråten et al., 2009; Stadtler & Bromme, 2007; Wiley & Voss, 1999; Wolfe & Goldman, 2005).

The integration of various types of information can also be framed as a central aspect of psychological models of epistemic cognition. One widely known example is the AIR model proposed by Chinn et al. (2014). It specifies aims and values, epistemic ideals, and reliable processes which, altogether, influence and may improve knowledge, understanding, and explanation of topics and situations that individuals reflect on. The integration of multiple sources to form a mental model that is as complete as possible can be classified as an *epistemic ideal*, or a particularly high standard of epistemic cognition. The AIR model further assumes that an individual's epistemic cognition is shaped by their personal aims and values when they are confronted with topics covered by multiple sources, as well as by their beliefs about what constitutes a reliable process for arriving at credible conclusions.

Authors in the field of epistemic cognition further specify that the sources of information that individuals consult to achieve epistemic aims are not limited to merely textual information. In that respect, the AIR model has widened the view of the documents model framework regarding the variety of information needed to establish a mental model of a complex issue. Chinn et al. (2011) listed various sources of information, differentiating between internal (e.g., perception, introspection, memory) and external (authority or testimony) sources. As many authors agree, these sources interact with each other, and an individual knowledge base is built by combining different internal and external sources. Bromme et al. (2010) propose that integrating external sources of information with knowledge generated by the knower can be described as an advanced level of epistemological thinking. The authors question the normative assumption that knowledge constructed by the knower is superior to knowledge acquired by others per se – as

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distributed knowledge and division of cognitive labor are key components of modern knowledge societies (see also Chinn et al., 2011). Therefore, from an epistemic point of view, they value the integration of externally produced and internally acquired knowledge, which is complemented by second-hand evaluative competencies, e.g., the ability to judge the credibility of empirical findings. Individuals with high epistemic sophistication recognize how sources complement each other to support different knowledge claims (Bromme et al., 2008; Chinn et al., 2011; Moshman & Tarricone, 2016). Using data gathered from one sample of university students, Flaig et al. (2018) show that knowledge integration may also support conceptual change in higher education by counteracting a fragmentation of conflicting knowledge representations.

Although psychological frameworks of epistemic cognition and multiple source integration may, in theory, apply to any thematic context, research has revealed various differences between and within individuals with regard to their epistemic stances and beliefs. There seems to be an emerging consensus that epistemic cognition includes domain-related or discipline-specific levels. Generally speaking, disciplines from the natural sciences are widely perceived to be more absolute and less multiplistic than social science disciplines (Buehl et al.,; Rosman et al., 2020). As Joram's (2007) study illustrates, pre-service teachers view educational knowledge as so context-specific that it cannot be generalized to a broader set of teaching situations. Moreover, recent research has shown how pre-service teachers' different sets of epistemic beliefs correspond to their perceptions regarding findings from educational sciences (e.g., Guilfoyle et al., 2020; Merk & Rosman, 2019). For these reasons, the setting of pre-service teacher education seems particularly rich for an empirical investigation of multiple source use with regard to specific classroom situations. As domain-specific epistemic beliefs will be at play during the completion of a multiple source task, they might relate to the outcomes of epistemic tasks involving connecting evidence from sources to teaching practice.

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Alignment of Source Information with Pedagogical Practice – the Case of Epistemic Reflexivity

Understanding and integrating information from multiple texts is one of the core aspects of preparing pre-service teachers for a rationally informed and evidence-oriented teaching practice. As educational policy usually stipulates, teachers are supposed to access and incorporate relevant pedagogical theory and evidence into their instructional methods. Moreover, because teachers can be seen as role models for their students, their proficiency in handling multiple sources of information and relying on the best available evidence in the course of a rational decision-making process leads to positive outcomes for both schools and their own teaching practice (Buehl & Fives, 2016; McGrew et al., 2018; Muis et al., 2006). More generally, this process corresponds to the concept of evidence-oriented practice – originally developed in the domain of medicine – in which practitioners integrate the best available external evidence with their individual professional practice and experience to meet their clients’ needs (Sackett et al., 1996). This goal of integrating external and internal sources is especially valuable for a field like education, where robust evidence supporting specific instructional practices is still scarce, and professional methods are inextricably linked to local conditions (e.g., Brown & Zhang, 2016; Burkhardt & Schoenfeld, 2003; Stark, 2017). Hence, for any individual teacher at work, multilayered contextual factors mediate the effectiveness of any educational practice executed in a single classroom. Consequently, teachers need to be qualified to interpret new information while, at the same time, considering their individual experiences with and observations from comparable pedagogical situations to find the best possible solution for an instructional problem. This process of knowledge integration and inquiry as part of a teaching practice has been described as a “knowledge of practice” (Cochran-Smith et al., 2014; Cochran-Smith & Lytle, 1999), and has recently been further elaborated with frameworks describing teachers’ epistemic reflexivity (Cramer et al., 2019; Lunn Brownlee et al., 2017).

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Lunn Brownlee and colleagues (2017) drew on the AIR model of epistemic cognition by Chinn et al. (2014), and proposed the concept of epistemic reflexivity, which is closely related to integrating different sources of information with regard to professional teaching practice. In their 3R-EC framework, the authors suggest that pedagogical situations can stimulate an internal dialogue that merges teaching practices and experiences on the one hand, with reliable processes for evaluating different sources of information on the other, all in order to achieve epistemic aims and lead to considered courses of action in classrooms. Their assumption corresponds to Fives and Buehl's (2010) finding that, in making a plan of action, teachers consider various internal and external sources of knowledge, ranging from formalized bodies of knowledge to observational, interactive, and enactive experiences (memorized personal actions). Buehl and Fives (2016) state that pre-service teachers "are exposed to a large array of content, but have a limited schema to house that information" (p. 13), whereas practicing teachers may either show a higher integration of content to schema, or may be limited by their current perceptions of a single context. Following this line of argumentation, pre-service teachers' practical experiences – when supervised by university staff – can provide an entry point for influencing students' epistemic cognition by widening their views of a particular classroom situation through the integration of various sources of information.

Cramer and colleagues (2019) argue in the same direction. They propose a prototypical sequence of teacher education with the goal of enhancing teachers' epistemic reflexivity. They characterize a competent teacher as a person who knows about teaching-related theoretical concepts and empirical evidence, is able to critically reflect on their explanatory values and limitations, and on possible interrelations among them, and can refer to these external bodies of knowledge to interpret school situations in a careful and context-sensitive manner. Based on these interpretations, teachers subsequently generate rationales for action that may be used to enhance professional decision-making. According to their model, teachers acquire epistemic

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meta-reflexivity in a six-step sequence (see Figure 1). The first three steps are situated within the context of teacher education at university. However, as pre-service teachers enter schools, for example via practical placements, they need to broaden their views to fit the complexity of real-life school situations. The authors therefore suggest three further steps situated in the context of school practice, including a reflection on how pedagogical practice can be interpreted with regard to theories and evidence, while at the same time noticing the boundaries between scientific approaches and the inherent uncertainty of pedagogical practice. The last two steps of this model address teachers' conclusions for their professional practice, assuming that integration of various pieces of knowledge supports the weighting and justification processes used to align externally acquired information with individual pedagogical decisions. Following this line of argumentation, the integration of multiple approaches, various explanatory works, theory and evidence could possibly serve as a method for prospective teachers to acquire a state of epistemic reflexivity that allows for professional reflection on complex pedagogical situations.

