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# Self-efficacy beliefs of student teachers in the context of teaching-related practical experiences in schools

# Selbstwirksamkeitserwartungen von Lehramtsstudierenden im Kontext von schulpraktischen Erfahrungen

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# Danksagung

# Abstract

Self-efficacy beliefs play a significant role in teachers' professional behavior in class (Tschannen-Moran et al., 1998) and students' achievement and behavior (Mojavezi & Tamiz, 2012). Teacher self-efficacy beliefs are defined as teachers' own beliefs about their capability to achieve certain goals in a specific situation (Dellinger et al., 2008; Tschannen-Moran & Hoy, 2001). Due to the essential role of teachers in the educational system and society, supporting teachers' well-being, productivity, and efficiency is important (Kasalak & Dagyar, 2020). Empirical evidence highlights the positive effects of teacher self-efficacy beliefs on their well-being (Perera & John, 2020) and on students' learning and performance (Zee & Koomen, 2016), but there is a lack of empirical research focusing on the importance of self-efficacy beliefs for student teachers in teacher education programs (Yurekli et al., 2020), especially during practical training periods. Based on the importance of teachers' own teaching experiences, which have been described as mastery experiences, i.e. the strongest source of self-efficacy beliefs for student teachers (Pfitzner-Eden, 2016b), this dissertation examines practical experiences as a source of (student) teacher self-efficacy beliefs and, relatedly, the development of and changes in student teachers' self-efficacy during teacher education. Therefore, Study 1 focuses on changes in student teachers' self-efficacy beliefs during short-term practical experiences compared to online teaching without teaching experiences.

Due to inconsistent findings of reciprocal relations between teacher self-efficacy beliefs and teaching quality (Holzberger et al., 2013; Lazarides et al., 2022), Study 2 examines the interrelation of student teachers' self-efficacy beliefs and their teaching behavior during teacher education. Feedback can be an important source of self-efficacy beliefs, serving as verbal persuasion that enhances feelings of competence (Pfitzner-Eden, 2016b). In this context, Study 2 also focuses on the relation between changes in student teachers' self-efficacy beliefs and the perceived quality of peer feedback in terms of short-term practical experiences in teacher education.

Moreover, for the investigation of the development of student teachers' self-efficacy beliefs, it is important to examine individual personality aspects and specific conditions of the learning environment in teacher education (Bach, 2022). Based on the assumption that the support of reflective processes in teacher education (Menon & Azam, 2021) and the use of innovative learning settings such as VR videos (Nissim & Weissblueth, 2017) foster the development of student teachers' self-efficacy beliefs, Studies 3 and 4 investigate student

teachers' reflection processes regarding their own experiences in teaching and the teaching experiences of others observed during teacher education.

Against the background of inconsistent findings and a lack of empirical research on the relations between self-efficacy beliefs of student teachers and different circumstances pertaining to the learning environment or personal characteristics, further empirical research is needed that investigates different sources and relations of student teachers' self-efficacy beliefs during teacher education. In this context, this dissertation examines which individual characteristics and learning environments enhance student teachers' self-efficacy beliefs, especially during short-term practical experiences in teacher education.

In addition, the dissertation concludes with a discussion of the findings of the four studies by summarizing the strengths and weaknesses of each study. Limitations and implications for further research are discussed as well.

# Structure

# Theoretical Background

# Introduction

The teaching profession includes challenging job-related situations in everyday school life. Teachers often have a high workload and face excessive work-related demands. In this context, it is highly important that teacher training prepares student teachers effectively for their future jobs. One important personal resource that enables people to deal with job-related demands is their own self-efficacy beliefs. In Bandura's social-cognitive theory, self-efficacy is described as the judgments of one's own capability to organize and carry out the actions necessary to achieve certain performance goals (Bandura, 1986). Teachers' self-efficacy, in turn, is defined as the belief in one's capability to organize and carry out sequences of actions required to successfully complete a certain instructional task in a specific context (Tschannen-Moran et al., 1998). Against this theoretical background, this dissertation investigates how the self-efficacy beliefs of student teachers develop in the context of school-related practical experiences.

In the first section of the dissertation, teacher self-efficacy beliefs are defined and conceptualized and the sources of teacher self-efficacy beliefs are described. In this context, the way in which self-efficacy develops throughout teacher education is addressed. The section also draws on the impact of individual characteristics such as student teachers' pedagogical-psychological knowledge, gender, teaching behaviors, and perceived work stress on their self-efficacy beliefs. Finally, the importance of characteristics of the learning environment for self-efficacy is discussed, such as online versus face-to-face teaching during the COVID-19 pandemic, feedback from others, reflection in university courses, and innovative teaching methods.

In the second section, the results of four empirical studies on student teacher self-efficacy are presented: Study 1 examines the differences in the changes of self-efficacy beliefs and burnout in a group of student teachers who experienced short school-related practical experiences versus a group of student teachers who attended courses in an online semester during the COVID-19 pandemic. Results indicate that student teachers who taught in schools experienced an increase in their self-efficacy beliefs during the semester, whereas student teachers who did not teach during the COVID-19 pandemic experienced no increase in their self-efficacy beliefs. No differences occurred for the level of burnout.

Study 2 investigates the reciprocal relations between self-efficacy beliefs and different dimensions of teaching quality for student teachers. Further, the study examines relations between the perceived quality of peer feedback on lesson plans presented in the university

course and changes in self-efficacy beliefs of student teachers who taught during school-related practical trainings. Findings show that observer-rated teaching behavior contributed to an increase in self-efficacy beliefs of student teachers. Further, student teachers who perceived the feedback from peers as positive or helpful also experienced an increase in their self-efficacy for classroom management during one semester.

Study 3 extends the focus of the dissertation to student teachers' reflection processes and their self-efficacy in relation to reflection. The study examines how student teachers' self-efficacy for reflection changes in learning settings that include reflections on teaching experiences involving real classroom videos as well as virtual reality videos. Results reveal that student teachers who reflected on their own virtual reality video experienced a significant increase in their self-efficacy for reflection.

Study 4 examines the development of self-efficacy for reflection over one semester for student teachers who taught and reflected on their teaching experiences (intervention group) compared to student teachers who did not teach and did not reflect during the semester of teacher training (control group). Findings show that the self-efficacy for reflection increased for student teachers who taught and systematically reflected on their teaching experiences. The increase in self-efficacy beliefs for student teachers in the intervention group was moderated by their previous pedagogical experiences.

Section 3 includes a discussion of the four studies against the background of social-cognitive theory and in the context of existing empirical research. Limitations and strengths are discussed and implications of the empirical findings for the further development of teacher training are discussed.

## 1. Theoretical background

### 1.1 Defining Teacher Self-Efficacy

Professional competencies of teachers are important for effective teaching, as well as for students' academic development (Baumert & Kunter, 2006; Karlen et al., 2020; König, 2020). Teacher self-efficacy is a central component of teachers' professional competence and accordingly plays an important role in teaching, students' academic learning, and even teachers' well-being and job satisfaction (Perera & John, 2020; Zee & Koomen, 2016). Therefore, teacher efficacy beliefs are described in social cognitive theory as a key personal resource that enables teachers to cope with job-related demands and reduces job-related strains (Bandura, 1997). Self-efficacy beliefs are generally defined as the "beliefs in one's capabilities

to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). With respect to the teacher profession, Tschannen-Moran and Hoy (2001) define teacher self-efficacy beliefs as teachers' judgments about their own capabilities to achieve their desired outcomes in terms of student engagement and learning, even with students who are difficult or unmotivated. Another definition of teacher self-efficacy beliefs includes teachers' beliefs about their own abilities to arrange, organize, and carry out the activities necessary to achieve the educational objectives in the classroom (Skaalvik & Skaalvik, 2014). Both definitions thus describe teachers' self-efficacy beliefs as competence-related beliefs in their own job-related ability to achieve certain outcomes in the face of job-related obstacles. This dissertation has a specific focus on *student teachers'* self-efficacy beliefs. Thus, applying the established definitions of teachers' self-efficacy beliefs to the context of teacher education, student teachers' self-efficacy can be defined as the beliefs of student teachers regarding their own capabilities to organize teaching, manage students, and address their needs in the classroom during school-related teaching experiences. However, whereas empirical research has widely studied in-service teachers' self-efficacy beliefs (Holzberger et al., 2013; Klassen & Chiu, 2010; Lauermann & König, 2016; Skaalvik & Skaalvik, 2014; Tschannen-Moran & McMaster, 2009), research has started to investigate the self-efficacy beliefs of student teachers and preservice teachers, where open questions remain with regard to the measurement, development, antecedents, and consequences of student teachers' self-efficacy beliefs. This dissertation, therefore, examines the development of student teachers' self-efficacy beliefs under different conditions in their teacher education programs (online teaching: Study 1), and more specifically the learning environments in which student teachers acquire their skills (VR-based and video-based reflection: Study 3; reflection via different media: Study 4) and the (reciprocal) interrelations with teaching behaviors (Study 2), which have been described as a consequence of in-service teachers' self-efficacy beliefs (see for example Holzberger et al., 2013).

## 1.2 Measurement

To assess teachers' self-efficacy, researchers have developed the *general teacher self-efficacy scale,* which is a 10-item Likert scale including items like "Thanks to my resourcefulness, I know how to handle unforeseen situations," and "When I am confronted with a problem, I can usually find several solutions" (Jerusalem & Schwarzer, 1992). However, it has been emphasized in prior theoretical work Bandura (2006) that the scales used to assess teachers'

self-efficacy should be specifically designed for the respective field of activity under investigation. Thus, measures of self-efficacy beliefs should be adapted to the teaching task or field of activity under investigation (Bandura, 1997), because general or global measurements of self-efficacy beliefs weaken the impact (Pajares, 1996). In this context, Tschannen-Moran and Hoy (2001) developed the well-established and often examined 12-item version of the *Teacher Sense of Efficacy Scale* (TSES) including the subscales *self-efficacy for instructional strategies*, *self-efficacy for classroom management,* and *self-efficacy for student engagement. Self-efficacy for instructional strategies* refers to teachers' self-perceived competencies with respect to the implementation of different instructional methods and teaching strategies in class, including adaptive teaching strategies and diverse sets of performance-assessment strategies. An example item is "To what extent can you use a variety of assessment strategies?" *Self-efficacy for classroom management* refers to teachers' belief that they can carry out effective behavioral management in class, including controlling students' disruptive behavior using rules and routines in class. An example item for this is "How much can you do to calm a student who is disruptive or noisy?" The third subscale, *self-efficacy for student engagement,* refers to teachers' beliefs around being able to engage and motivate students in the context of learning, including implementing strategies that aim to engage particularly unmotivated or uninterested students by communicating the value of learning in class. An item example here is "How much can you do to get students to believe they can do well in school-work?" The subdimension *teacher self-efficacy for student engagement* has been criticized due to the assumed one-dimensionality of the construct against the background of multiple definitions of student engagement (Eccles & Wang, 2012). Despite such criticism, the measures developed by Tschannen-Moran and Hoy (2001) are often used in empirical research on teacher self-efficacy beliefs (Shaukat & Iqbal, 2012; Shoulders & Krei, 2015). However, particularly in the context of research on student teachers, it is unclear whether the *Teacher Sense Efficacy Scale* (Tschannen-Moran & Hoy, 2001) is useful, because student teachers might interpret the items differently than teachers due to their lack of practical experience. Duffin et al. (2012), for example, have pointed out that pre-service teachers who lack pedagogical knowledge and teaching experience are not able to differentiate between the different aspects of teaching measured by the TSES. In this context, Pfitzner-Eden et al. (2014) adapted the *Teacher Sense Efficacy Scale* from Tschannen-Moran and Hoy (2001) for student teachers, for example, by changing the introduction wording to "How certain are you that you can …?" with response options from 1 ("not at all certain can do") to 9 ("absolutely certain can do").

Research on self-efficacy within the last decade has focused on the development of task-specific measures that allow the assessment of self-efficacy beliefs in regard to a large range of specific teaching tasks. The same applies to teacher education research – researchers have developed self-efficacy scales that focus on specific fields of action in teacher education that are salient for student teachers' successful learning. Lohse-Bossenz et al. (2019), for example, developed a measure that assesses reflection-related self-efficacy, which refers to student teachers' expectation(s) of their own ability to cope with challenging situations that require them to reflect on teaching tasks. Moreover, Fraij (2018) developed a German scale for self-efficacy for reflection for student teachers, inspired by Niggli (2004) and Felten (2005). However, research on the development of student teachers' self-efficacy during teacher training is still scare. Because self-efficacy is an important resource not only for teachers, but also for student teachers (Kücholl et al., 2020), it is important to empirically examine whether established measures of teacher self-efficacy are applicable to the context of teacher education.

## 1.3 Development of and Changes in Student Teachers' Self-Efficacy Beliefs

Bandura (1997) assumes that self-efficacy is malleable particularly at the beginning of a teacher's professional career and becomes more stable through cumulative experiences over time. Practical phases in schools enable student teachers to gain experience through their own teaching, through feedback from others, and through observation of supervising teachers in the classroom. Recent research assumes that student teachers often experience *reality shock* when confronted with the complexity of the teaching task in authentic classrooms during their first practical teaching experiences (Pendergast et al., 2011; Tschannen-Moran et al., 1998). Thus, it is important to investigate which factors of the learning environment and of individual student teachers' personality characteristics increase their self-efficacy beliefs during their teacher training programs before entering the teaching profession. Empirical research is inconsistent regarding the changes in student teachers' self-efficacy beliefs during teacher education, and findings strongly depend on the type of the internship as well as on the program length and social support provided. For example, some findings showed that the self-efficacy of student teachers decreased seven weeks after teaching in schools in the context of university courses (Moseley et al., 2003). Other findings showed that particularly classroom management self-efficacy beliefs of student teachers decreased after the first two semesters of their teaching program (Pfitzner-Eden, 2016a). In contrast, other findings suggest that teaching experiences during a practicum might lead to an increase in student teachers' self-efficacy beliefs (Fives et

al., 2007; McDonnough & Matkins, 2010). For example, an intervention study showed that preservice teachers tend to increase their sense of efficacy for teaching English language learners after a 10-week educational psychology course (Yough, 2019). Pfitzner-Eden (2016a) showed that positive changes in student teachers' self-efficacy in the context of school internships was significantly predicted by their own experiences of success, and mastery experiences were the strongest predictor of the change in self-efficacy after a 4-week observation practicum, and even stronger after a 4-week teaching practicum. Rupp and Becker (2021) revealed that over the course of a 3-week teaching practicum some student teachers experienced "ups and downs" regarding their self-efficacy beliefs and other student teachers who perceived the teaching experience as positive increased their self-efficacy after the practicum. Arsal (2014), in turn, showed that during micro-teaching experiences over one semester, student teachers increased their sense of self-efficacy in teaching.

Given the inconsistency of findings on changes in student teachers' self-efficacy in the context of practical experiences, this dissertation systematically examines how the self-efficacy of student teachers changes over time in the context of short practical experiences in schools. It also investigates how individual characteristics and learning environments are associated with the expected changes in self-efficacy beliefs during teacher training.

## 2. Sources of Student Teachers' Self-Efficacy Beliefs According to Bandura's Social Cognitive Theory

Bandura (1989) identified four sources of self-efficacy beliefs – *mastery experiences, vicarious experiences, verbal persuasion,* and *emotional arousal. Mastery experiences,* the strongest source of personal efficacy, refer to the belief that one is able to control potential threats, whereby extraordinary personal achievements serve as experiences that encourage transformations (Bandura, 2006). The second source of support for self-efficacy beliefs is *vicarious experiences,* which are gained through observing the behaviors of social models (Bandura, 1994), such as watching experienced teachers in teaching situations. Depping et al. (2021) assume in this context that, following Bandura (cf. 1997), vicarious experiences could also include, for example, reading teaching vignettes in which teaching challenges (e.g., motivating learners) are effectively and professionally addressed. The assumption is that observing sustained efforts leading to success increases the observers' belief that they similarly possess the ability to manage equivalent activities resulting in success (Bandura et al., 1977).

The third source of self-efficacy beliefs, *verbal persuasion,* leads people to believe through suggestion that they can successfully manage difficult situations that they have

mastered in the past (Bandura, 1997). Due to the ease of application and availability of *verbal persuasion* (encouragement), which takes the form of input from others, it is often used to change human behavior. However, verbal persuasion is not based on authentic, experimental experiences or accomplishment and therefore has a weaker impact than mastery experiences or vicarious experiences (Bandura, 1978).

The weakest source of self-efficacy beliefs involves *physical states* or *emotional arousal,* which includes mood states such as stress, anxiety or fatigue. Self-efficacy beliefs further have an impact on how people deal with such emotional arousal (Bandura, 1994). Besides circumstances, emotional arousal might be an indicator of personal competence as well, because in excitement situations people's appraisal of their own high physical arousal may lead to weakened performance, while people are more likely to expect success when they are not affected by aversive arousal (Bandura, 1978). Studies examining the influence of these four factors on teachers' self-efficacy beliefs for reading in context of an intervention (information, modelling, practice, coaching) (Tschannen-Moran & McMaster, 2009) showed a relation between the four sources, with mastery experiences being the strongest factor. Moreover, in the context of teacher education, Clark and Newberry (2019) have shown, that three sources of self-efficacy (mastery experiences, vicarious experiences and verbal persuasion) are a predictor of student teachers' self-efficacy beliefs during teacher education. In addition, Pendergast et al. (2011) indicated in their study about the sources of pre-service teachers that the fourth and weakest source of self-efficacy beliefs, emotional arousal, was related to overestimation, and thus student teachers could experience a reality shock when they start teaching.

However, since most research examines in-service teachers, further investigation is needed to determine whether the sources of self-efficacy are equally effective for student teachers. Future research thus needs to focus on student teachers – for example, at the beginning of their training when they first observe expert teachers in the classroom or through their own practical experiences in teaching. There is currently a lack of empirical research especially regarding the development of measures adapted to assess the sources of and changes in student teachers' self-efficacy beliefs during teacher training (Poulou, 2007). Theoretically, it is assumed that the four sources of self-efficacy beliefs are equally relatable to the development of student teachers' self-efficacy. In this context, the qualitative case study by Yurekli et al. (2020) identified 6 factors (lecture hours, group work, feedback on group work, peer presentations, assigned reading, and examination) in a method course as sources of student teachers' self-efficacy. Mastery experiences, for example, may be gained through one's own

teaching practice during internships in a teacher training program. However, it is crucial to consider how the practical experiences are structured, because this may provide indications of the extent to which practical teaching experiences have a positive effect on preservice teachers' self-efficacy (Clark & Newberry, 2019). With regard to vicarious experiences, student teachers can observe experienced teachers as part of their training. In some cases, observing classes taught by fellow students is also seen as learning from a model (Moulding et al., 2014). Studies examining the self-efficacy of student teachers either captured verbal persuasion generally as performance-related feedback from others (without clearly defining whether from students, supervising teachers or fellow students) (Pfitzner-Eden, 2016b), or have differentiated between feedback from mentors and from university teachers (Clark & Newberry, 2019).

In addition to Bandura's sources of self-efficacy beliefs, Tschannen-Moran et al. (1998) have developed a model that identifies further contextual factors involved in the generation of self-efficacy beliefs through a cyclical process. They assume that the development of teacher self-efficacy beliefs in terms of their *performance* in class is dependent on circumstances and contexts in the classroom. Furthermore, it is essential to evaluate one's own strengths and weaknesses in relation to the demands of the given tasks in class. One important process for developing self-efficacy is *cognitive processing,* which means interpreting and analyzing information regarding the teaching task (*analysis of teaching task*) including the assessment of one's own personal teaching competence (*assessment of personal teaching competence),* which leads to the determination of *teacher efficacy*. Therefore, the model includes the *consequences of teacher self-efficacy,* which encompass the characteristics of determination, perseverance, risk-taking, and various aspects of teacher motivation. In this context, further research may evaluate whether the contextual factors around self-efficacy beliefs and the relations between them are applicable for student teachers attending teacher training.

## 2.1 (Prior) Teaching Experiences as Mastery Experiences

At the beginning of the teacher training program until the first school internships, student teachers have little to no experience teaching. A study of 12 secondary school teacher training programs in Germany showed what a low proportion of the overall teacher training program is allocated to the practical component: subjects 58.2%, didactics 9.3%, educational sciences 12.4%, and internships 6.7% (Bauer et al., 2012). Mastery experiences are highly important during this time – in Germany, however, student teachers often teach for the first time later on in their studies (Kleinknecht & Weber, 2020) (e.g. at the end of their bachelor degree).

Vicarious experiences are therefore also an important source of student teachers' self-efficacy beliefs. During their first school internships, student teachers mainly observe their supervising teacher in classrooms, but the content, purpose, and procedure of the practicums in Germany vary greatly between the federal provinces and universities – for example, in Brandenburg and Berlin the practicum is called "Orientierungspraktikum" and in Rheinland-Pfalz "Blockpraktika" (Bellenberg, 2002). Student teachers generally observe the teaching behaviors of an expert teacher during these first internships, where both observing expert teachers as role models and teaching in authentic classrooms can be assumed to enhance self-efficacy beliefs (Fives et al., 2007; Palmer, 2006). Thus, practical experiences during teacher education are important for the professional development of student teachers (Makrinus, 2012). However, the lack of practical experience in teacher education is often criticized (Ma & Cavanagh, 2018).

