Learning to plan self-controlled physical education: Good vs. problematic teaching examples

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HIGHLIGHTS

- Pre-service teachers improved their instruction planning via reflections on teaching examples.
- Comparisons of examples were superior to reflecting good or problematic examples only.
- Reflections on teaching examples changed the pre-service teachers' beliefs.
- Comparing examples led to the highest changes in pre-service teachers' beliefs.

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ABSTRACT

Educational research assumes reflection on teaching examples to have positive effects on pre-service teachers' professional development. The role of teaching quality in such examples is unclear, however. In a field experiment with a pre-post-design, we taught "planning self-controlled learning" to 83 undergraduate pre-service physical education teachers and assigned them to three conditions: they either reflected on good teaching or problematic teaching examples or they compared both types of examples. We found that the comparison of examples supported their instruction planning more than reflecting good or problematic teaching examples only. In addition, comparing examples changed the pre-service teachers' beliefs.

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1. Introduction

Educational research considers a profound professionalization of pre-service teachers at university as a core element to improve teaching in schools (Kennedy, Ahn, & Choi, 2008; Terhart, 2012). But even though the number of investigations into effective pre-service teacher education increased in the last years, scientific knowledge on this subject is still limited (Darling-Hammond, 2016; Desimone, 2009). Evidence is missing in particular with regard to experimental or quasi-experimental analysis of pre-service teacher education, although this was deemed necessary already more than 50 years ago (Gage, 1964). Since pre-service teacher education is increasingly geared towards linking theory and practice, there is

considerable inducement to conduct such research (Borko, Liston, & Whitcomb, 2006). Reflecting examples of real-life classroom practice is one approach to this end (Merseth, 1993; Seidel, Blomberg, & Renkl, 2013). In general, learning from examples and cases is considered to be a potential source for acquiring knowledge and competences in diverse domains (e.g., Gentner, Loewenstein, & Thompson, 2003; Renkl, 2011). Those approaches applied in pre-service teacher education vary with respect to the instructional implementation of examples. Some approaches employ "good" teaching examples (Seidel et al., 2013, p. 59), others provide pre-service teachers with "problematic" teaching examples (Doyle, 1990; Scherler, 2004). In well-structured domains, such as mathematics or physics, the impact of incorrect and correct examples has been empirically addressed. In less-structured domains such as teaching, however, the question whether good or problematic examples lead to different learning results is still open. The present study therefore extends previous research to the domain of

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teaching. Our study is grounded in physical education teacher education (PETE), where reflections on teaching examples have a long tradition (Scherler, 2004; Siedentop & Tannehill, 2000; Winnick & Porretta, 2016).

In the following, we position our study within general research on learning from examples before we describe teaching examples in teacher education and PETE. After presenting prior research on learning from good vs. problematic examples, we give reasons for the learning content of our study "planning self-controlled learning in physical education (PE)". In our field experiment within regular PETE, we investigated changes in undergraduate pre-service teachers' instruction planning and their beliefs after they reflected on good teaching examples, on problematic teaching examples, or compared both types of examples. The present study contributes to prior research in a twofold way: First, we expand prior research on learning from examples, which was mostly based on laboratory experimental designs in well-structured domains, by findings from a less-structured domain (teaching) and based on a more ecologically valid design, as we implemented our study in regular PETE university courses. Second, our study might help to understand the effects of implementing teaching examples in teacher education in general and PETE in particular.

1.1. Learning from examples

In many domains, learners manage to recall concepts and principles, but do not know how to apply them in new situations and thus acquire only *inert knowledge* (Renkl, Mandl, & Gruber, 1996). Empirical research ranging from elementary to higher education assumes that reflection on examples or cases might remedy the inert knowledge problem and support knowledge transfer (Gentner et al., 2003; Renkl, 2011). Typical *examples* include a problem statement and an expert solution or expert operations (Atkinson, Derry, Renkl, & Wortham, 2000). Similarly, *cases* reflect professional (expert) practice and thereby convey core principles of the specific domain (Gentner et al., 2003; Merseth, 1993). The different terms are due to different research approaches: the term "examples" is prominent in well-structured domains, such as mathematics or physics (Atkinson et al., 2000), whereas the term "cases" is widely applied in less-structured domains such as law, medicine or business (Merseth, 1993). In the context of teacher education, the use of both cases (Merseth, 1993) and examples of classroom practice (Seidel et al., 2013) has been promoted. In our study, we aim to demonstrate specific teaching principles by means of written real-life classroom situations. Examples refer to specific teaching principles and represent (written) descriptions of real-life classroom situations. Cases are also (written) descriptions of real-life classroom situations, but often do not refer to specific teaching principles. Instead, they are rather based on a quasi-paradigmatic use of classroom situations. That is why we prefer the term "example" while also referring to research that investigates learning from cases.