Insert Figure 1 around here.

This approach fits well with the framework of teachers' epistemic cognition created by Buehl and Fives (2016) in at least three ways. First, both emphasize the importance of specific tasks and domains for teachers' professional learning, which ideally contribute to teachers' epistemic aims. Second, both highlight the importance of reliable processes, e.g., source evaluation and justification, for the acquisition of new knowledge about teaching and learning (Chinn et al., 2011; 2014). And third, both models imply two kinds of products that may result from an epistemic processing of teaching issues. The first kind of product is called an *epistemic stance*, which comprises "the attitudes that people take with respect to an idea, such as believing it, doubting it, tentatively endorsing it, holding it as absolutely certain, or entertaining it as a possibility" (Chinn et al., 2011, p. 142). The second kind of product reflects the importance of epistemic processes for a future professional practice. According to Buehl and Fives (2016), an

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“epistemically informed praxis in teaching is the enactment of instructional decisions informed by the process of epistemic cognition” (p. 15). In the recognition of schools and classrooms as complex systems, affected by local circumstances, uncertainty, and unpredictability, teachers can construct an integrated knowledge base that merges situated experiences and externally acquired information to create possibilities for agency and action in the classroom (Alexander, 2017; Cochran-Smith & Lytle, 1999; Cochran-Smith et al., 2014).

Purpose of the Study and Research Questions

In our study, we connect the theoretical strands of multiple text use and epistemic reflexivity to address the practical context of teacher education. To do this, we analyze pre-service teachers’ reflective practice when they encounter real-life classroom situations. We limit our analysis to practical situations that were experienced and chosen by the participants of the study themselves. This decision was made in consideration of the component of epistemic value in the AIR model by Chinn and colleagues (2014), since we assume that individuals are likely to process information more thoroughly when the topic is significant to them (List & Alexander, 2017). This decision also resonates with Collin et al.’s (2013) view that a concrete, practical situation provides an appropriate entry point for reflection (p. 106).

In our research on multiple text use, we first explore how pre-service teachers integrate multiple external text sources when they try to explain what happened in a particular pedagogical situation. In accordance with List et al. (2019), we investigate specific indicators of multiple text integration in prospective teachers’ written explanations of that situation, and categorize them according to the four forms of documents model formation described by Britt et al. (1999), and Perfetti et al. (1999). After presenting a rationale for quantifying these types of text integration in our sample, we illustrate two prototypical types of high and low textual integration (document model type and separate representations type) using two contrasting case examples.

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Furthermore, we connect these two types of high and low integration to indicators of epistemic reflexivity displayed in participants' essays (Cramer et al., 2019; Lunn Brownlee et al., 2017), investigating the hypothesis that integration of various sources of information is related to prospective teachers' epistemic stance (Buehl & Fives, 2016). This step begins with a quantitative analysis by comparing epistemic stances in essays of high and low integration, and will be complemented by an in-depth illustration of the two contrasting cases.

Finally, building on models of teachers' epistemic reflexivity for their professional practice once more, we investigate Cramer et al.'s (2019) assumption that integration of various types of information is likely to enable students to arrive at better conclusions as part of an epistemically informed practice. We cannot prove the causal inference suggested by the authors of the model, but we use an expert rating procedure to evaluate the conclusions for their future professional practice that prospective teachers drew from their reflection on the pedagogical situation, and connect this rating to prospective teachers' multiple text integration.

Method

Context of the Study

This study is situated within a teacher education program at a mid-size German university. During their master's degree studies, pre-service teachers spend a five-month practical training period in schools in the local area. These placements are designed to connect the knowledge students have acquired in their university courses with the conditions of practical school situations. In a preparatory course at the university, students are provided with the tools to evaluate and reflect on their practical experiences in the context of the knowledge they've acquired at university. During their placements, prospective teachers are supervised directly by experienced teachers and teacher educators. At the same time, they are supervised remotely by their university instructors; they hand in assignments and receive frequent feedback. One of these reflective assignments is used in the present study to gain insight into prospective teachers'

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multiple source integration. Two of the authors of this study are university instructors who conduct preparatory courses and subsequently supervise the practical teaching phase remotely.

Sample

Participants in the study were 87 students in master's courses for teacher education, preparing for teaching positions in secondary schools ($M_{Age} = 26.41$, $SD_{Age} = 2.59$). Sixty-three percent of the sample were female (corresponding roughly to the gender distribution in the teaching population in Germany and other European countries; European Commission, 2015). On average, students were between their second and third semesters in the master's program. All of them had attended courses in the fields of teaching and instruction, student learning processes, and educational diagnostics. The combinations of teaching subjects were diverse; each student studied at least two main school subjects, which is obligatory in teacher education in Germany. At the time of the assessment, all participants were in their five-month placements at a public secondary school. The students were from six different preparatory courses at the university, and about 90% of these course attendees participated in the study. The essays that we analyzed for the study were part of their regular coursework. No incentives were given to the students. All participants provided written consent to participate in the study prior to sending their essays to their university instructor. Adherence to the regional and federal privacy protection guidelines, including anonymity in all publications, was assured.

Essay Task

The essays that we analyzed for this study were written by pre-service teachers during their practical training placements in secondary schools. Before entering the practical phase, they took part in a preparatory university course where they were introduced to the spiral model of reflection (Korthagen, 1999). To practice this reflective procedure, the instructors used video materials documenting real-life school situations. Students were instructed to write down

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essential characteristics of the pedagogical situation, and to formulate possible explanations for the situation using multiple external references. Additionally, they were provided with guidance on how to search for external sources in scientific databases. Following Korthagen's cyclical approach, they were encouraged to use these external sources to arrive at practical conclusions and alternative methods for constructing an action plan in comparable practice situations. The students' instruction and training therefore taught them to include three aspects in their reflections: (a) the objective description of a pedagogical situation, (b) the explanation of that situation referring to different external texts, and (c) the formulation of a conclusion for their own professional teaching practice. Participants were explicitly told to refer to scientific literature, including empirical studies, and include these in their explanation of the situation.

After pre-service teachers had actually entered their practical training phase, they were given an assignment that required them to pick a pedagogical situation from their school practice for deeper reflection according to the schema learned in the preparatory course. Each of the participants submitted a written product in the form of an essay including a description, explanation, and conclusion for a self-selected pedagogical situation. These essays were, on average, approximately four typed pages in length.