The need for practical experiences in teacher education is indicated by the low level of self-efficacy of student teachers in comparison to experienced teachers and novice teachers (3 or fewer years of experience) (Giallo & Little, 2003; Tschannen-Moran & Hoy, 2007). However, other conceptual work reports that student teachers still hold inaccurately high self-efficacy beliefs, as they display *unrealistic optimism* about the risk of facing negative events (Weinstein, 1989; Weinstein & Klein, 1996). Empirical findings in this context have shown that student teachers' self-efficacy decreased following practical teaching experiences, but student teachers with work placements experienced a more "realistic" estimation of teaching and learning in comparison to student teachers who did not have such experiences (Lamote & Engels, 2010). In contrast, qualitative findings confirm that student teachers who had already previous experiences dealing with children perceived their self-efficacy even higher (Kappler, 2013; Ma & Cavanagh, 2018). In this context, previous practical experiences enable student teachers to develop a better perception of their own teaching abilities (Ma & Cavanagh, 2018) and therefore have been included in prior research on teacher self-efficacy (Cantrell et al., 2003). Further, Ma and Cavanagh (2018) also found that some student teachers also reported a decrease in their self-efficacy for student engagement due to negative previous experiences. Other findings report, for example, relations between the amount of teaching per week and the development of student teachers' self-efficacy beliefs, because student teachers in a method course who taught more than 3 hours during a 3-week practicum experienced the largest increase in their personal science teaching efficacy in comparison with student teachers who did not teach as much during the course (Cantrell et al., 2003). Therefore, it seems to be important for student teachers to gain more and positive teaching experiences in combination with courses that convey teaching methods and offer parallel practical teaching experiences in

class, which would be particularly beneficial for the development of student teachers' teaching efficacy (Cantrell et al., 2003; Ma & Cavanagh, 2018).

Based on the research finding that predominantly prior teaching experiences promote self-efficacy in student teachers and that the quantity of practical experiences is usually not enough to prepare student teachers for their future jobs, this dissertation investigates the relation between practical experiences and the development of self-efficacy for student teachers attending university courses that involve structured micro-teaching experiences in schools (Study 1) accompanied by peer feedback (Study 2) and systematic reflection in the higher education learning setting (Studies 3 and 4).

## 2.2 Feedback from Others as Verbal Persuasion

Verbal persuasion as a source of self-efficacy beliefs plays an important role in teacher education, because student teachers regularly receive verbal feedback from their lecturers and supervising teachers (Berg & Smith, 2018). Verbal or written feedback is useful to establish a relation between the content student teachers have learned in university courses and real-world situations in the classroom (Akkuzu, 2014). In a mixed-method study, supervision by a professor concerning preservice teachers' learning and teaching behavior was found to be supportive for their science teaching self-efficacy (McDonnough & Matkins, 2010). However, feedback quality varies depending on the source of feedback. Poulou (2007), for example, showed that primary school student teachers perceived the feedback they received from peers after a 6-week teaching period as a less credible source of teaching efficacy compared to the student teachers' own motivation, personality traits or capabilities, which had the highest rankings as sources of teaching efficacy.

To investigate the relationship between verbal persuasion and self-efficacy, empirical studies use different measures of feedback. During teacher training the support has been assessed with measures that focus, for example, on the perceived quality of graphical feedback by peers and experts in the context of a web-based environment, which is positively linked to preservice teachers' self-efficacy for writing (Dempsey et al., 2009). Other studies used qualitative interviews that assessed the feedback from the student teachers' assessors, where the reported feedback quality had a positive effect on student teachers' self-efficacy beliefs (van Dinther et al., 2015). Akkuzu (2014) conducted interviews with six student teachers of chemistry and provided evidence for positive effects of different types of feedback on student teachers' self-efficacy beliefs and their teaching performance. In the context of an intervention,

results further showed that asynchronous online discussions, along with guided observations including video reflection and lesson planning, led to similar changes in self-efficacy beliefs and similar perceived support from the supervising teacher compared to groups of student teachers that only shared their video reflection with peers to receive feedback (Kopcha & Alger, 2011).

Due to the large number of studies showing that feedback is well suited to serve as a source of self-efficacy for student teachers, the present dissertation investigates the role of peer feedback in the context of practical experiences during university courses concerning changes in student teachers' self-efficacy (Study 2).

## 2.3 Individual Characteristics and Student Teachers' Self-Efficacy

It is well known that personal characteristics of preservice teachers, such as their pedagogical-psychological knowledge (Dicke et al., 2015) and gender (Cakiroglu & Isiksal, 2009), are related to their self-efficacy beliefs while attending teacher training programs.

### 2.3.1 Professional Knowledge

On a theoretical level, the extended model by Fives (2003) added the component *pedagogical knowledge* to the cyclical model introduced by Tschannen-Moran et al. (1998), referring to the "personal store of information, skills, strategies, and experiences related to the teaching process" (Fives, 2003, p. 96). The sources of information (mastery experiences, vicarious experiences, verbal persuasion, physiological arousal, and any other form of information) incorporated in the model have a direct influence on the development of teachers' pedagogical beliefs, which reflect teachers' understanding of teaching, their pedagogical knowledge, and the value they attach to their understanding – thereby, teachers' beliefs and knowledge are interrelated. It is assumed that teachers' existing knowledge and beliefs are directly related to the cognitive processing that takes place in the formation of teachers' sense of efficacy. Empirically, student teachers have indicated that their knowledge is the main source of their self-efficacy in English teaching (Filatov & Pill, 2015). Other studies, however, show no significant relation between prospective teachers' overall financial knowledge and high or low teaching self-efficacy regarding basic concepts in personal finance in the context of a student-teacher orientation meeting (Brandon & Smith, 2009), as well as no linear relation between domain-specific general pedagogical knowledge and self-efficacy beliefs of student teachers during their master studies (Depaepe & König, 2018). Findings are thus inconsistent

concerning the interrelations between professional knowledge and self-efficacy beliefs, and further research is needed to examine the elusive links, especially for student teachers during teacher education. Against this background, this dissertation explores relations between pedagogical knowledge and self-efficacy beliefs of student teachers during the practical phases of their teacher training programs (Studies 2 and 4).

## *2.3.2 Gender*

Another factor that affects student teachers' self-efficacy is their gender. Empirical findings have revealed that the gender of preservice teachers is associated with the development of their self-efficacy beliefs – findings illustrate that male preservice teachers reported higher self-efficacy beliefs and attitudes toward mathematics compared to female student teachers (Cakiroglu & Isiksal, 2009). Klassen and Chiu (2011) found that male preservice teachers rated their self-efficacy for classroom management higher than did female preservice teachers, but not their self-efficacy for student engagement or self-efficacy for instructional strategies. Studies on primary school science student teachers who participated in laboratory courses found no significant difference in student teachers' gender and the change in self-efficacy beliefs in the laboratory (Aka, 2016). Against this background, this dissertation explores gender differences in self-efficacy beliefs of student teachers during the practical phases of their teacher training programs (Study 2).

## 3. Consequences of (Student) Teachers' Self-Efficacy Beliefs: Relations between Teacher Self-Efficacy and Teaching Quality

The social cognitive theory of Bandura (1997) describes self-efficacy as an important personal resource that guides human behavior by influencing goal setting, persistence, and effort in relation to a specific task. In this context, the triadic reciprocal system explains that the relations between an individual's cognition, environment, and behavior are bidirectional, such that these processes influence each other in reciprocal relations (Bandura, 1997). Therefore, teachers' self-efficacy beliefs influence how they cope with teaching-related challenges and, similarly, it has been theorized that teachers' self-efficacy not only affects students' academic outcomes but is also affected by students' learning processes (Bandura, 1993).

Research has widely examined the reciprocal relations between teaching behaviors, teacher self-efficacy, and students' motivational, affective, and cognitive learning outcomes – resulting in inconsistent findings. Some studies have revealed positive effects of teacher self-

efficacy and student motivation in class (Pan, 2014; Ramos Salazar & Hayward, 2018), or student achievement (Althauser, 2015; Shahzad & Naureen, 2017). Other studies have found no significant relation between teachers' self-efficacy and student motivation beliefs (Burić & Kim, 2020) or student performance (Mahler et al., 2018). Some studies have not found any positive association between changes in teaching quality (student-perceived emotional support, classroom management or instructional clarity) and teacher self-efficacy (Lazarides et al., 2021). In contrast, other empirical findings show a significant and positive relation between teacher self-efficacy and student-reported instructional quality (Burić & Kim, 2020; Tschannen-Moran et al., 1998). One consistent finding, however, is that teachers' self-efficacy beliefs are positively interrelated with job satisfaction (Aldridge & Fraser, 2016; Klassen & Chiu, 2010) and well-being (Cansoy et al., 2020; Zee & Koomen, 2016). Empirical research on reciprocal relations between teachers' self-efficacy beliefs and their teaching behavior in class is also incoherent (Holzberger et al., 2013; Lazarides et al., 2022; Praetorius, Lauermann, et al., 2017). Some findings reveal reciprocal effects between teacher' self-efficacy and instructional quality, underlining the assumption that the cognitive process involved in successful behavior in class influences teachers' self-efficacy beliefs (Holzberger et al., 2013). Other studies found no significant relation between teacher self-efficacy and student-reported teaching quality (Lazarides et al., 2022; Praetorius, Lauermann, et al., 2017).

Focusing on student teachers, one study that examined student teachers during their Master's programs who taught for five months showed a positive relation between their self-efficacy and self-reported instructional practice (cognitive activation, classroom management, learning support) (Depaepe & König, 2018). Temiz and Topcu (2013) showed positive relations between observer-rated constructivist teaching practices (lesson design and implementation, content, and classroom culture) of elementary mathematics and science student teachers and their self-efficacy beliefs. Jamil et al. (2012), however, showed that the teaching performance of preservice teachers did not predict their self-efficacy beliefs at the end of the teacher preparation program.

Theoretical work conceptualizes different components of teaching quality. Pianta et al. (2012) developed the Classroom Scoring System that describes *instructional support*, *classroom organization,* and *emotional support* as generic dimensions of teaching quality (Pianta & Hamre, 2009). Other concepts include the three core dimensions of *cognitive activation* (e. g. co-constructive learning), *classroom management* (e.g. rules, routines, monitoring student's learning) and *supportive climate* (respectful atmosphere, individualized student support) (Klieme et al., 2009; Praetorius et al., 2018). In this dissertation, when

focusing on teaching quality, I refer to the conceptualization of the Classroom Scoring System for Secondary School (Pianta et al., 2012). The dissertation relies on this model because the conceptualization has been internationally validated (Pakarinen et al., 2010; Virtanen et al., 2018; Westergård et al., 2019) and the dimensions are assessed with observer ratings, which allow a certain level of objectivity. The few existing studies using the CLASS instrument to assess teachers' classroom behavior revealed that teachers' self-efficacy for classroom management was positively associated with high observer-rated classroom support (Virtanen et al., 2018). Moreover, Jang et al. (2019) showed that all subscales of teacher self-efficacy (instructional strategies, classroom management, and student engagement) were positively correlated with instructional support of teachers for English as foreign language.

Due to the lack of studies investigating the relations between student teachers' self-efficacy and their teaching behavior as rated by CLASS, empirical research is needed to examine to what extent student teacher self-efficacy beliefs and teaching quality are interrelated.

Against the backdrop of the theoretical and empirical research findings reviewed here, this dissertation examines the reciprocal relations between observer-rated teaching quality and student teachers' self-efficacy beliefs (Study 2).

## 4. Learning Environments and Student Teachers' Self-Efficacy

Learning environments shape student teachers' self-efficacy beliefs decisively by providing ways to test and experience their own teaching abilities in a secure setting. Contextual factors such as support and teaching resources play an important role for novice teachers' self-efficacy beliefs (Tschannen-Moran & Hoy, 2007). Findings show, for example, that learning settings that include the option of teaching peers in small groups are likely to enhance student teachers' perceptions of being able to plan and teach a lesson (Jakopovic et al., 2021). Against the background of changes in teacher education and related learning settings, this dissertation examines the differences in changes to student teachers' self-efficacy beliefs over one semester during COVID-19-related university closures (Study 1), in learning settings including peer feedback during practical experiences (Study 2), in innovative learning settings regarding the use of Virtual Reality (VR) videos (Study 3), and in learning environments that include reflection processes (Study 4).

## 4.1 Self-Efficacy and Stress in Online Teaching during the COVID-19 Pandemic

Due to the COVID-19 pandemic, schools and universities in Germany were temporarily closed and students and student teachers were taught online. Consequently, student teachers no longer had the opportunity to gain practical experience teaching in the classroom in schools. Theoretically, it is assumed that student teachers perceive a high level of stress already during their practicums because they have limited knowledge about strategies to manage their stress level (see for a review Gardner, 2010). Accordingly, the few existing empirical findings indicate that student teachers felt highly stressed during internships (Dicke et al., 2015; Fives et al., 2007), for example, because of a new school environment and work with a new curriculum (Lampadan, 2014). Even without the new demands that the pandemic imposed on teachers in everyday school life, 20%-30% of teachers in Germany are affected by a significant stress-related health disorder (Bauer, 2009). Therefore, further empirical research is needed to investigate the student teachers' stress levels with regard potential interventions which counteract stress-related health disorders already during teacher training and especially during practical periods. However, practical teaching experiences represent a possibility to learn how to deal with stressful and challenging situations in class (Kasperski & Crispel, 2021) in order to be more prepared for beginning a carrier as a teacher. During the COVID-19 pandemic, the change of learning settings also affected student teachers' self-efficacy beliefs. VanLone et al. (2022), for example, showed that preservice teachers had particularly high overall self-efficacy beliefs during the COVID-19 pandemic when they had the option to teach in schools in person. Empirical evidence, in contrast, has shown that the COVID-19 pandemic has resulted in a lack of online teaching experiences due to missing classroom interaction, school management processes, and inadequate student academic performance (Ma et al., 2021). Other studies revealed that limited access to digital resources (Kwaah et al., 2022), the adaption to a new way of learning, financial constraints, uncooperative classmates and the lack of communication skills caused in preservice teachers' stress during the pandemic (Francisco et al., 2022). It is therefore assumed that student teachers feel stressed during online teaching in university courses, such as when they perceive the integration of the curriculum through the online mode as insufficient (Ramakanta & Sahoo, 2020). In this regard, student teachers had no opportunities to teach during the COVID-19 pandemic due to school closures, which resulted in a lack of practical teaching experiences that could have acted as a potential support for student teachers' development of self-efficacy beliefs (Martins et al., 2015). Empirically, Takunyaci (2021) investigated teachers' self-efficacy during the pandemic and found out that

beginning teachers had lower teacher self-efficacy beliefs when teaching mathematics than teachers with 11 or more years of experience.

Therefore, this dissertation examines changes in self-efficacy beliefs and in student teachers' stress levels over one semester in a university course during the COVID-19 pandemic and during practical experiences in teacher training (Study 1).

## 4.2 Feedback in Learning Settings in Teacher Education

It is well known that feedback is an effective tool to make the learning process of student teachers visible (Newton et al., 2020). Constructive feedback can therefore be seen as a source of self-efficacy in terms of verbal persuasion, which supports an increase in teacher self-efficacy (Ma & Cavanagh, 2018; Palmer, 2011). In a qualitative study, it has been shown that student teachers described the feedback on group work in a course that focused on instructional methods as a source of their self-efficacy beliefs, especially in the form of verbal persuasion (Yurekli et al., 2020). Emphasizing the role of feedback as source of self-efficacy, Yang et al. (2006) indicated in their study that student teachers' peer feedback on written scripts about a task in a university course had a greater effect on student teachers' perceptions than feedback from teachers. Other findings showed non-significant relations between peer and mentor feedback in school and changes in student teachers' self-efficacy (Seifert & Schaper, 2018). Klassen and Durksen (2014) pointed out that for student teachers verbal persuasion is important, but support or feedback from school mentors might in some cases be obstructive. In contrast, in a qualitative study it was shown that preservice teachers perceived feedback from tutors as more beneficial as the teaching experience itself (Ma & Cavanagh, 2018). Due to different findings on feedback from mentors, peers or teachers in relation to teacher self-efficacy beliefs, empirical research is needed that investigates the role of feedback for teacher self-efficacy, especially in the context of teacher education. This dissertation thus also examines the role of peer feedback for student teachers' self-efficacy beliefs (Study 2).

## 4.3 Reflection in Learning Settings in Teacher Education

Similar to structured feedback, the systematic reflection on teaching behaviors during teacher preparation is crucial for the development of student teachers' self-efficacy beliefs during teacher education programs (Menon & Azam, 2021). Reflection refers in general here to a cognitive process in which individuals think about their actions in order to understand a certain situation - which ultimately helps them to draw conclusions from their actions and plan their

future behaviors (Wyss, 2013). For student teachers, the process of reflective teaching includes the reflection on their experiences in schools and might lead to an analysis of their own teaching behavior and subsequent actions (Akkuzu, 2014). Studies examining the relation between self-efficacy beliefs and reflection processes of student teachers report that student teachers who reflected on teaching experiences were able to activate previous knowledge and transfer this knowledge to their behaviors in the classroom (Bernadowski et al., 2013). Other findings show that student teachers who reflected in the context of a field-based experiment by means of a written reflection were more effective in teaching reading to students (Rogers-Haverback & Mee, 2015). After watching videos of their own teaching experiences and writing reflective e-journals, pre-service teachers felt able to create a positive classroom climate, which in turn enhanced their self-efficacy beliefs (Tavyl, 2014). In conclusion, theoretical and empirical studies in different contexts have pointed out that reflection processes are important for the development of student teachers' self-efficacy beliefs. Therefore, this dissertation investigates reflection in teacher education and its relation to self-efficacy beliefs (Studies 3 and 4).

## 4.4 Innovative Teaching Methods in Learning Settings in Teacher Education

The implementation of new technologies in teacher education is a relatively new field in research that also yields implications for research on student teachers' self-efficacy beliefs. For example, classroom videos derived from virtual reality classrooms have been described as an opportunity to reflect on teaching experiences (Buchbinder et al., 2021; Theelen et al., 2019). Research has shown that *Virtual Reality* (VR) functions as a supportive learning tool in teacher education (Stavroulia et al., 2019), but until now, it has been unclear *how* exactly the VR features support student teachers' learning (Chen, 2006). Nissim and Weissblueth (2017) found that VR learning environments helped student teachers to increase their self-efficacy beliefs and supported them to be more innovative and creative. Moreover, the use of VR in a classroom training system supported student teachers' classroom competencies, which was perceived as a useful tool for the evaluation of and reflection on individual teacher behavior (Seufert et al., 2022).VR has the advantage that student teachers easily get access to the learning environment of a classroom (Stavroulia et al., 2019), which is an important institutional resource in times of societal challenges such as the school closures due to the COVID-19 pandemic. Against this background, this dissertation investigates VR classrooms in teacher education and their effects on student teachers' self-efficacy beliefs (Study 3).

## 5. Theoretical Conclusions and Schematic Model

Given this theoretical and empirical review of changes in student teachers' self-efficacy beliefs during their teacher training, along with the role of individual characteristics and different learning environments in such changes, I propose the schematic model depicted in Figure 1 as a conceptual overview of social and individual characteristics related to changes in student teachers' self-efficacy beliefs. The model refers to social cognitive theory (Bandura, 1989, 1997) and the main sources of self-efficacy beliefs described therein.
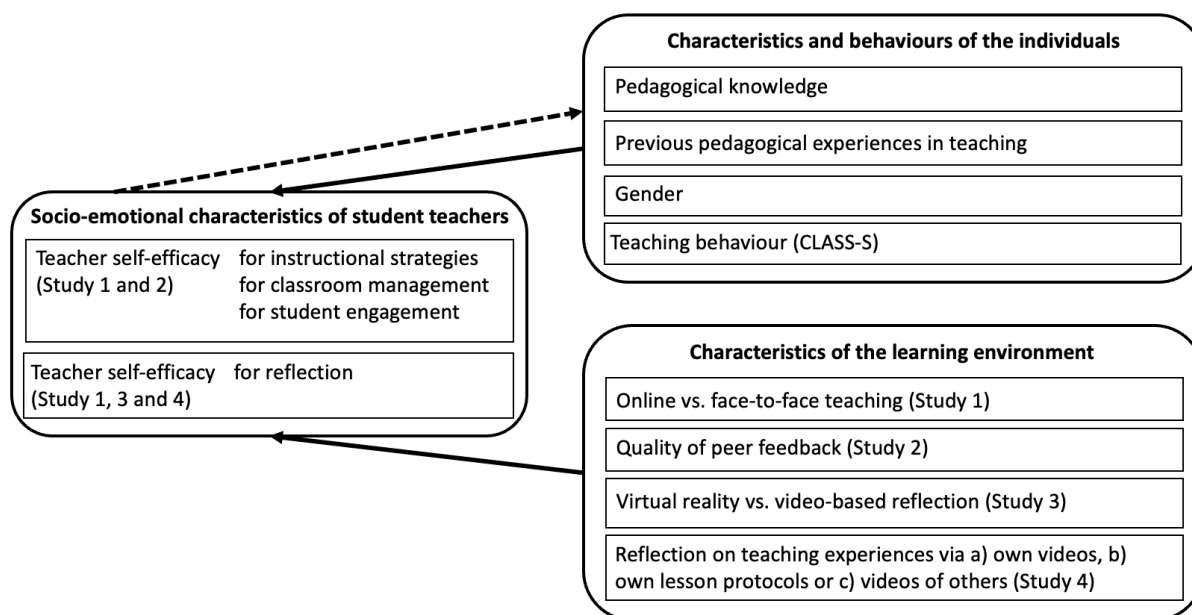


**Fig. 1** Model design of student teachers' socio-emotional and individual characteristics and characteristics of the learning environment during a teacher education program

In this dissertation, the *changes in student teachers' self-efficacy beliefs* during practical teaching experiences were investigated over the course of one semester in Studies 1 and 2, using an adapted measure based on the German version of the *teacher self-efficacy* measure developed by Pfitzner-Eden et al. (2014). Thus, three different dimensions were longitudinally examined: student teachers' self-efficacy for classroom management, for student engagement, and for instructional strategies. In regard to *learning settings* in teacher education, this dissertation compared the changes in self-efficacy beliefs during *online teaching* without practical teaching experiences during the COVID 19 pandemic with changes in self-efficacy beliefs during *face-to-face teaching* that included short practical teaching experiences in schools over the course of one semester (Study 1).