1.1.1. Learning mechanisms and empirical findings

Topical research assumes comparable learning mechanisms for both examples and cases. In accordance with Bandura's (1986) social learning theory, Schunk & Zimmerman (2007) emphasized the significance of teaching new skills by modeling either cases or examples. Similarly, according to Models of Concept Teaching, the appropriation of new concepts only succeeds if learners — after having gained descriptive knowledge of a new concept — test specific attributes of the concept by way of examples (Tennyson & Cocchiarella, 1986). Following theories of analogical reasoning (Gentner et al., 2003) or case-based learning (Kolodner, 1997), cases can contain prototypical rules and approaches that help individuals

to handle new complex situations: If the learning process included a phase in which examples or cases were analyzed elaborately, its conclusion can be applied to the new situation. The closer a current situation corresponds to former situations, the better such examples will be recalled. Summarizing these different theoretical approaches, Renkl (2011) states that the success of reflection on cases and examples is due to a better understanding of general principles and a better comprehension of the relevance of the principles of a learned concept.

In addition, empirical evidence indicates that reflecting on examples and cases has a crucial impact on obtaining new knowledge and skills with regard to various domains and ages. For well-structured domains such as mathematics, for instance, Sweller and Cooper (1985) found that learning from examples is often more effective than learning by problem-solving due to the cognitive overload resulting from unstructured problem-solving. Besides, examples stimulate learning in less-structured domains as well: Gentner et al. (2003) found the negotiation skills of undergraduate students that had reflected on cases to be better than those of students without such reflection; similarly, dyads of psychology students that reflected on examples showed better collaborative working skills than dyads who freely collaborated (Rummel & Spada, 2005).

An important factor enhancing the learning process from examples refers to the implementation of prompts. Since not all learners show elaborate reflections spontaneously, prompts support the learners' understanding significantly, helping them to channel their attention and increasing active elaboration (Atkinson, Renkl, & Merrill, 2003; Schworm & Renkl, 2007).

1.1.2. Applying examples in (physical education) teacher education

For teacher educators, a core challenge is to connect theory and practice, i.e. to enable students to link their professional knowledge to real classroom situations (Borko et al., 2006; Korthagen & Kessels, 1999). To cope with this challenge, reflecting teaching examples of real-life scenarios in the classroom, and thus providing "approximations of practice" (Grossman & McDonald, 2008, p. 190) seems promising because it allows students to consider situations they have never experienced before in a "nonthreatening environment" (Veal & Taylor, 1995, p. 54). That is why reflecting on examples and cases became an increasingly prominent learning method in teacher education since the mid-1980s (Merseth, 1993) in general, and in PETE in particular (Scherler, 2004; Siedentop & Tannehill, 2000; Winnick & Porretta, 2016). One core argument for reflecting on teaching examples in PETE refers to the *biography bias:* Pre-service PE teachers often made numerous experiences in physical activities and sports before beginning their teacher education program. These experiences, centered within the family, with coaches or peers, foster specific personal theories about and attitudes towards physical activities and sports (Flory & McCaughtry, 2014; Volkmann, 2008; Webster, 2011). Such personal theories and attitudes often compete against the theoretical and empirical grounding of PE teaching. Pre-service teachers who made experiences in competitive sports, for instance, sometimes develop the idea that motor learning only succeeds if students imitate the ideal movement clearly presented by the PE teacher (Volkmann, 2008, p. 227). Yet, this approach contradicts both findings of research on motor development (e.g. Brady, 2008; Schöllhorn, Mayer-Kress, Newell, & Michelbrink, 2009) and PE conceptions of more student-centered approaches (Griffin & Patton, 2010; Wallhead & Ntoumanis, 2004). Teaching examples that provide new insights into PE learning might challenge these biographical experiences. They might extend teachers' knowledge of teaching approaches in PE, which in turn might be helpful to avoid moving back into a "curricular zone of safety" (Amade-Escot,