Analyses and Coding Procedure

Our research approach for this study was a modification of qualitative content analysis for cognitive processes and products, following the guidelines proposed by Chi (1997) for the analysis of linguistic data. To ground our work in previous research, we based the coding framework for multiple source integration on the work by List et al. (2019), and that for epistemic reflexivity on the model by Cramer et al. (2019). In addition, we implemented an expert rating procedure to quantify the quality of students' conclusions for an epistemically informed teaching practice. The following paragraphs describe the various steps of the analysis in detail. All coding steps were conducted by one of the authors together with a student research

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assistant to ensure high inter-coder reliability throughout the entire process. Each step was discussed and approved by the whole research team.

Coding Procedure for Multiple Source Integration

Step 1: Coding External Sources in Prospective Teachers' Essays. First, content analysis was applied to code the external sources that students used in their essays to explain a practical teaching situation. Information sources were categorized as follows: scientific literature (e.g., handbooks, university textbooks), empirical studies, or non-scientific documents (e.g., political documents, practical teaching guidelines, newspaper articles, non-scientific websites). All sources were coded by two independent coders (Cohen's kappa = .74).

Step 2: Segmentation of Integrative Statements. Two coders worked through all essays to identify segments with external source use. A segment of potential source integration was marked when more than one source was mentioned in a meaningful unit. When 30% of the material was analyzed for consistency, 80% of the segments marked by the independent coders were identical. Unclear cases were discussed to reach consensus.

Step 3: Coding Integration of Multiple Sources and Source-tagging. Each of the segments was then coded independently by two coders according to the scoring rubric created by List and colleagues (2019). In this process, we distinguished explicit forms of document integration from implicit ones. Furthermore, we added a category of *pseudo integration* that was applied when two or more ideas referring to different sources were mentioned but were only connected by words such as supplementary or additionally, without specifying any further relation between the two sources. Cohen's kappa for source integration was .85.

In addition, we coded whether or not external sources were referenced in an explicit and unambiguous manner. When all sources mentioned within an integrated statement were fully referenced, we coded the statement as *correctly tagged*. When some references were clearly stated while others were not, we coded this segment as *partly tagged*. When references were

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mostly missing or flawed, we coded the segment as *untagged*. Cohen's kappa for source-tagging was .73.

Step 4: Types of Multiple Source Integration. After coding students' integration of external sources and their use of tags, we aggregated these codes to describe the kind of overall integration model (Britt et al., 1999) students used to support their explanation of the pedagogical situation. A separate representations model was coded when essays showed either no or just pseudo integration, regardless of the tagging displayed by students. A mush model was coded in essays that showed implicit and/or explicit integration of two or more external sources, using tags that were mostly flawed or missing completely.

Because both the documents model and the tag-all model are defined by integration of information from different sources as well as correct tagging, we had to specify additional criteria to arrive at a clear categorization for each essay. We compiled a list of four criteria for tag-all model texts:

1. a comparatively high number of integrative statements (1.5 SD above the mean for texts with at least one integrative statement);
2. at least 90% of the sources that were listed in the references were covered by either one or more integrative statements of the essay, therefore displaying an exceptionally rigorous integration of source information;
3. no integrative statements that lacked references to their information sources;
4. and no more than a quarter of integrative statements exhibiting flawed or ambiguous tagging of sources.

Texts that showed relatively high integration and correct tagging, but did not meet the high threshold of all the above-mentioned criteria, were coded as documents model.

Furthermore, as some of the essays only used a single external source to explain the pedagogical situation, we created an additional code of a *one-document model*.

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The rationale for the classification of multiple text models is displayed in Figure 2. See also Table 1 for coding examples of integrative statements and tagging.

Insert Figure 2 here.

Coding Procedure for Epistemic Stance

In a similar procedure to that described for coding the integration of sources, we first identified segments in which information from external sources was applied to or connected with the pedagogical situation. For each segment, we applied a dichotomous code evaluating students' epistemic stance. Following Lunn Brownlee et al. (2017) and Cramer et al. (2019), we coded statements that displayed a schematic application of a theory or research finding to a specific practical situation as *lower reflexivity statements*. These statements revealed a linear view of how information from external sources could be transferred to an individual pedagogical situation. In these statements, teachers' or students' actions in a situation were classified as right or wrong, according to a theoretical approach or an empirical finding. In *higher reflexivity statements*, an application of external source information to a specific situation was also present. However, these statements displayed a more nuanced and considered view of its applicability, generalizability, or appropriateness, reflecting on unique features of the situation, or differences between the situation and information presented in the source. Coding examples are provided in Table 1. Coder agreement amounted to 77.3% for this dichotomous code. Unclear cases were resolved through a discussion between coders. For the analyses presented in the subsequent sections, we computed a mean score for each essay to reveal how many higher reflexivity statements were formulated on average by each student. The same procedure was applied to the amount of lower reflexivity statements in each essay.

Expert Rating of Pre-service Teachers' Conclusions for Educational Practice

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To rate the quality of conclusions for future classroom strategies that prospective teachers drew from their reflections, we applied an expert rating procedure. Because of the variety in the topics of the essays and the ensuing differences in the written practical conclusions, we decided to obtain overall evaluations from educational experts. Thirteen experts were selected on the basis of their professional experience as teacher educators, seven of them working at universities (71 % female; professional experience $M = 8.33$ years), and six working in schools (83 % female; professional experience $M = 16.4$ years). After reading the description of the situation and the concluding paragraph of the essay, experts judged the overall quality of the conclusions about future classroom strategies that prospective teachers drew from their literature-based reflection (ranging from 1 = low quality to 5 = high quality). We deliberately did not specify the criteria the experts should use to make their judgments. Expert ratings were rotated so that each essay was evaluated by at least three experts. Agreement among the experts was tested on approx. 30% of the sample material and amounted to an ICC of .84, indicating a moderate to a strong consensus between experts.

Results

Sources in Pre-service Teachers' Essays

On average, pre-service teachers used four different textual sources in their written explanation of a pedagogical situation. About two thirds of the essays contained sources from scientific books (67%) and/or non-scientific documents (70%). Thirty-seven percent of the essays included references to empirical studies. About half of the participants included sources from two of the categories above. Fifteen percent included sources from all three categories.

Types of Multiple Source Integration

Of the 87 essays, 35.6% were categorized as the documents integration (DI) type, displaying content integration and correct tagging of multiple sources. We classified 12.6% as a mush model type, indicating content integration without correct tagging. The remaining 51.8% of

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the sample showed no or largely incomplete integration of multiple sources, either because only one source was used to explain the practical situation (12.7%), or because they corresponded to the separate representations (SR) type (39.1%). None of the essays in our sample could be categorized as the tag-all model type.