Further, the dissertation examined *how* short practical experiences shape or are shaped by student teachers' self-efficacy beliefs by investigating the reciprocal relations between

student teachers' *self-efficacy beliefs* (for classroom management, for student engagement, for instructional strategies) and their videotaped and observer-rated *teaching behavior* in classrooms. The CLASS Scoring System by Pianta et al. (2012) was used to evaluate videotaped teaching behaviors of student teachers. Moreover, student teachers' self-perceived *quality of peer feedback* regarding their presented lesson plans in university courses in the context of their short-term practical experiences were examined as antecedents of self-efficacy beliefs (Study 2). The dissertation also considered student teachers' *individual characteristics* such as their *pedagogical knowledge, previous teaching experiences,* and *gender* as covariates of their self-efficacy beliefs (Studies 2 and 4).

The last two studies in this dissertation focus on self-efficacy for reflection with established measures developed by Fraij (2018) and Lohse-Bossenz et al. (2019). Study 3 examines how innovative teaching settings – here *Virtual Reality classrooms* – shape student teachers' self-efficacy beliefs in regard to reflection in comparison with real-life teaching videos and whether VR videos enhance student teachers' reflective processes during teacher education. Moreover, Study 4 examines changes in self-efficacy related to reflective processes during short practical experiences and during online teaching assessing self-efficacy for reflection. Student teachers systematically reflected on either their own videotaped or protocol-based teaching experiences or videotaped teaching situations of others during their university courses (Study 4). Furthermore, changes in student teachers' self-efficacy beliefs are investigated in relation to student teachers' *individual characteristics* (*pedagogical knowledge* and *previous pedagogical experiences teaching*) during short practical experiences in teacher education (Studies 3 and 4).

Summarizing the studies in this dissertation, the presented empirical studies are concerned with the examination of changes in different dimensions of student teachers' self-efficacy beliefs in relation to short-term teaching experiences during teacher training.

## 6. Research Questions and Hypotheses

Against the background of social cognitive theory (Bandura, 1989, 1997) and research on changes in and sources of *student teachers' self-efficacy beliefs* (Martins et al., 2015; Morris et al., 2017; Pendergast et al., 2011; Tschannen-Moran & McMaster, 2009; Usher & Pajares, 2006), *characteristics of individuals* (Depaepe & König, 2018; Filatov & Pill, 2015; Klassen & Chiu, 2011), and *(innovative) learning settings* (*reflection processes*: Bernadowski et al. (2013), Rogers-Haverback and Mee (2015); *VR video settings*: Stavroulia et al. (2019), Seufert et al. (2022)), this dissertation addresses the lack of empirical research on changes in student

teachers' self-efficacy beliefs during teacher education and, more specifically, in the context of short practical experiences in university courses. The dissertation was guided by the following overarching research questions:

1. How do different dimensions of student teachers' self-efficacy beliefs (instructional strategies, classroom management, and student engagement) change throughout the course of a semester and in learning settings with and without short practical experiences (Study 1)?

2. How is the observer-rated teaching behavior of student teachers during short practical experiences and the perceived quality of peer feedback related to different dimensions of their self-efficacy beliefs (for instructional strategies, classroom management, student engagement) (Study 2)?

3. How do student teachers' self-efficacy beliefs for reflection change over the course of one semester with and without innovative technologies, and to what extent do VR videos provide the opportunity to stimulate reflection processes among student teachers in teacher education (Study 3)?

4. How do student teachers' self-efficacy beliefs for reflection change throughout the course and in learning settings with and without short practical experiences and reflection on these experiences (Study 4)?

5. How do individual characteristics of student teachers, such as their professional knowledge (Studies 2 and 4), previous pedagogical experience (Studies 2 and 4), and gender (Study 2) relate to the changes in different dimensions of their self-efficacy beliefs?

Due to the lack of empirical research examining self-efficacy and burnout of student teachers during teacher education (Weber & Greiner, 2019), Study 1 deals with the question of to what extent the self-efficacy and burnout level of student teachers changes over one semester at a German university. In regard to Research Question 1, following empirical evidence (Fives et al., 2007; McDonnough & Matkins, 2010; Pfitzner-Eden, 2016a), we expected increases in self-efficacy beliefs over the course of one semester particularly in courses in which student teachers had the chance to teach in schools – because such practical experiences serve as mastery experiences (Bandura, 1997), which in turn enhance self-efficacy beliefs. Thereby, two groups were investigated – the student teachers in the intervention group ($n = 113$) who taught and reflected on micro-teaching experiences and the control group consisting of student teachers ($n = 127$) teaching online without the possibility to teach or reflect on teaching

experiences. Moreover, a 2*2 factorial analysis of variance with repeated measures was computed for the 3 subscales of teacher self-efficacy (for instructional strategies, for classroom management, for student engagement) in the German version adapted for student teachers by Pfitzner-Eden et al. (2014). In addition, a 2*2 factor ANOVA with repeated measures was also computed for the 3 subscales of the Burnout Inventory in the German version for student teachers (emotional exhaustion, depersonalization, and efficiency) by (Schaufeli et al., 2002). Furthermore, in the context of the reflection task including written reflections on teaching experiences focusing on a successful and a challenging situation, the changes in student teachers' self-efficacy for reflection developed by Fraij (2018) was also examined. Moreover, Study 1 focused on changes in stress levels of student teachers during online versus face-to-face teaching, but only current studies investigated student teachers' stress level in the context of online teaching during COVID-19 pandemic which showed that student teachers are potentially more stressed during the pandemic (Francisco et al., 2022; Kwaah et al., 2022). In terms of student teachers' changes in their stress level during practical teaching phases, recent research indicated higher stress levels of student teachers (Dicke et al., 2015; Fives et al., 2007). Against this background we exploratory examined changes in student teachers' stress levels during online teaching and during practical teaching phased in teacher education.

With regard to Research Question 2, based on prior empirical evidence (Menon & Azam, 2021; Tavyl, 2014), we expected that student teachers' self-efficacy would be reciprocally associated with their teaching behavior in class through short-term practical experiences in teacher education over the course of one semester. Due to predominantly positive findings of the relation between feedback and self-efficacy and the assumptions of feedback as source of teacher self-efficacy beliefs (Ma & Cavanagh, 2018; Palmer, 2011), we assumed that the perceived quality of peer feedback at mid-semester supports student teachers' changes in self-efficacy over the semester. With respect to Research Question 5, following theoretical assumptions about professional knowledge (Fives, 2003), different results on previous pedagogical experiences (Cantrell et al., 2003; Ma & Cavanagh, 2018), and inconsistent findings regarding student teachers' gender (Aka, 2016; Klassen & Chiu, 2011) and self-efficacy beliefs, we included student teachers' individual personality characteristics as covariates.

Consequently, Study 2 explores the extent to which changes in student teachers' self-efficacy beliefs are reciprocally related to their teaching behavior and the perceived quality of peer feedback they received over one semester at a German university. In this context, N = 38 student teachers from the sample of the intervention group in Study 1 were used to investigate

the impact of teaching behavior in short practical experiences and the perceived quality of peer feedback about the planned lesson in the university course on changes in self-efficacy beliefs of student teachers in the teacher training program. Therefore, the student teachers' self-efficacy beliefs were assessed through the German version of a scale measuring student teachers' self-efficacy beliefs (Pfitzner-Eden et al., 2014), the quality of peer feedback (Laschke & Blömeke, 2014), and teaching quality rated by trained and certified observers using the CLASS Secondary Scoring System (Pianta et al., 2012). Moreover, Study 2 investigates the relation between student teachers' individual characteristics (educational knowledge, prior teaching experiences, and gender) and their self-efficacy beliefs in the context of practical experiences during one semester of teacher education.

In regard to Research Question 3, following empirical evidence (Nissim & Weissblueth, 2017) and theoretical assumptions (Stavroulia et al., 2019), we exploratively assumed that student teachers experience an increase in their self-efficacy for reflection and that the usage of VR videos in teacher training programs enhances student teachers' reflection processes.

In Study 3, as in Study 1, two groups of student teachers are compared with regard to their changes in reflection-related self-efficacy by the German scale developed by Lohse-Bossenz et al. (2019). The intervention group is represented by $n = 46$ student teachers who reflected on their own videotaped teaching experiences using recorded VR videos and $n = 23$ student teachers in the control group who only had the chance to reflect on a single teacher's teaching video due to the COVID-19 pandemic and had not actually taught on their own. The reflection task consisted of reflecting on one successful and one challenging situation in the video. Moreover, Study 3 investigates the extent to which the reflection on VR videos is a chance to enhance self-efficacy for reflection, as well as the extent to which the written reflections of student teachers in the two groups differ from each other in terms of the content reflected on.

In regard to Research Question 4, based on theoretical assumptions (Bernadowski et al., 2013; Rogers-Haverback & Mee, 2015), we expected that student teachers who taught and reflected on teaching experiences would increase their self-efficacy for reflection over one semester in teacher education. With regard to Research Question 5, following theoretical assumptions about professional knowledge (Fives, 2003) and inconsistent findings with respect to previous pedagogical experiences (Cantrell et al., 2003; Ma & Cavanagh, 2018) and their relations to student teachers' self-efficacy beliefs, we included the individual characteristics of student teachers as covariates.

In this context, Study 4 focuses on student teachers' reflection processes during short practical experiences in a teacher education program by comparing changes in self-efficacy for

reflection of $n = 352$ student teachers who did not have the chance to teach or to reflect on teaching experiences with that of $n = 248$ student teachers who participated in short-term teaching settings including planning a lesson, presenting the lesson in the university course, teaching the lesson, and reflecting on the teaching experience through the use of different media (their own teaching video, a video of others or the lesson protocol of their own teaching). In this study, the German reflection-related self-efficacy scale by Fraij (2018) was used, and covariates such as student teachers' pedagogical knowledge and their previous pedagogical experiences were investigated. Due to the investigation of student teachers' individual characteristics and their changes in self-efficacy, Study 4 investigates the role of student teachers' previous teaching experiences and their pedagogical knowledge in the development of self-efficacy for reflection over the course of one semester.

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# Empirical studies

## *Study 1*

### COVID-19-bedingte Online- vs. Präsenzlehre: Differentielle Entwicklungsverläufe von Beanspruchung und Selbstwirksamkeit in der Lehrkräftebildung?

# COVID-19-bedingte Online- vs. Präsenzlehre: Differentielle Entwicklungsverläufe von Beanspruchung und Selbstwirksamkeit in der Lehrkräftebildung?

Isabell Hußner · Rebecca Lazarides · Andrea Westphal

**Zusammenfassung** Bedingt durch die COVID-19-Pandemie haben Universitäten die Lehrkräftebildung in den vergangenen Monaten rasant auf Online-Formate um- stellen müssen. Für eine evidenzbasierte Weiterentwicklung der Online-Lehre sind empirische Ergebnisse zur professionellen Entwicklung von Lehramtsstudierenden erforderlich. Vor diesem Hintergrund ist es wichtig, Unterschiede zwischen Präsenz- und Onlineformaten in der Lehre zu untersuchen. In der vorliegenden Studie gehen wir daher der Frage nach, inwiefern sich Selbstwirksamkeitserwartungen und Beanspruchungserleben von Lehramtsstudierenden im Verlauf eines COVID-19 bedingten Online-Semesters sowie im Verlauf von schulpraxisbezogenen Präsenzsemestern differentiell entwickeln. An der längsschnittlichen Fragebogenstudie mit quasi-experimentellem Design nahmen N = 240 Lehramtsstudierende teil (n = 127 Online-Semester; n = 113 Präsenzsemester). Die Ergebnisse verweisen auf einen stärkeren Anstieg der Selbstwirksamkeitserwartungen in Präsenzformaten als im Onlineformat. In Bezug auf das Beanspruchungserleben zeigten sich keine Gruppenunterschiede. Implikationen dieser Befunde für die Weiterentwicklung der Lehrkräftebildung werden weiterführend diskutiert.

**Schlüsselwörter** Selbstwirksamkeitserwartungen · Beanspruchungserleben · Lehrkräftebildung · COVID-19 · Online-Lehre

**Face-to-face vs. online teaching in the COVID-19 pandemic: Differential development of burnout and self-efficacy in teacher training?**

Abstract In recent months, as a result of the COVID-19 pandemic, universities have had to rapidly move teacher training programs onto online platforms. In order to be able to develop these online formats in an evidence-based way, it is vital to have access to empirical data on the development of professional competencies in student teachers. Key to this is understanding the differences between classroom and online formats in teaching. In the present study, we therefore investigate the extent to which self-efficacy expectations and experiences of stress

(burnout) in student teachers develop differently in practice-based face-to-face semesters in schools as compared to the equivalent online semester under the COVID-19 pandemic restrictions. N = 240 student teachers (n = 127 online semester; n = 113 face-to-face semesters) took part in the longitudinal questionnaire study with a quasi-experimental design. The results indicate a higher increase in self-efficacy expectations in face-to-face formats than in the online formats. There were no group differences with regard to experiences of stress. We discuss the implications of these findings for the further development in teacher training.

## 1  Einleitung

Hohe Selbstwirksamkeitserwartungen sind eine bedeutsame Ressource in der Lehrkräftebildung – sie wirken einem erhöhten Beanspruchungserleben entgegen (Fives et al. 2007) und stehen mit dem pädagogischen Professionswissen im Studium in korrelativem Zusammenhang (Schulte et al. 2008). Erfolgreiche eigene Praxiserfahrungen gelten als besonders bedeutsam für die Entwicklung von Selbstwirksamkeitserwartungen in der Lehrkräftebildung (Bandura 1997). Praxisphasen werden dabei sowohl als Bereicherung (Makrinus 2012) als auch als Belastung wahrgenommen (Holtz 2014). Wie sich Selbstwirksamkeitserwartungen und Beanspruchungserleben von Studierenden entwickeln, wenn Praxiserfahrungen in der Lehrkräftebildung fehlen, ist insbesondere im Kontext der COVID-19-bedingten Online-Lehre an Universitäten eine bedeutsame Frage. Zahlreiche Studien befassen sich aktuell mit den Auswirkungen des COVID-19-bedingten Fernunterrichts auf Schülerinnen und Schüler (Huber et al. 2020; Steinmayr et al. 2021) – allerdings existieren bisher wenige Studien, die sich mit der Bedeutung der COVID-19-bedingten Online-Lehre im Hochschulbereich befassen (z. B. Osterberg et al. 2020; Schmölz et al. 2020; Scull et al. 2020). Die vorliegende Untersuchung geht vor diesem Hintergrund der Frage nach, wie sich Selbstwirksamkeitserwartungen und Beanspruchungserleben in der Lehrkräftebildung im Semesterverlauf verändern und welche Unterschiede dabei zwischen der Online-Lehre während der COVID-19-Pandemie und der Präsenzlehre mit schulpraktischem Anteil bestehen.

## 2. Theoretischer Hintergrund

### 2.1 Selbstwirksamkeitserwartungen von angehenden Lehrkräften

Im Modell professioneller Handlungskompetenz von Lehrkräften (Baumert und Kunter 2006)gelten Lehrerselbstwirksamkeitserwartungen als bedeutsame Komponente motivationaler Orientierungen. Die sozial-kognitive Theorie nach Bandura (1997) beschreibt Selbstwirksamkeitserwartungen als individuelle Überzeugungen, eigene Handlungen erfolgreich initiieren und aufrechterhalten zu können, um schwierige Situationen zu bewältigen. Lehrerselbstwirksamkeit bezieht sich dabei unter anderem auf die Überzeugung, unterrichtsbezogene Herausforderungen auch angesichts von Schwierigkeiten erfolgreich bewältigen zu können (Tschannen-Moran und Woolfolk Hoy 2001). Empirische Befunde zeigen, dass hohe Selbstwirksamkeitserwartungen es Lehrkräften ermöglichen, qualitätsvollen Unterricht durchzuführen (Schwarzer und Jerusalem 2002; Zee und Koomen 2016). Die Entstehung von Selbstwirksamkeitsüberzeugungen wird dabei als zyklischer Prozess verstanden: Zu den zentralen Quellen der Selbstwirksamkeit zählen erfolgreiches Handeln, stellvertretende Erfahrungen, verbale Persuasion oder affektive sowie physiologische Erregung – eigene (Lehr-)Erfahrungen werden zunächst entlang dieses Kontinuums kognitiv bewertet und dieser Bewertungsprozess beeinflusst, wie neue (Lehr.-)Aufgaben in Relation zu den eigenen Lehrkompetenzen beurteilt werden. Aus diesem Beurteilungsprozess generiert sich das eigene Selbstwirksamkeitserleben, das sich wiederum auf die eigenen Zielsetzungen und die Anstrengung, die in die Erreichung der gesetzten Ziele investiert wird, auswirkt. Aus diesem Prozess folgende (Lehr-)Erfahrungen wirken sich wiederum auf das Erleben wichtiger Quellen der Selbstwirksamkeit wie erfolgreiches Handeln oder affektive Erregung aus. Auf theoretischer Ebene wird angenommen, dass hohe Selbstwirksamkeitserwartungen dazu führen, dass Lehrkräfte sich herausfordernde Ziele für ihre Unterrichtsgestaltung setzen, sich daraufhin stärker mit neuen und innovativen Lehrmethoden auseinandersetzen und auch positiv auf die Bereitschaft wirken, neue Methoden und Unterrichtsstrategien in herausfordernden Unterrichtssituationen umzusetzen (vgl. Tschannen-Moran et al. 1998). Tschannen-Moran und Hoy (2001) unterscheiden dabei drei Facetten von Lehrerselbstwirksamkeit: *Selbstwirksamkeit für Instruktionsstrategien, Selbstwirksamkeit für Schülerinnen- und Schülerengagement und Selbstwirksamkeit für Klassenmanagement*. Hinsichtlich der Quellen von Selbstwirksamkeit – Erfolgserfahrungen (*mastery experiences*), Beobachtung von erfolgreichen Verhaltensmodellen (*vicarious experiences*), Feedback (*verbal persuasion*) und erlebte emotionale Zustände (*affective*

*arousal*) (vgl. Morris et al. 2017) spielt die kognitive Verarbeitung von eigenen oder bei anderen beobachteten (stellvertretenden) Erfolgs- und Misserfolgserlebnissen eine zentrale Rolle für die Entwicklung von Selbstwirksamkeit (Bandura 1997; Schwarzer und Jerusalem 2002). Auch Unterrichtshospitationen können als Lernen am Modell aufgefasst werden, wenn beispielsweise die hospitierende Person die Lehrkraft dabei beobachtet, wie neue Methoden im Unterricht eingesetzt und diese für den eigenen Unterricht in Betracht gezogen werden (Urton 2017). Darüber hinaus gelten konstruktives Feedback von Dozierenden und Mentoren bzw. Mentorinnen (im Sinne verbaler Persuasion, Clark und Newberry 2019) sowie das Ausmaß an physiologischer und emotionaler Aktivierung als Quelle für die Entwicklung von Selbstwirksamkeit im Lehramtsstudium (Bandura 1997; Pfitzner-Eden 2016). Forschungsarbeiten, die sich mit der Selbstwirksamkeit von Lehramtsstudierenden befassen, konnten dementsprechend auch einen positiven Zusammenhang zwischen der Auseinandersetzung mit fremden sowie eigenen Unterrichtsvideos und dem Kompetenzerleben Studierender feststellen (Gold et al. 2017). Im Hinblick auf die Veränderung der Selbstwirksamkeit bei Lehramtsstudierenden zeigen bisherige Studien vorwiegend einen Anstieg der Selbstwirksamkeit zu Studienbeginn (z.B. Lamote und Engels 2010) sowie während des Studiums vor allem im Verlauf von bzw. nach schulpraktischen Phasen (z.B. Garvis et al. 2012; Schüle et al. 2017a). Dennoch ist die Forschungslage bezüglich der Veränderungen der Selbstwirksamkeitserwartungen während des Lehramtsstudiums und darüber hinaus noch immer inkonsistent (Schüle et al. 2017a), da auch auf einen *university shock* verwiesen wird, den Studierenden zu Beginn des Studiums erleben können und der zu einem Absinken des Selbstwirksamkeitserlebens führen kann (Pfitzner-Eden 2016). Es wird davon ausgegangen, dass Selbstwirksamkeitserwartungen anfänglich leichter veränderbar sind und mit zunehmenden Erfolgserfahrungen immer stabiler werden, da Lehrkräfte und Lehramtsstudierende ihre Erfolgserfahrungen in einer spezifischen Situation auch auf andere Situationen übertragen können und annehmen, auch in diesen Situationen erfolgreich handeln zu können (Bandura 1977; Woolfolk Hoy und Spero 2005).