Contrasting Case Examples: Separate Representations and Document Integration

To illustrate the process of analysis, we selected two essays with similar topics for a more detailed presentation. We chose one essay by a pre-service teacher we will call “Tim” that fell into the separate representations category, and – as a contrasting case – one by “Nina” that was categorized as a documents model type. In both essays, pre-service teachers described a situation in which an experienced teacher, their mentor in their placement, asks them for their own evaluations of student participation at the end of a school term. This is a common teaching practice in the German school system, as teachers are required to grade the quantity and quality of each individual student’s participation throughout a school year, which is then merged with the grades from written examinations to arrive at a summative grade. Initially, both pre-service teachers experienced some difficulty with these evaluations, as shown in the following excerpts. This difficulty can be regarded as the entry point, resulting in an epistemic aim to reflect more deeply on the pedagogical situation.

Case A (Tim): “Because I wasn’t prepared to grade students’ participation, I had to make a spontaneous judgment.” (lines 6-7)

Case B (Nina): “However, it was surprisingly difficult to grade students’ oral participation off the cuff.” (lines 10-11)

Moreover, in Nina’s case, she explicitly stated at the beginning of the essay that this grading situation was relevant to her future professional practice: “The question came to my mind of how

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fair such a grading actually is (...), especially since our whole school system is based on grades and thus a teacher has a big responsibility when grading students” (Case B, lines 20-24).

Both essays described the fact that neither they as teacher trainees nor the experienced teachers had detailed documentation of students’ participation in each hour of class that they could refer to when determining an average grade. Besides this similarity in observations, each of the cases also emphasizes a specific focus on grading students’ verbal participation. In case A, Tim pointed out that some of the students in class showed a relatively high amount of disruptive behavior, and he wasn’t sure if he should take this behavior into account when grading them.

In case B, Nina focused on the relatively large differences in judgment that came up when Nina and the experienced teacher talked about the grades they had given to individual students.

After describing the situation, both prospective teachers tried to explain these situations using external information sources. Even though both authors based their explanation on information from scientific textbooks and non-scientific documents, they differed in their attempts to combine these sources into an integrated explanation.

In case A, two separate strands of explanation could be identified. First, Tim explained the assessment of student achievement in terms of different forms of comparisons that a teacher can make. To do this, he referred to a scholarly article:

First, it should be noted that assessments can be based on different methods of benchmarking. We distinguish between social (relating to a reference group), intraindividual (relating to prior achievements of the individual), and criterion-based (relating to an absolute standard) benchmarking (Rheinberg, 2000). (lines 24-27)

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Tim applied knowledge acquired from a source to his situation and noted that, since he does not have any information on the students' prior grades or the standards they are meant to achieve, he could only refer to a social benchmark. He also listed some concrete proposals for how teachers could grade students fairly and objectively.

After this short discussion Tim moved on to explain the two functions of grading, differentiating between summative and formative assessment, and citing a national report on the Austrian educational system: "Schmidinger, Hofmann, and Stern (2015) introduce the two sides of assessment when they write about the summative and formative aspect of grading" (lines 51-53). This reference was followed by a direct quote from a different source:

Two different, quite antinomic roles are ascribed to teachers; and these roles are difficult to unite: on the one hand, the role of the expert, who passes their professional judgement in a summative fashion, and on the other hand, the role of the coach, who supports the students' learning and assesses achievements in a formative function (Nolding & Eder, 20, p. 59) (lines 53-56)

An example of flawed tagging also appeared in this statement. The quoted source is not included in the reference list at the end of the essay, and it is not clear what the number 20 means.

Tim then discussed the merits and drawbacks of including the social conduct of students in their grades without mentioning any textual sources. A few sentences later, he cited an article from a teachers' union magazine: "Conduct grades are always controversial, as is shown in the discussion in Trautwetter (2007)" (lines 61-63).

No connections between the various strands of explanation – different benchmarking methods; summative vs. formative assessments; antinomic teacher roles – and the cited sources were

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established throughout the essay, characterizing this essay as a separate representations (SR) type.

In case B, Nina initially used empirical evidence as she cited a scientific textbook to show that student performance is often graded differently by different teachers. She then connected this finding to the assumption that every human judgment is influenced by individual psychological processes, referring to a review of empirical studies in an online source: “Every human judgement is influenced by unconscious psychological processes, which has been proven in numerous psychological studies (see Kerbel, B., 2016)” (lines 38-40).

In the following sentence, using a third source (a guidebook for teachers), she described various judgment biases that could help to explain the psychological processes that led to the differences between her judgments and those made by her teaching mentor: “A number of different effects that influence evaluations can be named in this regard, of which Oelker (2001) listed the following biases as the most important [...]” (lines 40-41).

In this segment, Nina presented the biases she cited from the guidebook as a subset of the aforementioned unconscious psychological processes and integrated the information taken from both sources by explicitly connecting both sentences (“in this regard”). Because such connections were established between various sources, this case was classified as a document integration (DI) type. Some minor errors in tagging mean that it could not be coded as a tag-all case.

Multiple Source Integration and Epistemic Stance

To test the hypothesis that multiple source integration may relate to prospective teachers’ epistemic stance, we compared the mean scores of higher reflexivity statements in the two essay types (SR and DI) via an independent-samples t-test. Because of the relatively small number of mush types ($n=11$), we had to omit these essays from the analysis. This led to a sample of 60

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essays ($n=31$ SR, $n=29$ DI). There was a significant difference in the mean epistemic reflexivity scores for the SR type ($M=.52$, $SD=.85$) and DI type ($M=1.48$, $SD=1.99$); $t(58)=-2.414$, $p = .021$).

We also conducted a similar t-test for the lower reflexivity statements. For these statements that displayed a linear transfer of content from a source to a practical situation, without any reflexive elements, no significant differences in mean scores were revealed when comparing the SR type ($M=3.52$, $SD=2.31$) and DI type ($M=4.34$ $SD=2.88$); $t(58)=-1.223$, $p = .222$.

Contrasting Case Examples: Pre-Service Teachers' Epistemic Reflexivity

Excerpts from the translations of Tim's and Nina's essays illustrate this quantitative finding in more detail. Tim, the SR type, connected what he found in the literature to the individual situation. For the first strand of his explanation, he applied the concept of grading as making different types of comparisons directly to what he did in the situation: "During the practice situation, I focused on a social benchmark. I tried to classify the grades of individual students in order of their standing compared to all the other students in the class" (lines 30-32).

For the second strand of his explanation, he came to a separate conclusion that directly addresses his primary question of whether or not students' disruptive behavior should influence his grading. A slight indication of epistemic reflexivity emerged when he reflected on the formative and summative function that grades can serve: "*According to this, one could argue* [emphasis added] that incorporating students' social behavior is legitimate if grades for verbal participations are to fulfill a formative function, and that they are supposed to motivate students to adapt their behavior (...)" (lines 57-59).

In Nina's essay, the DI type, she also began with a statement that applied what she read in the literature directly to the individual situation that she experienced:

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I think that, in this situation, three main biases have played a central role: The Halo effect, a slight effect of perseverance from the teacher, and a general tendency to grade students in a way that motivates them to enhance their participation in class. (lines 54-56)

After this linear application of her interpretation of the literature to the situation, she underscored her literature-based reflection on the situation with statements of higher epistemic reflexivity, exemplifying how the concepts apply to the concrete situation. To accomplish this, she articulated a process of transforming what she read into observable aspects of pedagogical practice, e.g., “I mainly base my judgment on the observation that (...)” (lines 56-57), “I would trace this behavior back to the Halo effect and to the tendency of perseverance” (lines 63-64), “This means that it seems even more likely that a teacher’s overall impression of a student influences the grading process” (lines 71-73).

Multiple Source Integration and Students’ Conclusions for Professional Practice

Following the assumption that integration of multiple sources relates to a deeper reflection on specific pedagogical situations, we tested whether or not the two essay types of high and low source integration corresponded to the quality of the pre-service teachers’ conclusions for their educational practice. Thus, we conducted an independent-samples t-test using the score of an expert rating on the quality of the conclusions for educational practice that prospective teachers wrote at the end of the essay. The sample for this test amounted to 50 essays ($n=26$ SR; $n=24$ DI). SR type essays ($M=2.91$, $SD=.75$) differed significantly from DI essays ($M=3.39$, $SD=.92$) in the expected direction, meaning that essays that contained a competent integration of different sources received higher ratings on their conclusions for educational practice; $t(48)=-2.028$, $p = .048$.

Contrasting Case Examples: Pre-Service Teachers’ Conclusions for their Educational Practice

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Following the application of what he read in the literature to the pedagogical situation, Tim picked out one of the two strands of explanation to arrive at a conclusion for his future work:

For now, I take the position that students who show disruptive behavior in the classroom should receive a lower grade, because disruptive behavior in most cases prevents active participation in class, and thus should be reflected in the grade they receive. (lines 63-66)

Neither the concept of benchmarking, which was part of his explanation of the situation, nor any other aspects of the situation described in the beginning, were taken up in this conclusion. However, the conclusion included an element of preliminary insight into the fact that this conclusion might be somewhat unidimensional and insufficient for Tim's future teaching practice: "At a later point in time during my teacher training, I will have a closer look at the literature to form a more differentiated viewpoint on this issue" (lines 66-68).

In contrast, Nina concluded from her literature-based reflection on the situation that it is an "absolute necessity to routinely document students' verbal performance at the end of each class" (lines 77-79). Additionally, reflecting on the responsibility that teachers have in grading students, she emphasized the need for "a regular reflection on and inspection of judgment tendencies" (lines 81-82). She formulated her goals for her future professional practice in the form of specific actions:

In the future, I will try to document students' achievement while simultaneously trying to reflect on what other factors could have influenced my judgment. To do that, it seems important to be actively aware of the judgment biases that might be at play. (...) With regard to extreme cases

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about which I feel unsure, talking to a colleague seems to be an option for checking on one's own judgment tendencies. (lines 83-89)

Discussion

Reflecting on real-life pedagogical situations from their field practice, in our study pre-service teachers demonstrated how they work with information from multiple sources in a real-life setting during a teacher education program. Essay data from 87 master students were analyzed for indicators of multiple text use, and two epistemic products: an epistemic stance and conclusions for an epistemically informed practice. Almost 13% of the sample limited their explanation of the pedagogical situation to one textual source. Nearly 40% employed a separate representations (SR) type of text use. The other half of the essays displayed either a mush type of integration (12.6 %), or a documents integration (DI) type (35.6%) showing both content integration as well as a correct tagging of sources. Considering this open setting of assessment with a vast array of pedagogical situations that students picked for a deeper reflection, it seems even more noteworthy that the distribution of multiple text integration types largely resembled those mentioned by List et al. (2019), who worked with college students in a field outside teacher education, a default topic, and a specified selection of sources to be considered. Building on this research, our results indicate that an assessment of multiple source use according to well-established psychological models can be reliably carried out in the more practical setting of teacher education. Moreover, we introduce a rationale for how to aggregate indicators of multiple text integration, providing a transparent way to categorize student essays on various topics, and an open source selection procedure according to theory-driven guidelines. This rationale can be used for both future research as well as teacher education.

Furthermore, our results suggest that university students predominantly consider information from university textbooks or handbooks, as well as non-scientific texts, to explain

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what happens during classroom practice. Less frequently (37% of our sample), they consult specific empirical research – even though this proportion still seems quite remarkable compared to other findings on teachers’ data use and data-driven decision making (e.g., Brown & Zhang, 2016; Schildkamp & Kuiper, 2010). The comparably high proportion of pre-service teachers using original research evidence could be traced back to the nature of the instruction they received during the preparatory course. Our findings indicate that, given previous instruction, pre-service teachers are able to find and analyze empirical studies on self-selected topics to explain classroom situations. Additionally, it seems notable that about two thirds of the essays included textual sources from more than one category, indicating that a majority recognizes the need for a broad basis of information to explain a pedagogical situation – perhaps an indicator of pre-service teachers’ epistemic aims and beliefs regarding a serious analysis of educational practice with the help of sources from educational science.

Our study further suggests that multiple source integration is associated with indicators of pre-service teachers’ epistemic reflexivity, assessed via statements that make a connection between external information sources and the specific pedagogical situation that pre-service teachers reflected on. Higher reflexivity statements appear more frequently in essays of a documents integration type than in the separate representations type. This finding contributes to the discussion on how teacher education can potentially support students in using their university-acquired knowledge for a context-sensitive reflection on real-life classroom situations (Lunn Brownlee et al., 2017). An epistemic stance in terms of Buehl and Fives’s (2016) framework might be one of the links that allows prospective teachers to merge their observations of schools and classrooms as being complex systems characterized by uncertainty and unpredictability, with theoretical knowledge and empirical evidence that provide them with clear epistemic standards. The integration of multiple text information could be one step toward addressing this need in professional teacher education and development (Cramer et al., 2019). Building on this finding,

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and based on an expert rating to validate prospective teachers' written reflections, our study also provides initial evidence in favor of the hypothesis that the quality of the conclusions prospective teachers draw from their reflective inquiries is likely to correspond to the quality of the source integration established during their explanation of the situation. This finding might provide a bit of empirical evidence for Buehl and Fives's description of a second epistemic product, an epistemically informed praxis, and also relates to salient issues in the suggestions made by Cochran-Smith and Lytle (1999), Cramer et al. (2019), and Lunn Brownlee et al. (2017), when reflecting on teachers' "dialectical relationship between critical theorizing and action" (Cochran-Smith & Lytle, 1999, p. 291).