## 2.2 Selbstwirksamkeitserwartungen während Praxisphasen in der Lehrkräftebildung

Praxisphasen können mit einem Anstieg von Selbstwirksamkeitserwartungen einhergehen (Klassen und Durksen 2014) – erklärende Faktoren dafür sind unterstützende Anleitungen von Mentorinnen und Mentoren (*verbal persuasion*) (Klassen und Durksen 2014; Moulding

et al. 2014) sowie eigene Unterrichtserfahrungen (*mastery experiences*) (Cantrell et al. 2003). Auch Rollenspiele und Microteaching-Erfahrungen mit spezifischem Feedback besitzen einen Einfluss auf die Selbstwahrnehmung der Lehrkräftekompetenz (Tschannen-Moran et al. 1998). Zudem kann davon ausgegangen werden, dass stellvertretende Erfolgserfahrungen (*vicarious experiences*) in Unterrichtshospitationen bei erfolgreichen Lehrpersonen im positiven Zusammenhang mit der Selbstwirksamkeit angehender Lehrkräfte stehen (Bandura 1997; Palmer 2006; Tatar und Buldur 2013). Empirische Studien zeigen, dass Lehramtsstudierende Praxisphasen als Herausforderung wahrnehmen und diejenigen Studierenden, die positive Veränderungen erleben, berichten, dass gerade die erfolgreiche Bewältigung dieser herausfordernden Studienphase als stärkend für die eigene unterrichtsbezogene Selbstwirksamkeit empfunden wird (Klassen und Durksen 2014). Dieser Befund ist im Einklang mit der Annahme von Bandura (1997), dass leicht zu bewältigende Aufgaben weniger selbstwirksamkeitsrelevant sind als herausfordernde Aufgaben. Neben Forschungsarbeiten, die einen Anstieg der Selbstwirksamkeit von Lehramtsstudierenden nach Praxisphasen berichten (Eisfeld et al. 2020; Fives et al. 2007; Ronfeldt und Reininger 2012; Schüle et al. 2017a), wird in anderen Studien jedoch auch auf eine Stabilität der Selbstwirksamkeit von Studierenden bzw. auf eine negative Korrelation der Anzahl von Unterrichtserfahrungen im Rahmen von Praxisphasen verwiesen (Capa Aydin und Woolfolk Hoy 2005; Lin und Gorrell 2001). Mögliche Erklärungen dieser inkonsistenten Befunde werden in Unterschieden im Studiendesign bzw. der Erhebungsmethoden z.B. in Bezug auf den Umfang der Praktikumsdauer vermutet (Bach 2013). Einige Studien zeigten einen Anstieg der Lehrer-Selbstwirksamkeit nach einem Schulpraktikum, die jedoch im Verlauf des ersten Berufsjahres wieder absinkt (Woolfolk Hoy und Spero 2005).

Ein wichtiges Anliegen von Praxisphasen ist darüber hinaus, dass sich Lehramtsstudierende einen Habitus des forschenden Lernens – im Sinne des Modells des *reflective practitioner* nach Schön (1983) – aneignen. Diese Fähigkeit zur kritischen Reflexion kann günstig auf die Entwicklung der unterrichtsbezogenen Selbstwirksamkeit wirken (Black 2015). Allerdings ist wenig darüber bekannt, inwiefern Praxisphasen einen Einfluss auf die Selbstwirksamkeit von Lehramtsstudierenden in Bezug auf das Reflektieren verschiedener Unterrichtshandlungen besitzen. Weß et al. (2018) konnten zeigen, dass die Selbstwirksamkeit zur Reflexion bei Studierenden nach mindestens einem Praktikum signifikant höher war als bei Studierenden ohne Praktikum ($d$ = 0,19). Somit kann angenommen werden, dass Praxisphasen das Kompetenzerleben im Bereich der Reflexion besonders anregen. Insgesamt sind die spezifischen Bedingungen, unter denen sich Selbstwirksamkeit im Verlauf der

Lehrkräftebildung verändert, bisher jedoch unzureichend empirisch untersucht worden (Clark und Newberry 2019).

## 2.3 Beanspruchungserleben von angehenden Lehrkräften

In der aktuellen Forschung wird zwischen Belastungen und Beanspruchungen unterschieden – während Belastungen als objektive, von außen auf Individuen einwirkende Prozesse und Faktoren gelten, werden Beanspruchungen als interindividuell variierende Auswirkungen objektiver Belastungen definiert (Rudow 1995). Eine psychische Beanspruchung resultiert aus der Einschätzung, dass externe Anforderungen bedrohlich sind oder die individuellen Bewältigungsressourcen übersteigen (Lazarus und Folkman 1984). Durch die wiederholte Konfrontation mit solchen Stressoren können Symptome von Burnout entstehen (Rudow 1995). Das Burnout-Syndrom wurde von Maslach et al. (1996) als ein dreidimensionales Phänomen aus emotionaler Erschöpfung, Depersonalisierung und Ineffektivität (verringerter persönlicher Leistungsfähigkeit) beschrieben. In anderen Publikationen wird der letztgenannte Faktor auch im Sinne positiv formulierter Überzeugungen einer professionellen Wirksamkeit (*professional efficacy*) erfasst (z.B. Schaufeli und Salanova 2007). *Emotionale Erschöpfung* bezeichnet eine gefühlsmäßige Überforderung. *Depersonalisierung* (Zynismus) wird durch eine distanzierte und durch Abwertung charakterisierte Einstellung gegenüber Personen des Arbeitsgeschehens beschrieben. *Professionelle Wirksamkeit* ist durch das Gefühl charakterisiert, Arbeitsanforderungen erfolgreich bewältigen zu können.[1]

Besonders im Lehrberuf begünstigen stressfördernde Arbeitsaufgaben und soziale Gegebenheiten ein hohes Belastungserleben (Rothland 2013). Bisherige Studien konnten zeigen, dass Lehramtsstudierende bereits während ihres Studiums psychisch belastet sind (Bauer 2019; Römer et al. 2012) – insbesondere durch Aspekte wie Prüfungsleistungen, zu viele Anforderungen in zu kurzer Zeit oder der Koordinierung von Nebenjobs und Studium (Kosinár und Leineweber 2010). Darüber hinaus konnte Bauer (2019) feststellen, dass die personalen Gesundheitsressourcen der Lehramtsstudierenden wie Selbstwirksamkeit oder Achtsamkeit als bessere Prädiktoren der psychischen Beanspruchung gelten als soziodemografische bzw. studiumsbezogene Charakteristika.

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[1] Die Items werden in manchen Arbeiten rekodiert und als reduzierte Leistungsfähigkeit benannt (Schaufeli und Salanova 2007), in anderen Arbeiten werden die Items nicht rekodiert und im Sinne einer professional efficacy erfasst (Bresó et al. 2007). In der vorliegenden Studie nutzen wir das positiv formulierte Konstrukt.

## 2.4 Beanspruchung während Praxisphasen in der Lehrkräftebildung

Zahlreiche Studien untersuchen das Beanspruchungserleben während Praxisphasen im Lehramtsstudium – allerdings sind die Ergebnisse eher inkonsistent. Es wird davon ausgegangen, dass mangelnde Unterrichtserfahrungen und Fähigkeiten im Unterrichten dazu führen können, dass die vielfältigen Belastungen in Praxisphasen als besonders beanspruchend erlebt werden (Bauer 2019). In der Studie von Holtz (2014) berichten die Studierenden, dass das Beanspruchungserleben im Praxissemester höher ist als in anderen Phasen des Studiums. Studierende berichten aber auch, dass sie die überdurchschnittlichen Belastungen nicht als Bedrohung, sondern als wertvolle Herausforderung wahrnehmen (Bauer 2019). Auch Längsschnittstudien, die Studierende im Verlauf von Praxisphasen mehrfach zu ihrem Belastungserleben befragen, finden unterschiedliche Verläufe. Einige Studien verweisen auf einen Anstieg des Beanspruchungserlebens während des Praxissemesters bzw. im Vorbereitungsdienst (Pereira Kastens et al. 2020; Schüle et al. 2017b). Andere Studien deuten auf eine Abnahme des Beanspruchungserlebens im Verlauf des Praxissemesters hin (Krawiec et al. 2020; Römer et al. 2018). Eine mögliche Erklärung für solche inkonsistenten Befunde könnte in praxisbegleitenden Faktoren liegen – so wirken beispielsweise Handlungsspielräume oder soziale Unterstützung (Gusy et al. 2016), die Anzahl der Unterrichtsstunden oder die Unterstützung durch Mentorinnen und Mentoren (Kücholl et al. 2019) sowie ein guter Kontakt mit Schülerinnen und Schülern (Timoštšuk und Ugaste 2012) dem Beanspruchungserleben in Praxisphasen entgegen. Zu hohe universitäre Anforderungen sowie problematische Interaktionen mit betreuenden Lehrkräften bzw. Dozierenden wirken sich wiederum negativ auf das Beanspruchungserleben der Studierenden aus (Timoštšuk und Ugaste 2012).

## 2.5 Online-Lehre in Schule und Hochschule

Studien, die sich mit den Auswirkungen des COVID-19-bedingten Fernunterrichts befassen, zeigen ein hohes Beanspruchungserleben seitens der Lernenden im schulischen Fernunterricht (Huber et al. 2020), insbesondere bei Schülerinnen und Schülern, deren Eltern einen niedrigen Bildungsabschluss oder einen Migrationshintergrund besitzen bzw. die auf engem Raum leben (Ravens-Sieberer et al. 2021). Besonders individuelle Unterstützung und Rückmeldung sind für die Motivation und den Lernfortschritt im schulischen Fernunterricht bedeutend und sind sogar über den Einfluss des sozioökonomischen Status hinaus relevant (Steinmayr et al.

2021). Bisherige Studien zur pandemiebedingten Online-Lehre bei Studierenden zeigen, dass besonders die genutzte Technik, die Organisation sowie die Qualität der Instruktion oder der Umgang mit Lehrenden als herausfordernd wahrgenommen werden (vgl. Schmölz et al. 2020). In deskriptiven Umfragen an deutschen Universitäten berichtet eine Vielzahl der befragten Studierenden, dass sich die Arbeitsbelastung während der Online-Lehre im Gegensatz zur regulären Lehre erhöht hat (Stefanica et al. 2021; Traus et al. 2020). Auch andere Untersuchungen der COVID-19-bedingten Online-Lehre deuten darauf hin, dass Studierende Schwierigkeiten mit der situativ angepassten Lehre aufweisen (Traus et al. 2020; Van Nguyen et al. 2020). Faktoren, wie z.B. die Strukturierung bzw. die zeitliche Organisation der Arbeit zu Hause, Misserfolgsangst oder ressourcenintensivere Lernaktivitäten werden als erklärende Einflussfaktoren für ein erhöhtes Beanspruchungserleben der Studierenden während der Online-Lehre angesehen (Hahn et al. 2021; Stefanica et al. 2021). Neben den neuen Herausforderungen in der Online-Lehre fehlt gleichzeitig ein schulpraktischer Anteil, der von Lehramtsstudierenden teilweise als Herausforderung, aber teilweise auch als besonders beanspruchend wahrgenommen wird. Bislang existieren kaum empirische Studien, die sich vor diesem Hintergrund der Frage nach der Veränderung des Beanspruchungserlebens während der COVID-19-bedingten Online-Lehre in der Lehrkräftebildung widmen.

## 2.6 Die vorliegende Studie

Empirische Studien konnten zeigen, dass der COVID-19-bedingte schulische Fernunterricht eine hohe Belastung der Schülerinnen und Schüler zur Folge hat (z.B. Huber et al. 2020). Hinsichtlich der Kompetenzentwicklung der Lernenden während der Pandemie zeigt sich eine unklare Befundlage – einige Studien belegten eine ungünstigere Kompetenzentwicklung durch den Distanzunterricht während der Pandemie (Lernende der Sekundarstufe: Dorn et al. 2020; Lernende der Primarstufe: Tomasik et al. 2020), gleichzeitig konnte dies nicht studien- und altersgruppenübergreifend nachgewiesen werden (keine langsameren Kompetenzzuwächse bei Lernenden der Sekundarstufe: Tomasik et al. 2020; keine Kohortenunterschiede zwischen Präsenz- und Distanzunterricht in Primar- und Sekundarstufe: Depping et al. 2021). Auch in der Lehrkräftebildung ist zu erwarten, dass das Online-Format bedeutend für die Selbstwirksamkeitserwartungen und das Beanspruchungserleben der Studierenden im Semesterverlauf ist. Aufgrund der fehlenden Praxiselemente in der Online-Lehre haben Lehramtsstudierende nicht die Möglichkeit, Erfolgserfahrungen zu sammeln und konstruktives Feedback zum eigenen Unterricht zu

erhalten – allerdings stellen diese Faktoren potenzielle Quellen der Selbstwirksamkeit dar (Clark und Newberry 2019). Sie erleben zudem keinen erhöhten emotionalen Arousal während der realen Unterrichtspraxis, der auch als Quelle der Selbstwirksamkeit gilt (Morris et al. 2017). Die Beobachtung von erfolgreichen Verhaltensmodellen, die ebenfalls günstig für die Entwicklung von Selbstwirksamkeitserwartungen sein kann, ist jedoch auch in der Online-Lehre möglich. Andererseits müssen sich Lehramtsstudierende im Online-Semester nicht den vielfältigen Herausforderungen, wie unklaren Rollenzuweisungen in der Schulpraxis stellen, die potenziell als emotional erschöpfend erlebt werden (Krawiec et al. 2020). Aktuell beschäftigen sich nur wenige empirische Arbeiten mit den Effekten der Online-Lehre in der Lehrkräftebildung (z. B. Traus et al. 2020). Vor diesem Hintergrund untersucht die vorliegende Studie die differentielle Veränderung von Selbstwirksamkeitserwartungen und Beanspruchungserleben bei Lehramtsstudierenden im Verlauf von Präsenzsemester und Online-Semester.

Folgende Forschungsfragen und Hypothesen werden in der Studie untersucht:

**Fragestellungen 1a und 1b:** Wie verändern sich Selbstwirksamkeitserwartungen von Lehramtsstudierenden im Semesterverlauf? Welche Unterschiede in der Veränderung der Selbstwirksamkeit zeigen sich zwischen den Lehramtsstudierenden in den Präsenzsemestern und im Online-Semester?

**Hypothese 1a:** Insgesamt wird von einem Anstieg der Selbstwirksamkeitserwartungen von Lehramtsstudierenden im Semesterverlauf ausgegangen.

**Hypothese 1b:** Es wird angenommen, dass der Anstieg der Selbstwirksamkeitserwartungen aufgrund der eigenen sowie stellvertretenden Praxiserfahrungen und der verbalen Überzeugungen sowie der emotionalen Zustände im Präsenzsemester mit Praxisanteil stärker ausgeprägt ist als im Online-Semester.

**Fragestellungen 2:** Wie verändert sich das Beanspruchungserleben von Lehramtsstudierenden im Semesterverlauf in der Präsenzsemestergruppe und in der Online-Semestergruppe?

### 3. Methode

### 3.1 Stichprobenbeschreibung

Die vorliegende Studie basiert auf längsschnittlichen Fragebogendaten von insgesamt $N = 240$ Lehramtsstudierenden einer deutschen Universität (54,6 % weiblich; 88,8 % in Deutschland geboren), die jeweils zu Beginn und zum Ende des Semesters an einem Online-Survey

teilnahmen. Ein weiterer Teil der Lehramtsstudierenden wurde im Sommersemester 2019 bzw. im Wintersemester 2019/2020 befragt (Gruppe „Präsenzsemester": $n$ = 113 Lehramtsstudierende; 56,64 % weiblich; $M$Alter = 23,80; $SD$ = 3,24)[2]. Die in den Präsenzsemestern durchgeführten Seminare mit schulpraktischem Anteil beinhalteten Unterrichtsversuche, in denen die Lehramtsstudierenden zunächst bei der betreuenden Lehrkraft während einer Unterrichtsstunde (90 min) hospitieren, darauffolgend eine Unterrichtsstunde (90 min) im Seminar konzipieren und vorstellen, um im Anschluss Feedback von Studierenden und Dozierenden bezüglich der Planung und Umsetzung der Entwürfe zu erhalten. Anschließend wird der eigene Unterrichtsentwurf in einer der kooperierenden Schulen in einer Unterrichtsstunde (90 min) praktisch umgesetzt. Schließlich werden die Unterrichtserfahrungen im Seminar systematisch über mehrere Sitzungen reflektiert. Der durch die COVID-19-bedingte Ausfall des praktischen Anteils des Seminars im Online-Semester wurde durch praxisnahe Übungen ersetzt. Sowohl in der Online-Semestergruppe als auch in der Präsenzsemestergruppe wurden im Rahmen bildungswissenschaftlicher Seminare die Themen *Unterrichtsqualität* und *Motivierender Unterricht* behandelt, die in der Studienordnung am Ende des Bachelorstudiums verortet sind. Die Studierenden aus beiden Gruppen befanden sich zum Zeitpunkt der Befragung überwiegend im 4. bis 5. Fachsemester (Online-Semester: $M$ = 4,28; $SD$ = 1,88; Präsenzsemester: $M$ = 5,20; $SD$ = 2,35). Die vier häufigsten Erstfächer der befragten Studierenden im Online-Semester waren Sport (19,69 %), Deutsch (17,32 %), Englisch (10,24 %) und Geschichte (10,24 %). Die drei am häufigsten studierten Erstfächer der Studierenden in den Präsenzsemestern waren Deutsch (20,35 %), Englisch (12,39 %) und Sport (10,62 %).

## 3.2 Messinstrumente

### 3.2.1 Selbstwirksamkeitserwartungen angehender Lehrkräfte

Die Selbstwirksamkeitserwartungen der Studierenden in beiden Gruppen wurden anhand von drei Subskalen (*Instruktionsstrategien, Klassenmanagement, Engagement für Schülerinnen und Schüler*) mit validierten deutschsprachigen Messinstrumenten (Pfitzner-Eden et al. 2014) der Originalskalen von Tschannen und Woolfolk Hoy (2001) erhoben (siehe

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[2] Die in der Studie einbezogenen Konstrukte aus den zusammengefassten Kohorten (Sommersemester 2019 und dem Wintersemester 19/20) in der Präsenzsemestergruppe unterschieden sich nicht signifikant zwischen den Kohorten zu T1.

Tab. 1). Jede der drei Subskalen beinhaltet vier Items mit sechsstufigem Antwortformat von 1 (trifft überhaupt nicht zu) bis 6 (trifft voll und ganz zu).

Die internen Konsistenzen waren insgesamt akzeptabel bis gut (vgl. Tab. 1). Aufgrund der Reflexionsphase der Unterrichtserfahrungen der Studierenden und der Annahme der resultierenden unterstützenden Rollenfindung durch Mentorinnen bzw. Mentoren (Brombach 2019) sowie hinsichtlich der intensiven Betreuung der Studierenden insbesondere in der Reflexion der Lernumgebung als Maßnahmen zur Selbstwirksamkeitsstabilisierung nach Bandura (1997) wurde zusätzlich die Skala *Reflexionsbezogene Selbstwirksamkeitserwartung* von Fraij (2018) verwendet. Die Skala umfasst fünf Items mit einem Antwortformat 1 (trifft überhaupt nicht zu) bis 6 (trifft voll und ganz zu). Die Reliabilität der Skala ist zu allen Zeitpunkten akzeptabel bis gut (siehe Tab. 1).

**Tab. 1** Messinstrumente, Bespielitems und Statistiken der Subskalen der Selbstwirksamkeitserwartungen für die Online- und Präsenzsemestergruppe

| Skala | Konstrukt | Beispielitem | Interne Konsistenz | |
|---|---|---|---|---|
| | | | Online-Semester | Präsenz-semester |
| Selbstwirksamkeits-erwartungen [SWE] (Pfitzner-Eden et al. 2014) | SWE bzgl. Instruktions-strategien | „Ich bin davon überzeugt, eine alternative Erklärung oder ein anderes Beispiel finden zu können, wenn die Lernenden etwas nicht verstehen." | $\alpha_{T1} = 0{,}78$; $\alpha_{T2} = 0{,}85$ | $\alpha_{T1} = 0{,}69$; $\alpha_{T2} = 0{,}82$ |
| | SWE bzgl. En-gagement für Schülerinnen und Schüler | „Ich bin davon überzeugt, die Lernenden, die wenig Interesse am Unterricht haben, motivieren zu können." | $\alpha_{T1} = 0{,}80$; $\alpha_{T2} = 0{,}82$ | $\alpha_{T1} = 0{,}70$; $\alpha_{T2} = 0{,}82$ |
| | SWE bzgl. Klassenma-nagement | „Ich bin davon überzeugt, störendes Verhalten im Unter-richt kontrollieren zu können." | $\alpha_{T1} = 0{,}86$; $\alpha_{T2} = 0{,}87$ | $\alpha_{T1} = 0{,}78$; $\alpha_{T2} = 0{,}85$ |
| Reflexionsbezogene Selbstwirksam-keitserwartungen (Fraij 2018) | SWE bzgl. Reflexion | „Ich kann mir vorhergegange-ne problematische Situationen noch einmal vorstellen, um zu überlegen, wie ich hätte besser handeln können." | $\alpha_{T1} = 0{,}82$; $\alpha_{T2} = 0{,}86$ | $\alpha_{T1} = 0{,}76$; $\alpha_{T2} = 0{,}81$ |

### 3.2.2 Beanspruchungserleben angehender Lehrkräfte

Zur Erfassung der Beanspruchung bzw. des Burnouts der Lehramtsstudierenden während des Semesters wurden die Subskalen des Maslach-Burnout-Inventorys in der Studierendenversion (MBI-SS) von Schaufeli et al. (2002) erhoben (siehe Tab. 2). Das MBI-SS umfasst die drei Subskalen *Emotionale Erschöpfung, Depersonalisierung* und *professionelle Wirksamkeit*. Das Antwortformat der drei Subskalen reicht von 1 (stimmt nicht) bis 4 (stimmt genau). Die

interne Konsistenzen sind insgesamt als akzeptabel bis sehr gut einzuschätzen (vgl. Tab. 2).

**Tab. 2** Messinstrumente, Bespielitems und Statistiken der Subskalen des Beanspruchungserlebens (Burnout) für die Online- und Präsenzsemestergruppe

| Skala | Konstrukte | Beispielitem | Interne Konsistenz | |
|---|---|---|---|---|
| | | | Online-Semester | Präsenz-semester |
| Beanspruchung/ Burnout (Schaufeli et al. 2002) | Emotionale Erschöpfung | „Durch mein Studium bin ich gefühlsmäßig am Ende." | $\alpha_{T1} = 0{,}85$ $\alpha_{T2} = 0{,}89$ | $\alpha_{T1} = 0{,}87$ $\alpha_{T2} = 0{,}85$ |
| | Depersonalisierung (Zynismus) | „Ich zweifele inzwischen stärker an der Nützlichkeit meines Studiums." | $\alpha_{T1,\,T2} = 0{,}85$ | $\alpha_{T1} = 0{,}82$ $\alpha_{T2} = 0{,}90$ |
| | Professionelle Wirksamkeit | „Ich habe während meines Studiums viele interessante Dinge gelernt." | $\alpha_{T1} = 0{,}67$ $\alpha_{T2} = 0{,}79$ | $\alpha_{T1} = 0{,}75$ $\alpha_{T2} = 0{,}73$ |

## 3.3 Statistische Analysen

Im Rahmen von Varianzanalysen mit Messwiederholung wurden Unterschiede im mittleren Niveau der Selbstwirksamkeitserwartungen und im Beanspruchungserleben zu allen Zeitpunkten sowie Unterschiede in der Veränderung dieser Merkmale im Semesterverlauf in beiden Gruppen (Online- versus Präsenzsemester) untersucht. Als Innersubjektfaktor wurde der Faktor Zeit ($T_1$: Beginn des Semesters; $T_2$: Ende des Semesters) und als Zwischensubjektfaktor wurde die Gruppenzugehörigkeit (Online- vs. Präsenzsemester) berücksichtigt.

In die Studie einbezogen wurde die Gesamtstichprobe der Studierenden, die entweder zum ersten oder zum zweiten Messzeitunkt an der Studie teilgenommen hatten. Zum ersten Messzeitpunkt (Beginn des Semesters) nahmen von den insgesamt $N = 240$ in die Analyse einbezogenen Lehramtsstudierenden 90,8 % ($n = 218$ Studierende) an der Befragung teil. Zum zweiten Zeitpunkt (Ende des Semesters) nahmen 81,6 % ($n = 196$) der Gesamtstichprobe an der Studie teil. In den Hauptanalysen wurden alle Studierenden mit fehlenden Werten auf den einbezogenen Variablen ausgeschlossen („listenweiser Fallausschluss"). Eine Analyse fehlender Werte zu beiden Messzeitpunkten mit den einbezogenen Messinstrumenten (vier Selbstwirksamkeitsskalen und drei Burnout-Skalen zu je zwei Messzeitpunkten) zeigte, dass kein systematisches Fehlen der Werte vorlag (siehe Appendix, Tab. 7).

# 4. Ergebnisse

## 4.1 Deskriptive Daten

Die in Tab. 3 dargestellten Mittelwerte der Selbstwirksamkeitserwartungen deuten bereits darauf hin, dass in der Gruppe Präsenzsemester ein tendenzieller Anstieg der Selbstwirksamkeitserwartungen stattfand, während in der Gruppe Online-Semester die Selbstwirksamkeitserwartungen teilweise sanken. Die Ergebnisse weisen zudem auf einen ähnlich starken Anstieg des Beanspruchungserlebens bei den Studierenden im Präsenzsemester und den Studierenden im Online-Semester hin. Die Korrelationen zwischen den Subskalen der Konstrukte Selbstwirksamkeitserwartungen und Beanspruchung bzw. Burnout sind in Tab. 4 dargestellt. Die Ergebnisse der Korrelationen deuten darauf hin, dass in der Präsenzsemestergruppe eine geringere zeitliche Rangstabilität des Selbstwirksamkeitserlebens als in der Online-Semestergruppe vorlag – vor allem traf dies auf die Selbstwirksamkeit für Instruktionsstrategien zu (Präsenz: $r = 0{,}170$, $p = 0{,}150$; Online: $r = 0{,}651$, $p < 0{,}001$) sowie auf die Selbstwirksamkeit für Klassenmanagement (Präsenz: $r = 0{,}180$, $p = 0{,}128$; Online: $r = 0{,}596$, $p < 0{,}001$). Die drei Burnout-Skalen *Emotionale Erschöpfung* ($BE_{EE}$), *Depersonalisierung* ($BE_{DP}$) und *Professionelle Wirksamkeit* ($BE_{PW}$) wiesen in beiden Gruppen hohe Korrelationen über die Zeit hinweg auf (Präsenzsemestergruppe: $BE_{EE}$: $r = 0{,}613$, $p < 0{,}001$; $BE_{DP}$: $r = 0{,}574$, $p < 0{,}001$; $BE_{PW}$: $r =$

**Tab. 3** Deskriptive Statistiken und statistische Vergleiche für die in Präsenz- bzw. Online-Semester erhobenen abhängigen Variablen von $N = 240$ Lehramtsstudierenden

|  | Online-Semester | | | | Präsenzsemester | | | |
|  | $T_1$ | | $T_2$ | | $T_1$ | | $T_2$ | |
|  | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
|---|---|---|---|---|---|---|---|---|
| *Selbstwirksamkeitserwartungen* | | | | | | | | |
| Selbstwirksamkeit für Instruktionsstrategien | 4,76 | 0,62 | 4,71 | 0,70 | 4,75 | 0,55 | 4,90 | 0,57 |
| Selbstwirksamkeit für Klassenmanagement | 4,59 | 0,70 | 4,62 | 0,68 | 4,45 | 0,58 | 4,77 | 0,65 |
| Selbstwirksamkeit für Engagement für SuS [a] | 4,86 | 0,65 | 4,73 | 0,64 | 4,72 | 0,57 | 4,91 | 0,57 |
| Reflexionsbezogene Selbstwirksamkeit | 5,16 | 0,58 | 5,05 | 0,66 | 5,06 | 0,56 | 5,15 | 0,54 |
| *Beanspruchung (Burnout)* | | | | | | | | |
| Emotionale Erschöpfung | 1,96 | 0,67 | 2,05 | 0,72 | 1,94 | 0,66 | 1,98 | 0,64 |
| Depersonalisierung (Zynismus) | 1,76 | 0,75 | 1,77 | 0,75 | 1,68 | 0,68 | 1,80 | 0,79 |
| Professionelle Wirksamkeit | 3,10 | 0,39 | 3,07 | 0,47 | 3,11 | 0,47 | 3,13 | 0,45 |

[a] Schülerinnen und Schüler

0,680, $p < 0,001$; Online-Semestergruppe: $BE_{EE}$: $r = 0,747$, $p < 0,001$; $BE_{DP}$: $r = 0,778$, $p <$ 0,001; $BE_{PW}$: $r = 0,637$, $p < 0,001$). Diese korrelativen Befunde deuten darauf hin, dass in der Online-Semestergruppe die Rangstabilität in allen Konstrukten relativ hoch war und Personen, die zu Semesterbeginn ein höheres Selbstwirksamkeitserleben und geringeres Burnout-Erleben berichteten, auch am Semesterende günstigere Ausprägungen erzielten. Von den drei Burnout-Skalen war es die Skala Professionelle Wirksamkeit, die am stärksten mit den Selbstwirksamkeitsfacetten korrelierte bzw. Depersonalisierung war geringer und überwiegend nicht signifikant (siehe Tab. 4).

## 4.2 Varianzanalysen mit Messwiederholung: Selbstwirksamkeitserwartungen

In einer 2*2-faktoriellen Varianzanalyse mit Messwiederholung wurden die einzelnen Selbstwirksamkeitsskalen als abhängige Variablen durch den Innersubjektfaktor Zeit ($T_1$: Beginn des Semesters; $T_2$: Ende des Semesters) und den Zwischensubjektfaktor Gruppenzugehörigkeit (Online- versus Präsenzsemester) prädiziert. Die Ergebnisse der Analysen sind in Tab. 5 verdeutlicht.

Für die Subskala *Selbstwirksamkeit für Instruktionsstrategien* ($SW_{IS}$) zeigten sich in der Varianzanalyse keine Haupteffekte des Messwiederholungsfaktors Zeit als Innersubjektfaktor, $F(1, 179) = 0,67$, $p = 0,415$, $\eta^2 = 0,004$ nach Greenhouse-Geisser-Korrektur sowie des Zwischensubjektfaktors Gruppe, $F(1, 179) = 3,64$, $p = 0,058$, $\eta^2 = 0,020$. Weiterhin war die Interaktion Zeit * Gruppe, $F(1, 179) = 2,48$, $p = 0,117$, $\eta^2 = 0,014$ nicht signifikant. Die Fehlervarianzen waren in beiden Gruppen zu beiden Messzeitpunkten gemäß Levene-Test für alle Variablen der Subskala ($SW_{IS}$) homogen ($p > 0,05$).

Für die Subskala *Selbstwirksamkeit für Klassenmanagement* ($SW_{KM}$) zeigten sich höchstsignifikante Effekte des Innersubjektfaktors Zeit, $F(1, 178) = 17,37$, $p < 0,001$, $\eta^2 = 0,089$, nach Greenhouse-Geisser-Korrektur jedoch keine signifikanten Ergebnisse des Zwischensubjektfaktors Gruppe, $F(1, 178) = 0,07$, $p = 0,785$, $\eta^2 = 0,000$.

**Tab. 4** Pearson-Korrelationen für alle Subskalen der Selbstwirksamkeitserwartungen und des Beanspruchungserlebens (Burnout) für die Online- bzw. Präsenzsemestergruppe

| | $BE_{EET1}$ | $BE_{DPT1}$ | $BE_{PWT1}$ | $SW_{IST1}$ | $SW_{KMT1}$ | $SW_{EST1}$ | $SW_{RT1}$ | $BE_{EET2}$ | $BE_{DPT2}$ | $BE_{PWT2}$ | $SW_{IST2}$ | $SW_{KMT2}$ | $SW_{EST2}$ | $SW_{RT2}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $BE_{EET1}$ | 1 | 0,374* | −0,273* | −0,081 | −0,044 | 0,016 | 0,037 | 0,613* | 0,219 | −0,166 | −0,151 | −0,307* | −0,218 | −0,273* |
| $BE_{DPT1}$ | 0,468* | 1 | −0,422* | −0,179 | −0,122 | −0,163 | −0,011 | 0,148 | 0,574* | −0,300* | −0,235* | −0,309* | −0,218 | −0,208 |
| $BE_{PWT1}$ | −0,338* | −0,477* | 1 | 0,199* | 0,126 | 0,239* | 0,285* | −0,230 | −0,439* | 0,680* | 0,193 | 0,218 | 0,243* | 0,370* |
| $SW_{IST1}$ | −0,090 | −0,066 | 0,286* | 1 | 0,405* | 0,550* | 0,279* | 0,072 | −0,006 | 0,064 | 0,170 | 0,171 | 0,328* | 0,124 |
| $SW_{KMT1}$ | −0,192* | −0,155 | 0,256* | 0,430* | 1 | 0,491* | 0,109 | −0,110 | 0,030 | −0,050 | 0,230* | 0,180 | 0,122 | 0,054 |
| $SW_{EST1}$ | −0,144 | −0,154 | 0,343* | 0,551* | 0,552* | 1 | 0,418* | −0,085 | −0,076 | 0,000 | 0,239* | 0,198 | 0,307* | 0,128 |
| $SW_{RT1}$ | −0,165 | −0,107 | 0,299* | 0,355* | 0,438* | 0,501* | 1 | 0,021 | −0,018 | 0,234* | 0,258* | 0,086 | 0,251* | 0,437* |
| $BE_{EET2}$ | 0,747* | 0,402* | −0,309* | −0,143 | −0,320* | −0,224* | −0,181 | 1 | 0,442* | −0,367* | −0,074 | −0,173 | −0,160 | −0,257* |
| $BE_{DPT2}$ | 0,413* | 0,778* | −0,436* | −0,083 | −0,158 | −0,160 | −0,170 | 0,447* | 1 | −0,458* | −0,196 | −0,274* | −0,225* | −0,171 |
| $BE_{PWT2}$ | −0,250* | −0,334* | 0,637* | 0,152 | 0,142 | 0,236* | 0,186 | −0,277* | −0,365* | 1 | 0,335* | 0,301* | 0,407* | 0,462* |
| $SW_{IST2}$ | −0,141 | −0,231* | 0,307* | 0,651* | 0,350* | 0,452* | 0,345* | −0,182 | −0,146 | 0,252* | 1 | 0,643* | 0,769* | 0,575* |
| $SW_{KMT2}$ | −0,126 | −0,155 | 0,175 | 0,389* | 0,596* | 0,345* | 0,283* | −0,200* | −0,106 | 0,172 | 0,565* | 1 | 0,633* | 0,491* |
| $SW_{EST2}$ | −0,130 | −0,174 | 0,337* | 0,524* | 0,349* | 0,582* | 0,399* | −0,105 | −0,046 | 0,254* | 0,642* | 0,472* | 1 | 0,638* |
| $SW_{RT2}$ | −0,044 | −0,148 | 0,302* | 0,522* | 0,335* | 0,414* | 0,509* | −0,121 | −0,141 | 0,294* | 0,659* | 0,481* | 0,647* | 1 |

Anmerkungen: Unter der Diagonalen: COVID-19-bedingtes Online-Semester/Über der Diagonalen: Präsenzsemester mit Praxisanteil. Alle mit * markierten Korrelationen sind mindestens auf dem Niveau $p < 0,05$ signifikant. $BE_{EE}$ Beanspruchung: Emotionale Erschöpfung, $BE_{DP}$ Beanspruchung: Depersonalisierung, $BE_{PW}$ Beanspruchung: Professionelle Wirksamkeit, $SW_{IS}$ Selbstwirksamkeit für Instruktionsstrategien, $SW_{KM}$ Selbstwirksamkeit für Klassenmanagement, $SW_{ES}$ Selbstwirksamkeit für SchülerInnen-Engagement, $SW_R$ Reflexionsbezogene Selbstwirksamkeit, $T1$ zu Semesterbeginn, $T2$ zu Semesterende

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**Tab. 5** Ergebnisse der multi-
variaten Varianzanalysen mit
Messwiederholung für die
Selbstwirksamkeitserwartun-
gen über $N = 240$ Lehramtsstu-
dierende für die Online- und
Präsenzsemestergruppe[a]

| Selbstwirksamkeit | Zeit (A) | Gruppe (B) | A × B | |
|---|---|---|---|---|
| $SW_{IS}$ | 0,67 | 3,64 | 2,48 | $F$ |
| | 0,415 | 0,058 | 0,117 | $p$ |
| | 0,004 | 0,020 | 0,014 | $\eta^2$ |
| $SW_{KM}$ | 17,37 | 0,07 | 5,28 | $F$ |
| | **0,000** | 0,785 | **0,023** | $p$ |
| | 0,089 | 0,000 | 0,029 | $\eta^2$ |
| $SW_{ES}$ | 1,57 | 0,12 | 14,24 | $F$ |
| | 0,213 | 0,656 | **0,000** | $p$ |
| | 0,009 | 0,001 | 0,074 | $\eta^2$ |
| $SW_R$ | 0,50 | 0,11 | 5,20 | $F$ |
| | 0,823 | 0,918 | **0,024** | $p$ |
| | 0,000 | 0,000 | 0,028 | $\eta^2$ |

[a] zusätzliche Analysen von Interaktionseffekten zwischen der Zeit und
den Kovariaten Geschlecht, Alter, Abiturnote bzw. Geburtsland zei-
gen überwiegend keine signifikanten Effekte

**Abb. 1** Mittelwertvergleich
der Subskala Selbstwirksamkeit
für Klassenmanagement der
Gruppen Online-Semester und
Präsenzsemester mit Praxisanteil
zu Semesterbeginn ($T_1$) und
Semesterende ($T_2$)
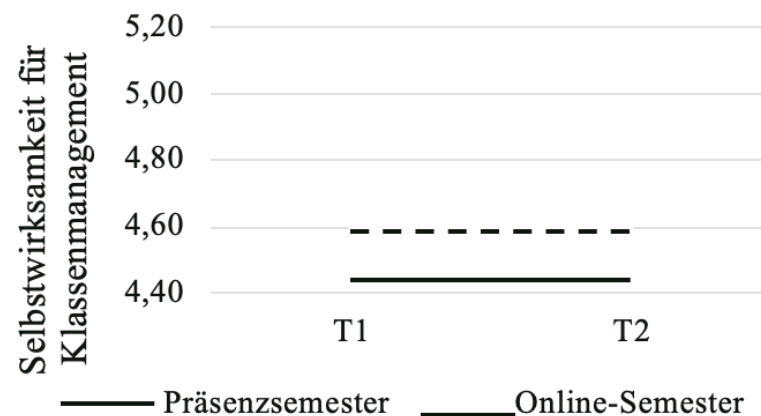


Für die Interaktion Zeit*Gruppe, $F(1, 178) = 5,28$, $p = 0,023$, $\eta^2 = 0,029$ zeigten sich hingegen signifikante Ergebnisse (siehe Abb. 1). Dabei stieg die Selbstwirksamkeit für Klassenmanagement bei den Studierenden des Präsenzsemesters von Semesterbeginn zum Semesterende stärker an ($M$Präsenz $\Delta$T1, T2 = 0,32) als bei den Studierenden im Online-Semester, bei denen kein signifikanter Zuwachs zu verzeichnen war ($M$Online $\Delta$T1, T2 = 0,03; vgl. Tab. 3). Zusätzliche Varianzanalysen, bei denen der Haupteffekt der Zeit auf die Selbstwirksamkeit getrennt für beide Gruppen untersucht wurde, verdeutlichten einen signifikanten Effekt des Innersubjektfaktors Zeit in der Präsenzsemestergruppe auf die Selbstwirksamkeit für Klassenmanagement, nicht jedoch im Online-Semester (Online-Semester: $F(1, 109) = 1,01$, $p = 0,317$, $\eta^2 = 0,009$; Präsenzsemester: $F(1, 85) = 19,79$, $p < 0,001$, $\eta^2 = 0,189$). Die Fehlervarianzen waren in beiden Gruppen zu beiden

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Messzeitpunkten gemäß Levene-Test für alle Variablen der Subskala ($SW_{KM}$) homogen ($p > 0{,}05$). Für die Subskala *Selbstwirksamkeit im Engagement für Schülerinnen und Schüler* ($SW_{ES}$) als abhängige Variable zeigten sich keine signifikanten Effekte des Innersubjektfaktors Zeit, $F(1{,}179) = 1{,}57$, $p = 0{,}213$, $\eta^2 = 0{,}009$, nach Greenhouse-Geisser-Korrektur und keine signifikanten Ergebnisse des Zwischensubjektfaktors Gruppe, $F(1, 179) = 0{,}12$, $p = 0{,}656$, $\eta^2 = 0{,}001$. Für die Interaktion Zeit*Gruppe, $F(1{,}179) = 14{,}24$, $p < 0{,}001$, $\eta^2 = 0{,}074$ ergaben sich, nach Greenhouse-Geisser-Korrektur jedoch höchstsignifikante Ergebnisse (siehe Abb. 2). Die Selbstwirksamkeit im Engagement für Schülerinnen und Schüler bei den Studierenden stieg im Präsenzsemester von Semesterbeginn zu Semesterende an ($M$Präsenz $\Delta$T1, T2 = 0,19) und sank im Verlauf des Online-Semesters ($M$Online $\Delta$T1, T2 = –0,13; vgl. Tab. 1). Zusätzliche Varianzanalysen, bei denen der Haupteffekt der Zeit auf die Selbstwirksamkeit getrennt für beide Gruppen untersucht wurde, zeigten, dass der Innersubjektfaktor Zeit in beiden Gruppen signifikant auf die Selbstwirksamkeit für Engagement für Schülerinnen und Schüler wirkt (Online-Semester: $F(1, 107) = 4{,}46$, $p = 0{,}037$, $\eta^2 = 0{,}400$; Präsenzsemester: $F(1, 85) = 12{,}53$, $p < 0{,}001$, $\eta^2 = 0{,}128$). Die Fehlervarianzen waren in beiden Gruppen zu beiden Messzeitpunkten gemäß Levene-Test für alle Variablen der Subskala



**Abb. 2** Mittelwertvergleich der Subskala Selbstwirksamkeit für Schülerinnen- und Schülerengagement der Gruppen Online-Semester und Präsenzsemester mit Praxisanteil zu Semesterbeginn (T₁) und Semesterende (T₂)
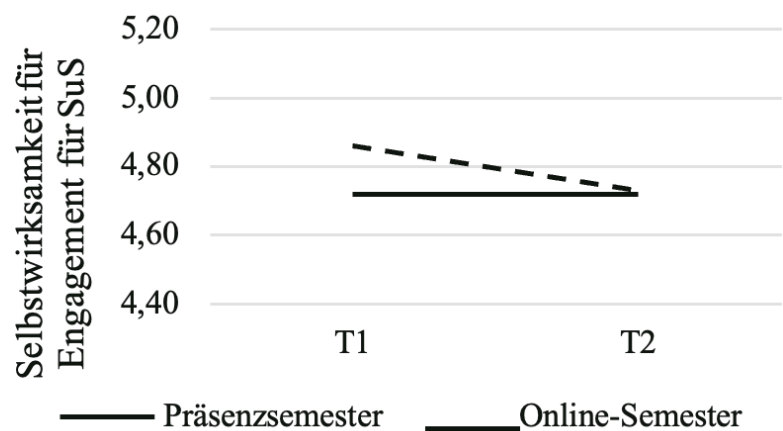
($SW_{ES}$) homogen ($p > 0{,}05$).