Limitations

The findings of our study are limited in their scope and generalizability. Our decision to let students self-select the pedagogical situations for a deeper, text-based reflection, comes with several methodological issues. We did not address whether or not some kinds of pedagogical situations may be more suitable for a source-based reflection than others. Hence, it is not clear if integration of multiple, perhaps controversial, textual sources can be carried out more easily when reflecting on some situations. Furthermore, we did not assess any indicators of the quality of source use in a more general, interpretive sense. The focus of our study was to assess indicators of textual integration, but we do not know whether information from sources was processed accurately. Another shortcoming of this study is the relatively small sample size. Given that, we were unable to subdivide the essays any further regarding the content that was addressed, nor with regard to individual participant characteristics. At the same time, what we can assume, according to models of multiple text use, is that the participants in our study are likely to display a motivational stance that is beneficial for thorough processing of a multiple text task: they picked a situation that they found personally relevant (List & Alexander, 2017), they received instruction on how to complete the task in their preparatory master's courses, and they worked

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with pedagogical situations that can be explained by theories and pieces of evidence that they most likely came across during their master's program. Taken together, these prerequisites could facilitate students' performance on this multiple text assignment (cf. Rouet et al., 2017).

However, extensions of the current study could more explicitly address how pre-service teachers' reflective practices might be mediated by the epistemic beliefs prevalent in their respective disciplines or other individual prerequisites, picking up on the research conducted by Merk and Rosman (2020), as well as Guilfoyle et al. (2020).

Another limitation relates to the intended outcomes for pre-service teachers' educational practice. Our study does not examine prospective teachers' actual behavior in classrooms. Meanwhile, existing models of epistemic reflexivity do propose that teachers showing sophisticated epistemic cognition may be more open to epistemic development, to changes in teaching practice, and even to education reform (Feucht, 2010; Lunn Brownlee et al., 2017). On the one hand, the expert rating that we implemented in our study can be regarded as a first proxy for teachers' intentions with respect to their future professional practice. On the other hand, the overall expert judgment of quality on the conclusions that we implemented in our study has several shortcomings and is not sufficient to answer the question of which aspects of reflective practice relate to nuances of practical action. Overall, empirical evidence of how epistemic reflexivity relates to teaching practice is still quite rare, and preliminary results are mixed (cf. Lunn Brownlee et al., 2017). As a recent addition to the field, Matewos et al. (2019) showed that doubt and self-questioning function as mediators for self-reflective practices that subsequently lead to a change in teachers' instructional practices. These concepts could be addressed in future studies on teachers' multiple source integration.

Conclusion

The current study adds to our knowledge about how prospective teachers try to make sense of real-life pedagogical situations with the academic tools acquired during their university

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education. From this perspective, our study might further encourage other researchers to work with material that teachers produce during their professional practice, and apply concepts from educational science, psychology, and so forth to enhance teachers' reflective practice in a systematic and theory-based manner. Even though such a road might be long and winding, we believe there is immense potential for research on teacher education that works with more realistic settings to address pre-service teachers' concerns regarding the transfer of university knowledge to the complex endeavor of professional practice. As we can conclude from our study, multiple text integration for real-life pedagogical situations does not appear to function in a completely different way than in more restricted laboratory settings.

Applying the psychological framework of multiple text integration, our study showed that more than half of the participants failed to construct an integrated account based on external sources of information. This could present a serious problem for education in reflective teaching, since our results indicate that multiple source integration is related to pre-service teachers' epistemic stances and their epistemically informed professional practice. Accordingly, our results suggest that acquiring the ability to integrate multiple information sources should be a priority in the education of future teachers. Its relation to epistemic stances and epistemically informed practice indicates that the integration of various pieces of knowledge is a specific antecedent of a robust reflective practice, which is a common paradigm for successful teacher education found around the world.

Regarding future work on this topic in both research and teacher education, we advocate for being more specific about what kind of reflection should be the goal of teacher education. We believe our study suggests a possible approach and some empirical indications that support viewing reflective practice as a challenge in which prospective teachers must connect various sources of information from theory and research to their practical experiences in school settings. Reflective practice includes the ability to describe discrete units of classroom practice in detail, to

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integrate various sources of information to explain these situations, and to be actively aware of the inherent differences between educational research and school practice. With this foundation of scientific rigor, prospective teachers should be able to draw conclusions for their future professional practice that are grounded in the best available theory and evidence, while at the same time remaining aware of the complex characteristics inherent in any pedagogical situation.

References

- Alexander, P. A. (2017). Reflection and Reflexivity in Practice Versus in Theory: Challenges of Conceptualization, Complexity, and Competence. *Educational Psychologist*, 52(4), 307–314. 10.1080/00461520.2017.1350181
- Beauchamp, C. (2006). *Understanding reflection in teaching: A framework for analysing the literature*. Montreal, Quebec, Canada: Unpublished doctoral thesis, McGill University.
- Beauchamp, C. (2015). Reflection in teacher education. Issues emerging from a review of current literature. *Reflective Practice*, 16, 123–141.
- Bråten, I., Strømsø, H. I., & Britt, M. A. (2009). Trust matters: Examining the role of source evaluation in students' construction of meaning within and across multiple texts. *Reading Research Quarterly*, 44, 6–28. 10.1598/RRQ.44.1.1
- Britt, M. A., Perfetti, C. A., Sandak, R., & Rouet, J.-F. (1999). Content integration and source separation in learning from multiple texts. In S. R. Goldman, A. C. Graesser, & P. van den Broek (Eds.), *Narrative Comprehension, Causality, and Coherence. Essays in Honor of Tom Trabasso* (pp. 209–233). Mahwah, NJ, US: Lawrence Erlbaum Associates.
- Bromme, R., Kienhues, D., & Porsch, T. (2010). Who knows what and who can we believe? Epistemological beliefs are beliefs about knowledge (mostly) to be attained from others. In L. D. Bendixen & F. C. Feucht (Eds.), *Personal Epistemology in the Classroom* (pp. 163–194). 10.1017/CBO9780511691904.006
- Bromme, R., Kienhues, D., & Stahl, E. (2008). Knowledge and Epistemological Beliefs: An Intimate but Complicated Relationship. In M. Khine (Ed.), *Knowing, Knowledge and Beliefs. Epistemological Studies across Diverse Cultures* (pp. 423–441). 10.1007/978-1-4020-6596-5_20
- Brown, C., & Zhang, D. (2016). Is engaging in evidence-informed practice in education rational? What accounts for discrepancies in teachers' attitudes towards evidence use and actual

MULTIPLE TEXT INTEGRATION BY PRE-SERVICE TEACHERS

- instances of evidence use in schools? *British Educational Research Journal*, 42(5), 780–801. 10.1002/berj.3239
- Buehl, M. M., Alexander, P. A., & Murphy, K. P. (2002). Beliefs about schooled knowledge. Domain specific or domain general? *Contemporary Educational Psychology*, 27(3), 415–449. 10.1006/ceps.2001.1103
- Buehl, M. M., & Fives, H. (2016). The role of epistemic cognition in teacher learning and praxis. In J.A. Greene, W.A. Sandoval, & I. Bråten (Eds.), *Handbook of Epistemic Cognition*. New York: Routledge.
- Burkhardt, H., & Schoenfeld, A. H. (2003). Improving Educational Research: Toward a More Useful, More Influential, and Better-Funded Enterprise. *Educational Researcher*, 32(9), 3–14. 10.3102/0013189x032009003
- Chi, M. T. H. (1997). Quantifying qualitative analyses of verbal data: A practical guide. *The Journal of the Learning Sciences*, 6(3), 271–315.
- Chinn, C. A., Buckland, L. A., & Samarapungavan, A. (2011). Expanding the dimensions of epistemic cognition: Arguments from philosophy and psychology. *Educational Psychologist*, 46(3), 141–167. 10.1080/00461520.2011.587722
- Chinn, C. A., Rinehart, R. W. & Buckland, L. A. (2014). Epistemic cognition and evaluating information: Applying the AIR model of epistemic cognition. In D. N. Rapp & L. G. Braasch, (Eds.), *Processing inaccurate information: Theoretical and applied perspectives from cognitive science and the educational sciences*, (pp. 425-453). Cambridge: MIT Press.
- Cochran-Smith, M., & Lytle, S. (1999). Chapter 8: Relationships of knowledge and practice: Teacher learning in communities. *Review of Research in Education*, 24, 249–305. 10.3102/0091732X024001249

MULTIPLE TEXT INTEGRATION BY PRE-SERVICE TEACHERS

- Cochran-Smith, M., Ell, F., Ludlow, L., Grudnoff, L., & Aitken, G. (2014). The challenge and promise of complexity theory for teacher education research. *Teachers College Record*, 116(5), 1–38.
- Collin, S., Karsenti, T. & Komis, V. (2013). Reflective practice in initial teacher training. Critiques and perspectives. *Reflective Practice*, 14, 104–117.
10.1080/14623943.2012.732935
- Cramer, C., Harant, M., Merk, S., Drahmman, M., & Emmerich, M. (2019). Meta-Reflexivitaet und Professionalitaet im Lehrerinnen- und Lehrerberuf. [Meta-reflexivity and professionalism in the teaching profession]. *Zeitschrift fuer Paedagogik*, 65(5), 401–423.
10.3262/ZP1903401
- European Commission (2015). *The Teaching Profession in Europe: Practices, Perceptions, and Policies. Eurydice Report*. Luxemburg: Publications Office of the European Union.
- Feucht, F. C. (2010). Epistemic climate in elementary classrooms. In L. D. Bendixen & F. C. Feucht (Eds.), *Personal epistemology in the class- room: Theory, research, and educational implications* (pp. 55–93). 10.1017/CBO9780511691904.003
- Fives, H., & Buehl, M. M. (2010). Teachers’ articulation of beliefs about teaching knowledge: Conceptualizing a belief framework. In L. D. Bendixen & F. Hearle, *Personal epistemology in the classroom: Theory, research, and implications for practice* (pp. 470–515). 10.1017/CBO9780511691904.015
- Flaig, M., Simonsmeier, B. A., Mayer, A. K., Rosman, T., Gorges, J., & Schneider, M. (2018). Conceptual change and knowledge integration as learning processes in higher education: A latent transition analysis. *Learning and Individual Differences*, 66, 92–104.
10.1016/j.lindif.2018.07.001
- Guilfoyle, L., McCormack, O., & Erduran, S. (2020). The “tipping point” for educational research: The role of pre-service science teachers’ epistemic beliefs in evaluating the

MULTIPLE TEXT INTEGRATION BY PRE-SERVICE TEACHERS

- professional utility of educational research. *Teaching and Teacher Education*, 90, 103033. 10.1016/j.tate.2020.103033
- Hennissen, P., Beckers, H., & Moerkerke, G. (2017). Linking practice to theory in teacher education: A growth in cognitive structures. *Teaching and Teacher Education*, 63, 314-325. 10.1016/j.tate.2017.01.008
- Joram, E. (2007). Clashing epistemologies: Aspiring teachers', practicing teachers', and professors' beliefs about knowledge and research in education. *Teaching and Teacher Education*, 23(2), 123–135. 10.1016/j.tate.2006.04.032
- Kim, L. E., & Klassen, R. M. (2018). Teachers' cognitive processing of complex school-based scenarios: Differences across experience levels. *Teaching and Teacher Education*, 73, 215–226. 10.1016/j.tate.2018.04.006
- Korthagen, F. (1985). Reflective Teaching and Preservice Teacher Education in the Netherlands. *Journal of Teacher Education*, 36(5), 11–15. 10.1177/002248718503600502
- Korthagen, F. (1999). Linking Reflection and Technical Competence: the logbook as an instrument in teacher education. *European Journal of Teacher Education*, 22(2). 191-207. 10.1080/0261976899020191
- Leonhard, T. & Rihm, T. (2011). Erhoehung der Reflexionskompetenz durch Begleitveranstaltungen zum Schulpraktikum? [Improvement of reflective competence via university courses that accompany students' field practice?] *Lehrerbildung auf dem Pruefstand*, 4(2), 240–270.
- List, A., & Alexander, P. A. (2018). Toward an integrated framework of multiple text use. *Educational Psychologist*, 54, 20–39. 10.1080/00461520.2018.1505514
- List, A., & Alexander, P. A. (2017). Cognitive Affective Engagement Model of Multiple Source Use. *Educational Psychologist*, 52, 181–199. 10.1080/00461520.2017.1329014

MULTIPLE TEXT INTEGRATION BY PRE-SERVICE TEACHERS

- List, A., Du, H., Wang, Y., & Lee, H. Y. (2019). Toward a typology of integration: Examining the documents model framework. *Contemporary Educational Psychology*, 58, 228–242. 10.1016/j.cedpsych.2019.03.003
- Lunn Brownlee, J., Ferguson, L. E., & Ryan, M. (2017). Changing Teachers' Epistemic Cognition: A New Conceptual Framework for Epistemic Reflexivity. *Educational Psychologist*, 52, 242–252. 10.1080/00461520.2017.1333430
- Matewos, A. M., Marsh, J. A., McKibben, S., Sinatra, G. M., Tien Le, Q., & Polikoff, M. S. (2019). Teacher learning from supplementary curricular materials: Shifting instructional roles. *Teaching and Teacher Education*, 83, 212–224. 10.1016/j.tate.2019.04.005
- McGrew, S., Breakston, J., Ortega, T., Smith, M., & Wineburg, S. (2018). Can students evaluate online sources? Learning from assessments of civic online reasoning. *Theory and Research in Education*, 46(2), 165–193. 10.1080/00933104.2017.1416320
- McNamara, D. (1990). Research on Teachers' Thinking: its contribution to educating student teachers to think critically. *Journal of Education for Teaching*, 16(2), 147–160. 10.1080/0260747900160203
- Merk, S., & Rosman, T. (2019). Smart but Evil? Student-Teachers' Perception of Educational Researchers' Epistemic Trustworthiness. *AERA Open*, 5(3), 1–18. 10.1177/2332858419868158
- Moshman, D., & Tarricone, P. (2016). Logical and Causal Reasoning. In J. Greene, W. A. Sandoval, & I. Bråten (Eds.), *Handbook of Epistemic Cognition* (pp. 54–67). New York: Routledge.
- Muis, K. R., Bendixen, L. D., & Haerle, F. C. (2006). Domain-general and domain-specificity in personal epistemology research: Philosophical and empirical reflections in the development of a theoretical framework. *Educational Psychology Review*, 18, 3–54. 10.1007/s10648-006-9003-6