Die für die Skala *Reflexionsbezogene Selbstwirksamkeit* ($SW_R$) als abhängige Variable durchgeführte 2*2-faktoriellen Varianzanalyse mit Messwiederholung weist keine signifikanten Ergebnisse für den Faktor Zeit auf $F(1, 179) = 0{,}050$, $p = 0{,}823$, $\eta^2 = 0{,}000$, nach Greenhouse-Geisser-Korrektur. Der Zwischensubjektfaktor Gruppe zeigte ebenfalls keine signifikanten Ergebnisse, $F(1, 179) = 0{,}11$, $p = 0{,}918$, $\eta^2 = 0{,}000$. Für die Interaktion Zeit*Gruppe, $F(1, 179) =$

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5,20, $p = 0,024$, $\eta^2 = 0,028$ ergaben sich jedoch signifikante Ergebnisse (siehe Abb. 3). Dabei stieg die Reflexionsbezogene Selbstwirksamkeit bei den Studierenden des Präsenzsemesters von Semesterbeginn zum Semesterende an ($M$Präsenz $\Delta$T1, T2 = 0,09) wohingegen bei den Studierenden im Online-Semester ein Abwärtstrend zu verzeichnen war ($M$Online $\Delta$T1, T2 = − 0,11; vgl. Tab. 3). Zusätzliche Varianzanalysen, bei denen der Haupteffekt der Zeit auf die Selbstwirksamkeit getrennt für beide Gruppen untersucht wurde, zeigten, dass die Zeit in der Präsenzsemestergruppe – nicht jedoch im Online-Semester – signifikant auf die Reflexionsbezogene Selbstwirksamkeit wirkte (Online-Semester: $F(1, 107) = 2,56$, $p = 0,113$, $\eta^2 = 0,023$; Präsenzsemester: $F(1, 85) = 5,00$, $p = 0,028$, $\eta^2 = 0,056$). Die Fehlervarianzen waren in beiden



**Abb. 3** Mittelwertvergleich der Skala Reflexionsbezogene Selbstwirksamkeit der Gruppen Online-Semester und Präsenz-semester mit Praxisanteil zu Semesterbeginn (T$_1$) und Semes-terende (T$_2$)
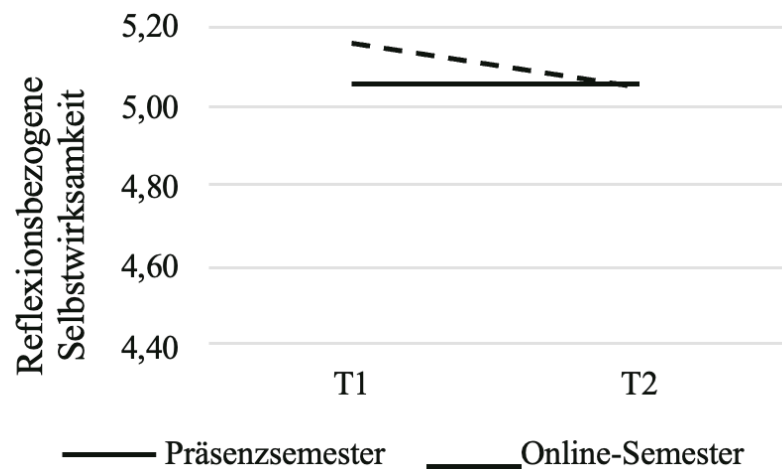
Gruppen zu beiden Messzeitpunkten gemäß Levene-Test für alle Variablen der Subskala (SW$_R$) homogen ($p > 0,05$).

## 4.3 Varianzanalysen mit Messwiederholung: Beanspruchungserleben

In weiteren 2*2-faktoriellen Varianzanalysen mit Messwiederholung wurden die Subskalen des Beanspruchungserleben durch den Innersubjektfaktor Zeit (T$_1$: Beginn des Semesters; T$_2$: Ende des Semesters) und den Zwischensubjektfaktor Gruppenzugehörigkeit (Online- versus Präsenzsemester) vorhergesagt (siehe Tab. 6).

Für die Subskala *Emotionale Erschöpfung* (BE$_{EE}$) zeigten sich signifikante Effekte des Innersubjektfaktors Zeit, $F(1, 179) = 5,13$, $p = 0,025$, $\eta^2 = 0,028$, nach Greenhouse-Geisser-Korrektur. Die Emotionale Erschöpfung der Studierenden in beiden Gruppen stieg signifikant über das Semester hinweg an (vgl. Tab. 1). Der Zwischensubjektfaktor Gruppe erwies sich nicht als

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signifikant, $F(1, 179) = 0,78$, $p = 0,378$, $\eta^2 = 0,004$. Für die Interaktion Zeit*Gruppe ergab sich keine signifikante Interaktion, $F(1, 179) = 0,21$, $p = 0,647$, $\eta^2 = 0,001$. Die Fehlervarianzen waren in beiden Gruppen zu beiden Messzeitpunkten gemäß Levene-Test für alle Variablen der Subskala ($BE_{EE}$) homogen ($p > 0,05$).

Für die Subskala *Depersonalisierung* ($BE_{DP}$) zeigten sich keine signifikanten Effekte der Zeit, $F(1, 179) = 2,39$, $p = 0,124$, $\eta^2 = 0,013$ und keine signifikanten Effekte des Zwischensubjektfaktors Gruppe, $F(1, 179) = 0,03$, $p = 0,858$, $\eta^2 = 0,000$. Für die Interaktion Zeit*Gruppe, $F(1, 179) = 1,77$, $p = 0,185$, $\eta^2 = 0,010$, zeigten sich nach Greenhouse-Geisser-Korrektur ebenfalls keine signifikanten Ergebnisse. Die Fehlervarianzen waren in beiden Gruppen zu beiden Messzeitpunkten gemäß Levene-Test für alle Variablen der Subskala ($BE_{DP}$) homogen ($p > 0,05$).

Auch für die Subskala *professionelle Wirksamkeit* ($BE_{PW}$) zeigte sich kein signifikanter Effekt der Zeit, $F(1, 179) = 1,20$, $p = 0,275$, $\eta^2 = 0,007$, nach Greenhouse-Geisser-Korrektur und des Zwischensubjektfaktors Gruppe, $F(1, 178) = 0,74$, $p = 0,390$, $\eta^2 = 0,004$. Darüber hinaus war die Interaktion Zeit*Gruppe nicht signifikant, $F(1,179) = 0,04$, $p = 0,855$, $\eta^2 = 0,000$. Die Fehlervarianzen waren in beiden Gruppen zu beiden Messzeitpunkten gemäß Levene-Test für alle Variablen der Subskala ($BE_{PW}$) homogen ($p > 0,05$).

**Tab. 6** Ergebnisse der multivariaten Varianzanalysen mit Messwiederholung für die Beanspruchungserleben (Burnout) über N= 240 Lehramtsstudierende für die Online- und Präsenzsemestergruppe[a]

| Beanspruchung | Zeit (A) | Gruppe (B) | A× B | |
|---|---|---|---|---|
| $BE_{EE}$ | 5,13 | 0,78 | 0,21 | $F$ |
| | **0,025** | 0,378 | 0,647 | $p$ |
| | 0,028 | 0,004 | 0,001 | $\eta^2$ |
| $BE_{DP}$ | 2,39 | 0,03 | 1,77 | $F$ |
| | 0,124 | 0,858 | 0,185 | $p$ |
| | 0,013 | 0,000 | 0,010 | $\eta^2$ |
| $BE_{PW}$ | 1,20 | 0,74 | 0,04 | $F$ |
| | 0,275 | 0,390 | 0,855 | $p$ |
| | 0,007 | 0,004 | 0,000 | $\eta^2$ |

[a] zusätzliche Analysen von Interaktionseffekten zwischen den hier genannten Hauptkriterien und den Kovariaten Geschlecht, Alter, Abiturnote bzw. Geburtsland zeigen überwiegend keine signifikanten Effekte

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# 5. Diskussion

Nur wenige Studien befassen sich bislang mit den Auswirkungen der Online-Lehre auf sozio-emotionale und motivationale Merkmale von Lehramtsstudierenden (z. B. Osterberg et al. 2020). Insbesondere Selbstwirksamkeitserwartungen werden als bedeutsamer Einflussfaktor auf den Umgang mit Belastungen beschrieben (Klusmann et al. 2012). Forschung zu den Effekten verschiedener Lehr-Lernsettings auf die Entwicklung solcher Kompetenzüberzeugungen sowie des Beanspruchungserlebens ist daher von hoher Relevanz für die aktuelle Lehrkräftebildung. Vor diesem Hintergrund hatte die vorliegende Studie zum Ziel, die Veränderung von Selbstwirksamkeitserwartungen und Beanspruchungserleben im Semesterverlauf unter Differenzierung von Präsenzlehre und digitaler Lehre in Zeiten der COVID-19-Pandemie zu untersuchen.

## 5.1 Selbstwirksamkeitserwartungen im Online- und im Präsenzsemester

Unsere Ergebnisse zeigen, dass sich drei der vier untersuchten Facetten der *Selbstwirksamkeitserwartungen* von Lehramtsstudierenden – konkret Selbstwirksamkeit für Klassenmanagement, im Engagement für Schülerinnen und Schüler und in Bezug auf Reflexion des Unterrichtsgeschehens – im COVID-19-bedingten Online-Semester und im Präsenzsemester differentiell entwickeln. Bei den Studierenden im Online-Semester blieben die Selbstwirksamkeit im Klassenmanagement und die Reflexionsbezogene Selbstwirksamkeit im Verlauf des Semesters stabil, wohingegen diese bei den Studierenden in den Präsenzsemestern im Semesterverlauf anstieg. Darüber hinaus sank die Selbstwirksamkeit im Engagement für Schülerinnen und Schüler im Online-Semester, während sie im Verlauf des Präsenzsemesters anstieg. Mögliche Erklärungen für die günstigere Entwicklung der drei Selbstwirksamkeits-Facetten im Präsenzsemester könnten erfolgreiche Praxiserfahrungen (*mastery experiences*) sowie die systematische Unterstützung und das konstruktive Feedback von erfahrenen Lehrkräften im Sinne verbaler Bestärkung durch andere Personen (*verbal persuasion*) in der Lehre mit praktischem Anteil sein (Bandura 1977; Morris et al. 2017). Sowohl die Auseinandersetzung mit Unterrichtserfahrungen als auch unterstützendes Feedback gelten als prädiktiv für die Lehrerselbstwirksamkeit wie Studien bei angehenden Lehrkräften zeigen konnten (Richter et al. 2011; Ronfeldt und Reininger 2012). Studierende im Präsenzsemester konnten außerdem auch ihre physiologische Aktivierung durch das Unterrichten wahrnehmen, die als bedeutend als Quelle von Selbstwirksamkeit angesehen wird (Snyder und Fisk

2016), was den Studierenden im Online-Semester aufgrund der fehlenden Praxisanteile nicht möglich war. Die differentielle Veränderung unterschiedlicher Selbstwirksamkeitsfacetten im Online-Semester könnte durch die Art der praxisbezogenen Anteile im Online-Semester bedingt gewesen sein. Diese praktischen Übungen bezogen sich insbesondere auch auf die Arbeit mit Unterrichtsvideografien – dabei sind Merkmale der Klassenführung für Studierende eventuell besser beobachtbar und beurteilbar als beispielsweise Motivierungsstrategien der Lehrkraft (Kunter und Baumert 2006). Stellvertretende Erfolgserfahrungen (*vicarious experiences*) als Quelle der Selbstwirksamkeit waren daher insbesondere im Bereich der Motivierung von Lernenden eventuell nur wenig verfügbar, während ein erfolgreicher Umgang mit Störungen auf Unterrichtsvideographien besser für die Lehramtsstudierenden beobachtbar war. Allerdings sind diese Erklärungsansätze für die differentielle Veränderung der einzelnen Selbstwirksamkeitsfacetten nur hypothetisch und sollten in weiterführenden Untersuchungen differenzierter in den Blick genommen werden.

Eine mögliche Erklärung für die nicht-signifikanten Effekte auf die Selbstwirksamkeit für Instruktionsstrategien könnte einerseits darin bestehen, dass erfolgreiche Instruktion häufig nur langfristig wahrnehmbar ist, während sich ein gezieltes Eingreifen bei Störungen oder eine erfolgreiche motivierende Unterrichtsführung, die das Schülerinnen- und Schülerengagement befördert, in ihren Konsequenzen eher unmittelbar wahrnehmen lassen (Luttenberger et al. 2019; Ophardt und Thiel 2017). Zudem könnte das systematische Reflektieren eigener kurzer Unterrichtserfahrungen im Präsenzsemester zum Anstieg der Selbstwirksamkeit im Reflektieren beigetragen haben (Stürmer et al. 2013).

## 5.2 Beanspruchungserleben im Online- und im Präsenzsemester

Unsere Befunde verweisen auf ähnliche Veränderungen der Facetten des *Beanspruchungserlebens* im Präsenz- und Online-Semester. Gleichzeitig zeigte sich ein Anstieg der Emotionalen Erschöpfung in beiden Gruppen, während Depersonalisierung und professionelle Wirksamkeit in beiden Gruppen stabil blieben. Sowohl in Praxisphasen als auch während der pandemiebedingten Online-Lehre gibt es spezifische universitäre Anforderungen, die von den Studierenden als belastend erlebt werden (Bach 2015; Hahn et al. 2021). In Praxisphasen erleben Studierende vor allem schwieriges Verhalten von Schülerinnen und Schülern, die Organisation und Betreuung des Praktikums sowie ambivalente Rollendefinitionen als emotional erschöpfend (Krawiec et al. 2020).

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Allerdings ist die Befundlage hinsichtlich der Veränderungen emotionaler Erschöpfung bei Lehramtsstudierenden in Praxisphasen inkonsistent, da Studien teilweise auf einen Anstieg der Erschöpfung verweisen (Schüle et al. 2017b), während andere Studien Rückgänge der emotionalen Erschöpfung aufzeigen (Fives et al. 2007). In der pandemiebedingten Online-Lehre werden Faktoren wie die zeitliche Organisation und Strukturierung der Arbeit zu Hause sowie Misserfolgsängste und ressourcenintensivere Lernaktivitäten von den Studierenden als emotional erschöpfend empfunden (Hahn et al. 2021). In unserer Untersuchung waren die Studierenden daher sowohl im Semester mit Praxisanteil als auch im Online-Semester mit spezifischen und für sie neuen universitären Anforderungen konfrontiert, die emotional erschöpfend gewirkt haben können. Um der emotionalen Erschöpfung von Lehramtsstudierenden im Semesterverlauf entgegenzuwirken, wären sowohl in der Online-Lehre als auch während Praxisphasen unterstützende Anleitungen durch Mentoren und Mentorinnen bzw. Dozierende (Klassen und Durksen 2014) bzw. die Förderung der Unterstützung zwischen den Studierenden möglich (Römer et al. 2018). Für die Belastungs-Facetten Depersonalisierung und professionelle Wirksamkeit zeigen unsere Ergebnisse keine Zunahme im Semesterverlauf. Dieses Befundmuster ist im Einklang mit früheren Studien zum Referendariat, die darauf verweisen, dass insbesondere die emotionale Erschöpfung in längeren Praxisphasen des Lehramtsstudiums ansteigt (Klusmann et al. 2012), während die professionelle Wirksamkeit stabil bleibt (Zimmermann et al. 2016). Paradox an unseren Befunden mag erscheinen, dass im Präsenzsemester mit Praxisanteil die emotionale Erschöpfung zwar im Semesterverlauf anstieg, aber auch die Selbstwirksamkeit – in drei von vier Facetten – anstieg. Klassen und Durksen (2014) konnten diesen Verlauf bei einigen Studierenden ihrer Stichprobe ebenfalls beobachten und führen diese Befunde auf hohe Belastungen zurück, die aber durch günstige Bewältigungsstrategien in Form sozialer Unterstützung durch Familie und Freunde bewältigt werden konnten. Da auch Unterstützungsangebote durch Kommilitonen und Kommilitoninnen sowie durch Mentoren und Mentorinnen als Prädiktoren für die emotionale Erschöpfung fungieren können (Römer et al. 2018), wäre eine mögliche Implikation unserer Befunde, dass eine verstärkte systematische Förderung der Kooperation zwischen den Studierenden sowohl in Präsenz- als auch in Online-Formaten sinnvoll wäre. Allerdings müsste die Wirksamkeit solcher Maßnahmen gesondert in zukünftigen Studien untersucht werden.

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## 5.3 Limitationen

Unsere Untersuchung weist einige Limitationen auf. Zunächst liegen uns keine Daten aus einem Online-Semester vor, das nicht zusätzlich durch COVID-19 bedingt war. Daher können wir Belastungen, die durch das Online-Format der Lehrveranstaltungen entstehen, nicht klar von Belastungen durch die COVID-19-Pandemie trennen. Da in der bisherigen Lehrkräftebildung reine Online-Veranstaltungsformate sehr selten waren, sollten weiterführende Untersuchungen prüfen, wie sich Selbstwirksamkeit und Belastungserleben von Lehramtsstudierenden in digitalen Veranstaltungen auch jenseits der COVID-19-Pandemie entwickeln. Unsere Untersuchung lässt offen, welche Relevanz verschiedene Wirkmechanismen – fehlende Erfolgserfahrungen und fehlende positive Rückmeldungen (Bandura 1997), höhere Arbeitsbelastung (Traus et al. 2020; Zentrum für Qualitätsentwicklung in Lehre und Studium 2020) und möglicherweise auch der geringere Grad an sozialer Eingebundenheit – für die differentielle Veränderung von Selbstwirksamkeit und Beanspruchung im Online-Seminar verglichen mit dem Präsenzseminar haben. Darüber hinaus konnte nicht eindeutig festgestellt werden, welche Rolle die Praxisanteile im Präsenzsemester in Bezug auf die Veränderung der Selbstwirksamkeit und der Beanspruchung der Studierenden gespielt haben. Die differentiellen Veränderungen sowohl der Selbstwirksamkeit als auch des Beanspruchungserlebens sind daher nur eingeschränkt auf andere Veranstaltungsformate mit zeitlich umfangreicheren Praxisanteilen, auf andere Stichproben (Zeitpunkt der Praxisanteile im Studienverlauf bzw. Fachsemester der Studierenden) bzw. auf andere Universitäten oder Länder übertragbar. Eine weitere Limitation der Studie liegt im eingesetzten Analyseverfahren, da keine tatsächlichen Veränderungen, sondern lediglich Gruppenunterschiede untersucht werden konnten. Zukünftig sollten die Ergebnisse der vorliegenden Studie anhand größerer Samples validiert werden, wobei auch elaboriertere Verfahren latenter Differenzenmodelle zum Einsatz kommen sollten, die Messfehler berücksichtigen und Differenzen so akkurater abbilden können.

## 5.4 Implikationen und Ausblick

Angesichts der COVID-19-bedingten Umstellung der Lehrkräftebildung auf Online-Formate in den vergangenen Monaten sind empirische Ergebnisse zur Entwicklung der professionellen Kompetenz von Lehramtsstudierenden im Rahmen dieser Veranstaltungsformate von großer Relevanz. Unsere Untersuchung liefert erste Hinweise, dass sich insbesondere Selbstwirksamkeitserwartungen im Klassenmanagement, im Engagement für Schülerinnen und Schüler und in den

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Reflexionsbezogenen Selbstwirksamkeitserwartungen in Veranstaltungen im Präsenzformat mit Praxisanteilen im Semesterverlauf deutlicher entwickeln als in Online-Seminaren ohne Praxisanteile, in dem sogar ein Absinken zu verzeichnen ist. Dennoch bedarf es weiterer empirischer Untersuchungen, um die Veränderung von Selbstwirksamkeitserwartungen von Lehramtsstudierenden in verschiedenen Veranstaltungsformaten nachzuzeichnen und die Rolle von Einflussfaktoren, wie Zeitpunkt des Praktikums im Studium, Dauer, Aufgaben, Reflexion und Betreuung an der Schule sowie der Hochschule, herauszuarbeiten (Ding 2020).

## 6. Anhang

**Tab. 7** Chi-Quadrat aller Skalen (Selbstwirksamkeitserwartungen und Beanspruchung/Burnout)

| Skala | $\chi^2$ für Missing Value[a] | $p$ |
|---|---|---|
| *Selbstwirksamkeitserwartungen* | | |
| Selbstwirksamkeit für Instruktionsstrategien | 1,19 | 0,553 |
| Selbstwirksamkeit für Klassenmanagement | 0,89 | 0,640 |
| Selbstwirksamkeit im Schülerinnen- und Schülerengagement | 1,63 | 0,443 |
| Reflexionsbezogene Selbstwirksamkeitserwartungen | 2,26 | 0,323 |
| *Burnout* | | |
| Emotionale Erschöpfung | 1,13 | 0,568 |
| Depersonalisierung (Zynismus) | 2,26 | 0,324 |
| Professionelle Wirksamkeit | 1,12 | 0,571 |

[a] mit Fachsemester

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# *Study 2*

**The Relation between Student Teacher Self-Efficacy and Observer-Rated Teaching Quality: A Video-Based Analysis using the CLASS-S Instrument**

# The Relation between Student Teacher Self-Efficacy and Observer-Rated Teaching Quality: A Video-Based Analysis using the CLASS-S Instrument

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## Abstract

Teachers' self-efficacy is an important predictor of effective teaching, but little is known about its role for student teachers' professional behaviours. This longitudinal study with data from $n$ = 38 student teachers examines (bidirectional) relations between self-efficacy, peer feedback and teaching behaviour (CLASS-S). Observer-rated effective classroom management and instructional support of student teachers at mid-semester predicted increases in self-efficacy for classroom management across the semester. Observer-rated classroom management predicted increases in self-efficacy for instruction. High levels of perceived peer feedback quality at mid-semester were related to increased self-efficacy for classroom management over the semester. Implications for teacher education are discussed.

*Keywords*: CLASS Scoring System, student teachers, teacher self-efficacy, teaching behaviours, teacher education

## Introduction

Teachers' self-efficacy beliefs are an important personal resource because they contribute to reducing burnout and increasing wellbeing for teachers in school (Kim & Burić, 2020; Skaalvik & Skaalvik, 2016). Furthermore, teacher self-efficacy beliefs are considered to be a central predictor of teachers' professional behaviours and student academic learning in class (Klassen & Tze, 2014; Zee & Koomen, 2016). Recent reviews, however, reveal that the effects of teacher self-efficacy on teaching behaviours and student academic outcomes are inconsistent across studies (Lauermann & ten Hagen, 2021). Furthermore, some studies propose that teacher self-efficacy, rather than students' behaviour in class, is predicted by effective teaching behaviours (Holzberger et al., 2013). The (reciprocal) relations between teacher self-efficacy and teaching have so far been studied mainly among in-service teachers, and little is known about the longitudinal relations between self-efficacy of *student teachers* and their teaching behaviours in schools. Addressing this question is important because it

provides insight into how future teachers can be effectively prepared before entering the profession. Against this background, this study examines how multiple dimensions of student teachers' self-efficacy are reciprocally interrelated with their teaching behaviours in real-life classrooms as assessed by external observers over the course of a semester. We also examined the role of perceived quality of peer feedback in these relations because, particularly in teacher education, peer feedback is an important social resource with positive effects on self-efficacy beliefs (Goker, 2006).

## 1. Theoretical Background

### 1.1 Changes in and Sources of Student Teachers' Self-Efficacy

Teacher self-efficacy is defined as teachers' beliefs about their ability to achieve desired outcomes in terms of the learning and engagement of their students, even when students are challenging or unmotivated (Tschannen-Moran & Woolfolk Hoy, 2001). In recent research, three dimensions of teacher self-efficacy beliefs have been distinguished: self-efficacy for *instructional strategies*, for *classroom management* and for *student engagement* (Tschannen-Moran & Woolfolk Hoy, 2001). *Teacher self-efficacy for instructional strategies* is defined as teachers' beliefs about their ability to enhance knowledge transfer by using different strategies in class (Tschannen-Moran & Woolfolk Hoy, 2001). *Self-efficacy for classroom management* is defined as the beliefs of teachers regarding their ability to organize and manage the course of action with the aim of maintaining students' classroom order (Brouwers & Tomic, 2000). *Teacher self-efficacy for student engagement* is defined as teachers' beliefs about their own capability to motivate students – particularly students who do not highly value learning or have little interest in learning (Tschannen-Moran & Hoy, 2001).

Studies that focus on changes in teacher self-efficacy suggest substantial decreases during the first years of teaching (Swan et al., 2011; Woolfolk Hoy & Spero, 2005). Some findings suggest that teacher education programs provide more support and enables student teachers to develop higher competence beliefs than internships of teachers (Clark et al., 2014). During university education, however, preservice teachers' self-efficacy first seems to increase, particularly after practical experiences – for example, over the course of a three-week teaching practicum during university studies (Rupp & Becker, 2021) or a four-week practicum in the course of student teachers' university studies in bachelor degree (Schüle et al., 2016), after the final practicum in an undergraduate three-year primary education teaching program (Berg & Smith, 2018), or during a one-month teaching practicum in a master study program

(Pfitzner-Eden, 2016a). There are, however, also some findings that propose a decrease in preservice teachers' self-efficacy (for instructional strategies, classroom management and student engagement), for example, after a seven-week practicum (Pendergast et al., 2011). The reasons for the inconsistencies in prior research might be related to the differences in mentoring support and feedback that preservice teachers received during the practicum (Fuchs & Wyss, 2018), or to the type of practical experience that student teachers experience (Gurvitch & Metzler, 2009). Another reason might be the extent of their own teaching experiences during the practicum – student teachers, for example, who taught more than 3 hours during a practicum over 3 weeks had higher self-efficacy scores than other student teachers who participated in seminars in which they did not have to teach at all (Cantrell et al., 2003). Gurvitch and Metzler (2009) showed that during a school internship in authentic classrooms, the self-efficacy of preservice teachers first decreased and then increased, whereas during micro-teaching settings that did not take place in authentic classrooms the self-efficacy of student teachers first increased and then remained relatively stable. In a similar study design, Hußner et al. (2022) found that student teachers' self-efficacy for classroom management and reflective self-efficacy increased over the course of a semester after micro-teaching settings, whereas student teachers' self-efficacy remained stable during a COVID-19 online semester without practical experiences. Moreover, Weß et al. (2020) showed that student teacher self-efficacy regarding the planning, implementation and reflection of teaching-learning situations increased in a seminar with practical elements and feedback provision.

On a theoretical level, according to social cognitive theory (Bandura, 1997; Schunk & Usher, 2012) it can be assumed that self-efficacy generally increases during practical phases in teacher education because teaching experiences to an appropriate extent enable student teachers to experience themselves as successful. *Mastery experiences*, but also *verbal persuasion*, *vicarious experiences* and *affective arousal* are considered to be central sources of self-efficacy beliefs (Bandura, 1997; Morris et al., 2017). Practical experiences during teacher education programs can be seen as *mastery experiences,* which are related to increases in self-efficacy (Berg & Smith, 2018; Cantrell et al., 2003; Rupp & Becker, 2021). Verbal or written feedback from mentors (Moulding et al., 2014), feedback from mentor teachers during a school practicum (Klassen & Durksen, 2014), peer feedback (Pfitzner-Eden, 2016b) and even videotaped peer feedback (Goker, 2006) can be seen as *verbal persuasion* and have positive effects on preservice teachers' self-efficacy beliefs. *Vicarious experiences* during teacher education occur when student teachers observe classrooms of experienced teachers, for example during an observation practicum (Eisfeld et al., 2020). Richter et al. (2011), for

example, showed that not only the instructional support of peers but also informational and emotional support from mentors are associated with increased self-efficacy beliefs of novice teachers during the teacher induction phase in Germany. Seifert and Schaper (2018) showed that the quality of supervision provided by university teachers, but not by peers and school teachers, had a small but positive effect on changes in student teacher self-efficacy during an internship semester.

Taken together, current research suggests that self-efficacy increases during practical experiences in teacher education (Pendergast et al., 2011; Schüle et al., 2016), and that these increases might be related to practical experiences as well as to feedback from others (Goker, 2006; Moulding et al., 2014).

## 1.2 (Student) Teachers' Self-Efficacy, Teaching Behaviours and Feedback

Previous studies have shown that in-service teachers with high self-efficacy beliefs provide effective teaching in terms of student-rated cognitive activation, effective classroom management and student support (e.g., Burić & Kim, 2020; Hettinger et al., 2021; Oppermann & Lazarides, 2021). *Teacher self-efficacy for instructional strategies* positively predicted teachers' motivational teaching behaviours in tertiary education English classrooms (Huangfu, 2012). *Self-efficacy for classroom management,* for example, has been shown to reduce classroom disruptions during teachers' induction phase (Dicke et al., 2014), and during their early careers (Lazarides et al., 2020). *Teacher self-efficacy for student engagement* in turn has been shown to be significantly associated with teachers' student-reported autonomy-supportive behaviours (Zee & Koomen, 2020). Although studies show that self-efficacy beliefs might lead to effective teaching behaviours, other studies propose that these effects function in the opposite direction, with effective teaching behaviours positively affecting self-efficacy, such as for student-reported cognitive activation and classroom management (Holzberger et al., 2013), or student-perceived learning support (Praetorius, Lauermann, et al., 2017). While a number of studies have examined the relations between teacher self-efficacy and the teaching behaviours of in-service teachers, there is a paucity of research on the relations between *student teachers' self-efficacy* and their *teaching behaviours* (Seethaler, 2012). As one of the few existing studies, Jamil et al. (2012), for example, showed that pre-service teachers' observer-rated mastery teaching performance (operationalized as emotional support, classroom management and instructional support) did not significantly predict teacher self-efficacy at the end of teacher preparation during the final year of the teacher education program. It is thus an

important question whether the interrelations among self-efficacy and teaching behaviours function similarly for both in-service and pre-service teachers.

Another deficiency in current research on the interrelations between self-efficacy and teaching behaviour is that most studies focus on teacher-rated (Dicke et al., 2014; Holzberger et al., 2013) or student-rated teaching behaviours (Burić & Kim, 2020; Hettinger et al., 2021; Oppermann & Lazarides, 2021). Student and teacher ratings are of limited validity, however, because student reports could, for example, be affected by the relationships between students and teachers (Göllner et al., 2018), and it is proposed that teachers are only able to accurately assess the level of adequate pacing and cognitive activation in class to a limited extent (Kunter & Baumert, 2006). Another option to assess teaching behaviours is observer ratings, which are carried out by trained observers and are thus more objective (Praetorius, McIntyre, et al., 2017). A well-established observer rating system for teaching behaviours in classrooms is the Classroom Assessment Scoring System for Secondary (CLASS-S) that includes the behavioural dimensions *emotional support* (e.g., positive classroom climate, high levels of teacher sensitivity, recognizing students' social, emotional and academic needs), *classroom management* (e.g., effective management of student behaviour, maximizing time on tasks and attention) and *instructional support* (e.g., promoting a deep understanding of the content, engaging students in higher-order thinking, providing high-quality feedback) (Pianta et al., 2012). Research on the interrelations between teacher self-efficacy and observer-rated teaching behaviours using the CLASS rating system is scarce, however. Existing studies on the relation between self-efficacy and the domains of CLASS found inconsistent results. Pakarinen et al. (2010) showed a positive and significant association between self-efficacy of kindergarten teachers and observed emotional support. Jang et al. (2019) found a significant correlation between all subscales of self-efficacy of English as a Foreign Language teachers and observed instructional support. In contrast, Infurna et al. (2018) found no significant relations between preschool teachers' general self-efficacy and the three CLASS dimensions.

Apart from one's own competence beliefs, the feedback of others about one's competence is important for effective teaching behaviour in (beginning) teachers in class. Existing findings show, for example, positive effects of peer or expert feedback on aspects of effective teaching. Bodur and Crawford (2016), for example, found that pre-service teachers who received unstructured peer feedback showed positive effects on their ability to analyze classroom events. Wilkins et al. (2009) showed that teacher candidates after one semester of receiving peer feedback increased their understanding of children, their self-confidence in teaching and their awareness of the diversity of their students' different learning styles.

## 2. The Present Study

An important question in current research on teachers' professional development is how self-efficacy changes across teacher education backgrounds, and how factors such as feedback and successful teaching experiences contribute to the positive development of teachers' self-efficacy, including early on in the course of their professionalization (Pendergast et al., 2011; Schüle et al., 2016). Current research on teacher self-efficacy often focuses on the interrelations between self-efficacy and effective teaching behaviours among in-service teachers – with some studies suggesting that effective teaching predicts subsequent self-efficacy (Holzberger et al., 2013; Praetorius, Lauermann, et al., 2017), whereas other empirical studies propose that self-efficacy predicts teaching behaviour (Burić & Kim, 2020; Lazarides et al., 2020). Little is known, however, about the (reciprocal) relations between self-efficacy and teaching behaviours of student teachers. Such research would inform how teaching experiences during teacher education have an impact on changes in student teachers' self-efficacy and how self-efficacy beliefs are related to effective teaching behaviours.

Against this background, the aims of this study were (i) to examine the changes in student teacher self-efficacy (*for instructional strategies, for classroom management and for student engagement*) from the beginning (Time 1) to the end (Time 4) of a semester; (ii) to analyse the longitudinal and potentially reciprocal relations between student teachers' self-efficacy at the beginning and at the end of the semester (Times 1 and 4) and their observer-rated teaching behaviours in the middle of the semester (*emotional support, classroom management and instructional support*; Time 3) and (iii) to examine how peer feedback (Time 2) related to both teaching behaviours (Time 3) and teacher self-efficacy (Time 4).

We tested the following hypotheses:

*Hypothesis 1:* Student teachers who have the opportunity to gain practical experiences accompanied by feedback and external support during teacher education (Goker, 2006; Moulding et al., 2014), will show an increase in their self-efficacy (*for instructional strategies, classroom management and student engagement*) from the beginning of the semester (Time 1) to the end of the semester (Time 4).

*Hypothesis 2:* Referring to previous findings that have shown positive relations between teacher self-efficacy and effective teaching (Burić & Kim, 2020; Hettinger et al., 2021; Oppermann & Lazarides, 2021), we assumed positive effects of student teacher self-efficacy at the beginning of the semester (Time 1) on observer-rated dimensions of teaching behaviour in the middle of the semester (Time 3).

*Hypothesis 3:* Given that previous research has demonstrated the influence of effective teaching on teacher self-efficacy (Holzberger et al., 2013; Praetorius, Lauermann, et al., 2017), we expected that observer-rated teaching behaviour in the middle of the semester (Time 3) would enhance increases in student teacher self-efficacy across the semester (Time 1 to Time 4).

*Hypothesis 4:* Because prior results indicated that feedback had a positive effect on the self-efficacy of student teachers (Moulding et al., 2014; Richter et al., 2011) and on effective teaching (Bodur & Crawford, 2016), and thus might serve as mastery and vicarious experiences, we assumed that the self-reported quality of feedback from fellow students on lesson plans in the middle of the semester (Time 2) would predict effective observer-rated teaching of student teachers mid-semester (Time 3) as well as increases in self-efficacy across the semester (Time 1 to Time 4).

We included the covariates of gender, previous pedagogical experience and educational knowledge in our analyses because previous research has suggested that teacher gender (Schiefele & Schaffner, 2015), years of work experience (Wolters & Daugherty, 2007), and teacher educational knowledge (Lohse-Bossenz et al., 2015) all relate to teachers' professional behaviours in class. The assumed interrelations are depicted in Figure 1.
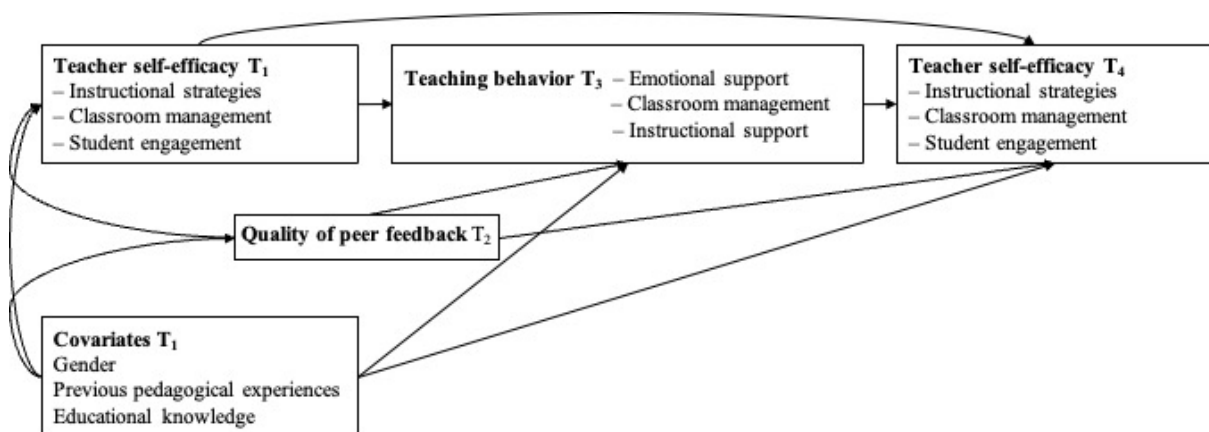


**Figure 1**
*Path model of the tested longitudinal Interrelations between Teacher Self-efficacy, observer-rated Teaching Quality, Quality of Peer Feedback and Covariates*

### 3. Methods

### 3.1 Sample

Data were used from *n* = 38 student teachers at a German university (60.5% male; 89.5% born in Germany). The 38 student teachers participating in this study were on average

24 years old ($M$ = 24.34, $SD$ = 4.27) and in their fifth semester ($M$ = 5.05, $SD$ = 1.89). The three most-studied first subjects of the student teachers were German (18.4%), Mathematics (18.4%) and English (15.8%). The coded videos were mostly in the subjects Mathematics (18.4%), Physics (15.8%) and History (13.2%). A minority of the participating student teachers (18.4%) already had previous experiences in teaching, such as working in schools during their studies.

## 3.2 Procedure

This study focuses on student teachers who participated in bachelor courses in the field of educational science on the topics of teaching quality and motivating teaching strategies, which took place at the end of the bachelor's program and included systematic micro-teaching experiences. The design of the study is depicted in Figure 2. The courses included micro-teaching sessions in secondary classrooms, in which the student teachers were introduced to a supervising teacher in one of six cooperating schools and taught one lesson (of 45-90 minutes) in the classroom of the cooperating teacher. Student teachers prepared this lesson on their own or in teams by transferring the theoretical input taught during the first weeks of the course into practice. Before teaching, student teachers prepared the lesson plans and presented their lessons in the course. After each presentation, their peers gave them oral feedback on the lesson plans. Before the micro-teaching experiences, student teachers observed one lesson given by their supervising teacher at the cooperating school. Student teachers finally taught their lesson in the cooperating schools and videotaped themselves doing so.
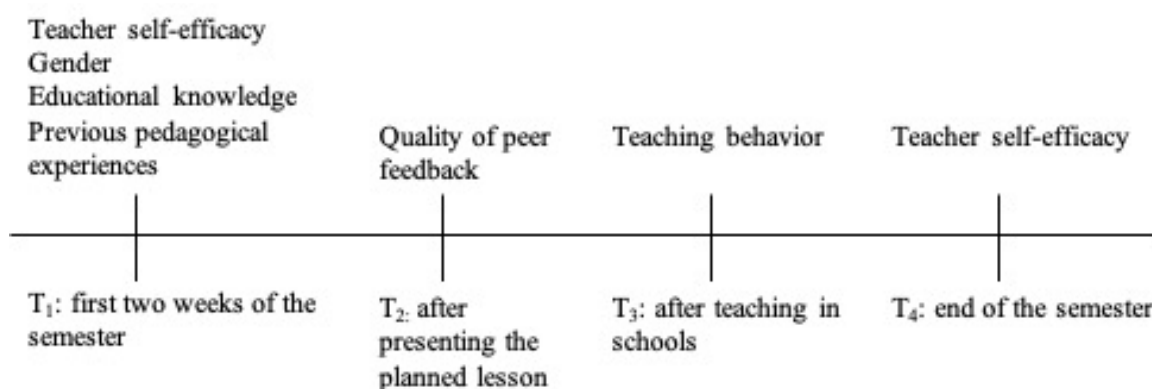


**Figure 2**
*Constructs and Data Collection Times per Measurement Time*

### 3.3 Data Assessment

Student teachers participated in an online questionnaire during the first two weeks of the semester (Time 1) and the last two weeks of the semester (Time 4). In addition, they participated in a short questionnaire assessing the quality of the feedback from their fellow students in the middle of the semester at week seven (Time 2). Student teachers videotaped their teaching performance at Time 3 in the middle of the semester (duration between 45 and 90 minutes each). The videotaped sequences were cut into segments of 15-20 minutes each for coding purposes. In total, we included $n = 39$ videotaped lessons that resulted in $n = 103$ segments of $n = 38$ student teachers of secondary school in this study (one student teacher with two videotaped lessons and two videotaped lessons of student teachers who taught in team teaching, but were separately rated). Five research assistants coded the segments of the lesson videos of the student teachers. For the analysis of the segments, all available segments per student were coded along the CLASS dimensions and the values averaged. These coders completed a two-day training program by a certified CLASS trainer and passed the online reliability test (5 videos to rate – passed with 80% agreement with the master code: +/- 1 point deviation). Approximately one-fifth (22%; $n = 22$) of all segments were randomly and independently double-coded by two of the five coders.