MULTIPLE TEXT INTEGRATION BY PRE-SERVICE TEACHERS

- Perfetti, C. A., Rouet, J.-F., & Britt, M. A. (1999). Toward a theory of documents representation. In H. van Oostendorp & S. R. Goldman (Eds.), *The construction of mental representations during reading* (pp. 99–122). Mahwah, NJ, US: Lawrence Erlbaum Associates.
- Rosman, T., Seifried, E., & Merk, S. (2020). Combining Intra- and Interindividual Approaches in Epistemic Beliefs Research. *Frontiers in Psychology, 11*. 10.3389/fpsyg.2020.00570
- Rouet, J. F., Britt, M. A., & Durik, A. M. (2017). RESOLV: Readers' Representation of Reading Contexts and Tasks. *Educational Psychologist, 52*(3), 200–215. 10.1080/00461520.2017.1329015
- Sackett, D. L., Rosenberg, W. M., Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: What it is and what it isn't. *BMJ (Clinical Research Ed.)*, 312, 71–72. 10.1136/bmj.312.7023.71
- Schildkamp, K., & Kuiper, W. (2010). Data-informed curriculum reform: Which data, what purposes, and promoting and hindering factors. *Teaching and Teacher Education, 26*(3), 482–496. 10.1016/j.tate.2009.06.007
- Schön, D.A. (1983). *The Reflective practitioner. How professionals think in action*. New York: Basic Books.
- Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*, 4-14. 10.3102/0013189X015002004
- Stadtler, M., & Bromme, R. (2007). Dealing with multiple documents on the WWW: The role of metacognition in the formation of documents models. *International Journal of Computer-Supported Collaborative Learning, 2*(2), 191–210. 10.1007/s11412-007-9015-3
- Stark, R. (2017). Probleme evidenzbasierter bzw. -orientierter pädagogischer Praxis. [Problems of evidence-based/ evidence-oriented educational practice]. *Zeitschrift fuer Pädagogische Psychologie, 31*, 99–110. 10.1024/1010-0652/a000201

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- Van den Bogert, N., van Bruggen, J., Kostons, D., & Jochems, W. (2014). First steps into understanding teachers' visual perception of classroom events. *Teaching and Teacher Education*, 37, 208-216. 10.1016/j.tate.2013.09.001
- Wiley, J., & Voss, J. F. (1999). Constructing arguments from multiple sources: Tasks that promote understanding and not just memory for text. *Journal of Educational Psychology*, 91(2), 301-311. 10.1037/0022-0663.91.2.301
- Wolfe, M. B. W., & Goldman, S. R. (2005). Relations between adolescents' text processing and reasoning. *Cognition & Instruction*, 23(4), 467-502. 10.1207/s1532690xci2304_2
- Wubbels, T., & Korthagen, F. A. (1990). The effects of a pre-service teacher education program for the preparation of reflective teachers. *Journal of Education for Teaching*, 16(1), 29-43. 10.1080/0260747900160102

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Figure Captions:

Figure 1. The Acquisition of Meta-Reflexivity in the Teaching Profession (adapted from Cramer et al., 2019).

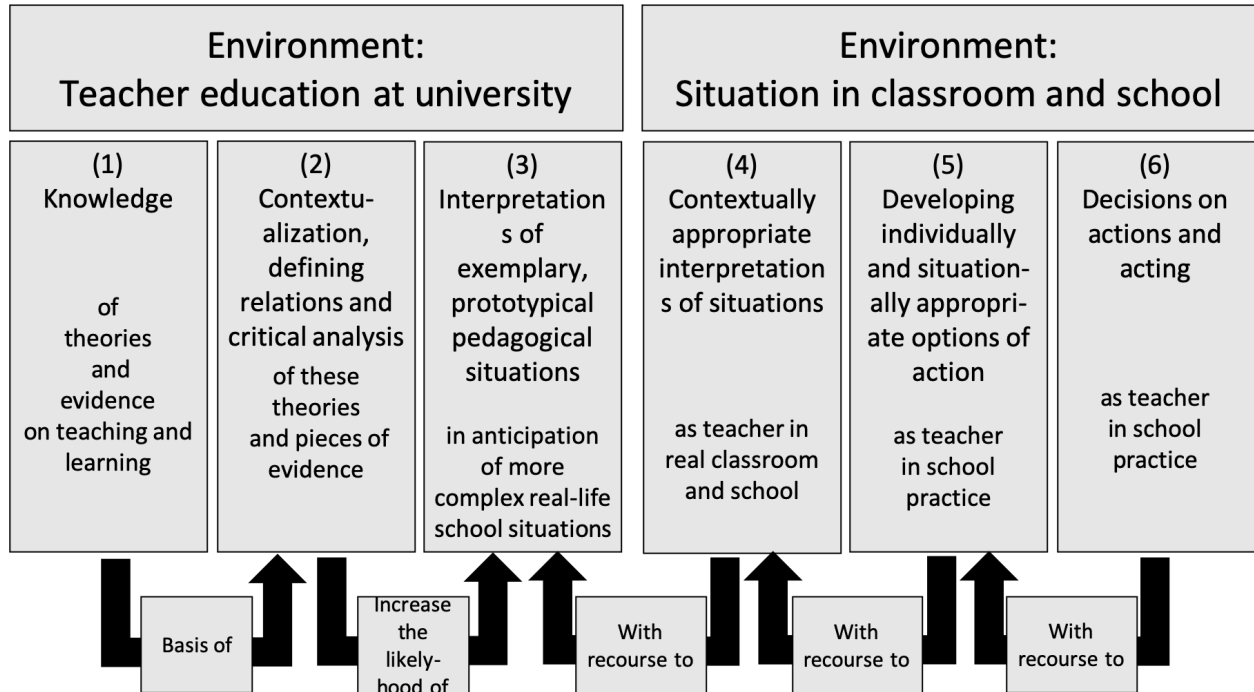


Figure 2. Rationale for the classification of Multiple Text Models in prospective teachers' essays.