### 3.4 Measures

The item wordings of each scale and the reliabilities (α) of teacher self-efficacy, teaching behaviour and the quality of peer feedback are presented in Table 1.

*Teacher self-efficacy* at the beginning and end of the semester was assessed using the three subscales of self-efficacy for instructional strategies, for classroom management and for student engagement developed by Tschannen-Moran and Woolfolk Hoy (2001) and adapted for the German version by Pfitzner-Eden et al. (2014). Response formats ranged from 1 (strongly disagree) to 6 (strongly agree).

*Teaching behaviour* was rated using the CLASS-S scoring system developed by Pianta and Hamre (2009) and based on videotaped lessons of the student teachers in the middle of the semester (Time 3). The three dimensions *emotional support*, *classroom management* and *instructional support* were rated on a Likert-type scale ranging from 1 (low) to 7 (high). High teaching quality is indicated by high scores in all of the subdimensions, except negative climate with a low score, but for the current analysis this subscale was reverse-coded.

Self-reported *quality of peer feedback* was measured by a 4-point Likert scale from 1 (disagree) to 4 (agree) (Laschke & Blömeke, 2014). The item wording was "The feedback I received from my fellow students will help me improve my teaching methods."

The covariates included were *gender* (1 = female; 2 = male), *previous pedagogical experiences* adapted according to König et al. (2013) (1 = student teachers did not have previous pedagogical experiences; 2 = student teachers had previous pedagogical experiences outside of the teaching degree program, for example as a substitute teacher or assistant teacher) and *educational knowledge*, assessed using the 23-item subscale *classroom instruction* from the original German version of the standardized knowledge test *Bilwis*s (Kunina-Habenicht et al., 2020). The subdimension of the standardized test consists of 23 multiple-choice items, 16 items with a binary response format ("true" / "not true") and seven items with a four-category response format as a multiple-choice question. The test assesses teachers' knowledge about different areas of classroom instruction, such as questions about classroom management or cooperative learning. Test scores range from 0 (minimum) to 23 (maximum). The sum of all test items represents the individual knowledge level. In this study, student teachers reached a minimum of 1.00 to a maximum of 19.00 points (theoretical range: 0-23; $\alpha_{T1}$= 0.99).

**Table 1**
*Measurement Instruments, Sample Items and Statistics for Gender, Previous Pedagogical Experiences, Educational Knowledge and Quality of Peer Feedback, Teaching Behaviour and Teacher Self-Efficacy*

| Scale | Construct | (Sample) Item | Internal consistency |
|---|---|---|---|
| Gender | $Sex_{T1}$ | *"I am ..." (1 = female; 2 = male)* | - |
| Previous pedagogical experiences (adapted to: König et al., 2013) | $PE_{T1}$ | *"The following questions refer to your previous teaching experience outside of your teacher training program. Please indicate to what extent the statements apply to you: own teaching activity at a school outside of your studies (e.g., substitute teacher, assistant teacher)."* | - |
| Educational knowledge (Kunina-Habenicht et al., 2020) | $EK_{T1}$ | *"In Helmke's offer-use model (German: Angebot-Nutzungsmodell), what aspects belong to the level of use of learning opportunities on the part of the student(s)?"* | $\alpha_{T1}$= 0,99 |

| Quality of peer feedback (Laschke & Blömecke, 2014) | QPF$_{T2}$ | *"The feedback I received from my fellow students will help me improve my teaching methods. "* | $\alpha_{T2}$= 0,75 |
|---|---|---|---|
| Teaching behaviour [CLASS] (Pianta, 2009) | Emotional support$_{T3}$ | *Positive Climate; Teacher Sensitivity; Regard for Adolescent Perspectives* | $\alpha_{T3}$ = 0,77 |
| | Classroom management$_{T3}$ | *Productivity; Behavior Management; Negative Climate* | $\alpha_{T3}$ = 0,78 |
| | Instructional support$_{T3}$ | *Instructional Learning Formats; Content Understanding; Analysis and Inquiry; Quality of Feedback; Instructional Dialogue* | $\alpha_{T3}$= 0,85 |
| Teacher Self-Efficacy [TSE] (Pfitzner-Eden et al. 2014) | TSE for instructional strategies | "I am confident, I can find an alternative explanation or example if learners do not understand something. " | $\alpha_{T1}$ = 0,76; $\alpha_{T4}$ = 0,79 |
| | TSE for student engagement | "I am convinced, that I can motivate the learners who have little interest in the lessons. " | $\alpha_{T1}$ = 0,74; $\alpha_{T4}$ = 0,82 |
| | TSE for classroom management | "I am confident in my ability to control disruptive behaviour in the classroom. " | $\alpha_{T1}$= 0,84; $\alpha_{T4}$ = 0,91 |

# 4. Results

## 4.1 Observed Teaching Behaviour: Interrater Reliability

All videos were split into two segments, each 15-20 min long, which were coded by the five trained and certified coders. The coders met one time to rate one segment together with the aim of maximizing reliability. In total, each coder coded 15-16 segments of the overall 103 segments. Two of the five coders rated an additional 24 segments (23.3%, $n = 24$) in a double-coding process. Intraclass correlation (ICC) was calculated to assess the interrater reliability of the double-coded ratings. The interrater reliability of double-coded segments of the 10 CLASS-S dimensions ($n = 24$) ranged from .63 to .93 (see Table 2). An ICC of 0 indicates random judgment behaviour, a value of 1 a perfectly reliable feature estimation by the coders. Values greater than .7 are generally considered to indicate good rater agreement (Cicchetti & Sparrow, 1981).

**Table 2**

*Interrater Reliability for all Dimensions of the CLASS-S Scoring System for Teaching Behaviour*

| Domains | Cycles with perfect agreement (%) | Cycles with agreement within 1 point (%) | Cycle intraclass correlations (ICC) |
|---|---|---|---|
| Positive climate | 77,30 | 100,00 | .925 |
| Teacher sensitivity | 72,70 | 100,00 | .711 |
| Regard for adolescent perspectives | 63,60 | 100,00 | .887 |
| Behavior management | 50,00 | 100,00 | .833 |
| Productivity | 63,60 | 100,00 | .842 |
| Negative climate | 100,00 | 100,00 | 1.0 |
| Instructional learning formats | 63,60 | 95,50 | .733 |
| Content understanding | 36,40 | 100,00 | .632 |
| Analysis and inquiry | 40,90 | 95,50 | .804 |
| Quality of feedback | 63,60 | 100,00 | .838 |
| Instructional dialogue | 45,46 | 100,00 | .902 |

## 4.2 Descriptive Statistics and Correlations

Descriptive statistics are reported in Table 3. Student teachers' self-efficacy for instructional strategies tended to increase over the course of the semester ($M_{IST1}$ = 4.77, $SD$ = 0.10; $M_{IST4}$= 4.93, $SD$ = 0.11), but the increase was not significant, $\chi^2$ (1) = 1.20, $p$ = 0.274. Teacher self-efficacy for classroom management ($M_{KMT1}$ = 4.39, $SD$ = 0.12; $M_{KMT4}$= 4.80, $SD$ = 0.14; $\chi^2$ (1) = 4.98, $p$ = 0.026) and self-efficacy for student engagement ($M_{EST1}$ = 4.55, $SD$ = 0.09; $M_{EST4}$= 4.96, $SD$ = 0.11; $\chi^2$ (1) = 8.43, $p$ = 0.004) increased significantly over the course of the semester.

**Table 3**

*Descriptive Statistics (N = 38)*

| | $T_1$ | | $T_4$ | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| **Teacher Self-Efficacy (TSE)** | | | | |
| for instructional strategies (IS) | 4.77 | 0.10 | 4.93 | 0.11 |
| for classroom management (CM) | 4.39 | 0.12 | 4.80 | 0.14 |
| for student engagement (ES) | 4.55 | 0.09 | 4.96 | 0.10 |

| | $T_1$ | |
|---|---|---|
| | *M* | *SD* |
| Gender (Sex) | 1.62 | 0.49 |
| Educational knowledge (EK) | 14.72 | 4.36 |
| Previous pedagogical experience (PE) | 1.20 | 0.41 |

|                                 | T$_2$ | |
| ------------------------------- | :---: | :---: |
|                                 | *M*   | *SD* |
| Quality of peer feedback (QPF)  | 3.16  | 0.85 |
|                                 | T$_3$ | |
|                                 | *M*   | *SD* |
| **Teaching Behaviour**          |       |      |
| Emotional support (CES)         | 5.34  | 0.63 |
| Classroom management (CCM)      | 4.05  | 0.54 |
| Instructional support (CIS)     | 4.89  | 0.67 |

The bivariate correlations in Table 4 show that observer-rated emotional support of student teachers' mid-semester (Time 3) was positively and significantly associated with student teachers' self-efficacy for classroom management and for student engagement at the end of the semester (Time 4). Observer-rated instructional support mid-semester (Time 3) was positively and significantly associated with student teachers' self-efficacy for instructional strategies, for classroom management and for student engagement at the end of the semester (Time 4). Observer-rated effective classroom management mid-semester (Time 3) was positively and significantly associated with student teachers' self-efficacy for instructional strategies at the end of the semester (Time 4). Perceived quality of peer feedback mid-semester (Time 2) was positively associated with student teachers' self-efficacy for instructional strategies and classroom management at the beginning (Time 1) and end of the semester (Time 4), but not with self-efficacy for student engagement at Time 1 or Time 4. Previous pedagogical experiences in teaching assessed at the beginning of the semester (Time 1) were positively and significantly associated with self-reported quality of peer feedback mid-semester (Time 2) and with student teachers' self-efficacy for instructional strategies at the end of the semester (Time 4).

Study 2

**Table 4**

*Pearson Correlations for Gender, Educational Knowledge, Previous Pedagogical Experiences, Quality of Peer Feedback and Teacher Self-Efficacy and Teaching Behaviour*

| | Sex_T1 | EK_T1 | PE_T1 | QPF_T2 | TSEIS_T1 | TSECM_T1 | TSESE_T1 | CES_T3 | CCM_T3 | CIS_T3 | TSEIS_T4 | TSECM_T4 | TSESE_T4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sex_T1 | 1 | | | | | | | | | | | | |
| EK_T1 | **-.359*** | 1 | | | | | | | | | | | |
| PE_T1 | -.162 | -.127 | 1 | | | | | | | | | | |
| QPF_T2 | -.003 | .144 | **.382*** | 1 | | | | | | | | | |
| TSEIS_T1 | .007 | .169 | .010 | **.450*** | 1 | | | | | | | | |
| TSECM_T1 | .166 | -.082 | .172 | **.368*** | **.335*** | 1 | | | | | | | |
| TSESE_T1 | .006 | .144 | -.115 | .196 | **.654*** | **.400*** | 1 | | | | | | |
| CES_T3 | .149 | -.162 | .087 | .110 | -.030 | .274 | .216 | 1 | | | | | |
| CCM_T3 | -.003 | -.082 | .096 | .203 | .017 | .048 | .039 | **.465*** | 1 | | | | |
| CIS_T3 | .253 | -.080 | .224 | .268 | -.085 | .246 | .148 | **.803*** | **.591*** | 1 | | | |
| TSEIS_T4 | .074 | .169 | **.357*** | **.620*** | **.541*** | .535 | .352 | .265 | **.360*** | **.386*** | 1 | | |
| TSECM_T4 | -.051 | .197 | .300 | **.557*** | **.365*** | **.842*** | **.443*** | **.349*** | .272 | **.383*** | **.611*** | 1 | |
| TSESE_T4 | .183 | -.343 | .210 | .266 | **.460*** | **.412*** | **.410*** | **.411*** | .235 | **.363*** | **.508*** | **.421*** | 1 |

Notes: All correlations marked with * are significant at least at the level $p < .05$. Sex = student teachers' gender, coded as 1 = female and 2 = male; EK = standardized educational knowledge test; PE = Previous pedagogical experiences; QPF = Self-reported quality of peer feedback; TSE_IS = Teacher self-efficacy for instructional strategies; TSE_CM = Teacher self-efficacy for classroom management; TSE_SE = Teacher self-efficacy for student engagement; CES = CLASS dimension emotional support; CCM = CLASS dimension classroom management; CIS = CLASS dimension instructional support; T1 = Beginning of the semester; T2 = Mid-semester - after presenting the lesson plan in the course; T3 = Mid-semester - after teaching; T4 = End of the semester.

## 4.3 Structural Validity and Measurement Models

Results of Confirmatory Factor Analysis for each subscale of teacher self-efficacy showed a good fit of each model: self-efficacy for instructional strategies, $\chi^2$ ($df = 8$) = 8.64; CFI = .99, TLI = .98, RSMEA = .05, SRMR = .07; self-efficacy for classroom management, $\chi^2$ ($df = 1$) = 2.21; CFI = .99, TLI = .93, RSMEA = .18, SRMR = .02; self-efficacy for student engagement: $\chi^2$ ($df = 8$) = 8.12; CFI = 1.00, TLI = 1.00, RSMEA = .02, SRMR = .09. We tested measurement invariance for each subscale of teacher self-efficacy across the two time points when self-efficacy was assessed at the beginning (Time 1) and the end of semester (Time 4). Results showed factorial invariance across time and are reported in Appendix A, Tables A1-A3.

Additionally, a joint CFA for the three CLASS dimensions of emotional support, instructional support and classroom management showed a good fit: $\chi^2$ ($df = 24$) = 27.96; CFI = .98, TLI = .97, RSMEA = .07, SRMR = .06.

## 4.4 Longitudinal Analysis: Direct Effects

Because of the high intercorrelations among the self-efficacy dimensions as well as among the teaching behaviour dimensions (see Table 4), we modelled manifest path models separately (i) for each teacher self-efficacy dimension (assessed at Times 1 and 4) and (ii) for each teaching dimension (assessed at Time 3), resulting in nine models. In each of these models, student teachers' gender, previous pedagogical experiences, educational knowledge (assessed at Time 1) and self-reported quality of peer-feedback (assessed at Time 2) were included.

### 4.4.1 Teacher Self-Efficacy for Instructional Strategies

The coefficients for the three models that included student teachers' self-efficacy for instructional strategies are displayed in Table 5. Results of these models show that student teachers' self-efficacy for instructional strategies at the beginning of the semester (Time 1) did not predict observer-rated classroom management or emotional or instructional support mid-semester (Time 3). Student teachers' educational knowledge, their gender, previous pedagogical experiences at the beginning of the semester (Time 1) and self-reported quality of peer feedback mid-semester (Time 2) had no significant effect on subsequent observer-rated classroom management, instructional support or emotional support mid-semester (Time 3) or on student teachers' self-efficacy for instructional strategies at the end of the semester (Time 4), when controlling for self-efficacy for

instructional strategies at the beginning of the semester (Time 1). Observer-rated emotional or instructional support mid-semester (Time 3) did not predict student teachers' self-efficacy for instructional strategies at the end of the semester (Time 4), when controlling for self-efficacy for instructional strategies in student teachers at the beginning of the semester (Time 1). However, observer-rated effective classroom management mid-semester (Time 3) predicted an increase in student teachers' self-efficacy for instructional strategies across the semester, when controlling for self-efficacy for instructional strategies at the beginning of the semester (Time 1).

**Table 5**

*Teacher Self-Efficacy for Instructional Strategies Relating to Teaching Behaviour*

| Variables | $CES_{T3}$ | | | $CCM_{T3}$ | | | $CIS_{T3}$ | | | $TSEIS_{T4}$* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | *SE* | *p* | β | *SE* | *p* | β | *SE* | *p* | β | *SE* | *p* |
| $Sex_{T1}$ | .11 | .18 | .564 | .03 | .18 | .745 | .27 | .16 | .098 | .00 | .16 | .998 |
| $EK_{T1}$ | -.19 | .20 | .348 | -.06 | .19 | .745 | -.025 | .18 | .891 | -.05 | .22 | .825 |
| $PE_{T1}$ | .01 | .19 | .961 | .09 | .20 | .468 | .14 | .18 | .442 | .16 | .20 | .419 |
| $TSEIS_{T1}$ | -.06 | .20 | .750 | -04 | .20 | .853 | -.23 | .18 | .192 | **.42** | **.15** | **.005** |
| $QPF_{T2}$ | .18 | .25 | .474 | .14 | .24 | .565 | .37 | .20 | .061 | .33 | .18 | .068 |
| $CES_{T3}$ | | | | | | | | | | .10 | .17 | .544 |
| $CCM_{T3}$ | | | | | | | | | | **.31** | **.12** | **.013** |
| $CIS_{T3}$ | | | | | | | | | | .27 | .16 | .087 |

*Note*. *for all models of teacher self-efficacy subscales and dimensions of teaching behaviour, the values of the covariates are represented for the teaching behaviour dimension emotional support because the values are similar. Sex = student teachers' gender; EK = educational knowledge; PE = previous pedagogical experiences; QPF = quality of peer feedback; TSEIS = teacher self-efficacy for instructional strategies; CES = CLASS emotional support; CCM = CLASS classroom management; CIS = CLASS instructional support; T1 = at the beginning of the semester; T2 = after presenting the lesson plan in the course; T3 = after teaching; T4 = at the end of the semester.

*4.4.2 Teacher Self-Efficacy for Classroom Management*

Our results for student teachers' self-efficacy for classroom management are shown in Table 6. Student teachers' self-efficacy for classroom management at the beginning of the semester

(Time 1) did not predict observer-rated classroom management or emotional or instructional support mid-semester (Time 3). Student teachers' educational knowledge, their gender and previous pedagogical experiences at the beginning of the semester (Time 1) and self-reported quality of peer feedback mid-semester (Time 2) had no significant effect on subsequent observer-rated classroom management, instructional support or emotional support mid-semester (Time 3) when controlling for self-efficacy for classroom management at the beginning of the semester (Time 1). However, student teachers' educational knowledge at the beginning of the semester (Time 1) and the self-perceived quality of peer feedback mid-semester (Time 2) positively predicted student teachers' self-efficacy for classroom management at the end of the semester (Time 4), when controlling for self-efficacy for classroom management at the beginning of the semester (Time 1). Observer-rated emotional support had no effect, but classroom management and instructional support mid-semester (Time 3) had a significant and positive effect on student teachers' self-efficacy for classroom management at the end of the semester (Time 4), when controlling for self-efficacy for classroom management at the beginning of the semester (Time 1).

**Table 6**

*Teacher Self-Efficacy for Classroom Management Relating to Teaching Behaviour*

| Variables | $CES_{T3}$ | | | $CCM_{T3}$ | | | $CIS_{T3}$ | | | $TSECM_{T4}$* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | SE | p | β | SE | p | β | SE | p | β | SE | p |
| $Sex_{T1}$ | .07 | .18 | .701 | .04 | .18 | .756 | .25 | .16 | .129 | -.13 | .10 | .169 |
| $EK_{T1}$ | -.17 | .19 | .389 | -.06 | .19 | .756 | -.03 | .18 | .869 | **.32** | **.11** | **.006** |
| $PE_{T1}$ | .02 | .19 | .389 | .10 | .19 | .600 | .16 | .17 | .354 | .04 | .11 | .731 |
| $TSECM_{T1}$ | .27 | .17 | .118 | .001 | .18 | .994 | .16 | .17 | .339 | **.69** | **.09** | **.000** |
| $QPF_{T2}$ | .01 | .23 | .963 | .11 | .22 | .612 | .19 | .19 | .305 | **.24** | **.10** | **.015** |
| $CES_{T3}$ | | | | | | | | | | .18 | .10 | .068 |
| $CCM_{T3}$ | | | | | | | | | | .18 | .08 | **.022** |
| $CIS_{T3}$ | | | | | | | | | | **.18** | **.09** | **.046** |

*Note.* *for all models of teacher self-efficacy subscales and dimensions of teaching behaviour, the values of the covariates are represented for the teaching behaviour dimension emotional support cause the values are similar. Sex = student teachers' gender; EK = educational knowledge; PE = previous pedagogical experiences; QPF = quality of peer feedback; TSECM = teacher self-efficacy for classroom management; CES = CLASS emotional support; CCM = CLASS classroom management; CIS = CLASS instructional support; T1 = at the beginning of the semester; T2 = after presenting the lesson plan in the course; T3 = after teaching; T4 = at the end of the semester.

### 4.4.3 Teacher Self-Efficacy for Student Engagement

Our results for student teachers' self-efficacy for student engagement are shown in Table 7. Student teachers' self-efficacy for student engagement at the beginning of the semester (Time 1)

did not predict observer-rated classroom management or emotional or instructional support mid-semester (Time 3). The gender and previous pedagogical experiences of the student teachers at the beginning of the semester (Time 1) and self-reported quality of peer feedback mid-semester (Time 2) had no significant effect on subsequent observer-rated classroom management, instructional support or emotional support mid-semester (Time 3). Observer-rated classroom management and emotional and instructional support mid-semester (Time 3) did not predict student teachers' self-efficacy for student engagement at the end of the semester (Time 4), when controlling for self-efficacy for student engagement at the beginning of the semester (Time 1). Only student teachers' educational knowledge was associated with an increase in teacher self-efficacy for student engagement, when controlling

self-efficacy for student engagement at the beginning of the semester (Time 1).

**Table 7**
*Teacher Self-Efficacy for Student Engagement Relating to Teaching Behaviour*

| Variables | $CES_{T3}$ | | | $CCM_{T3}$ | | | $CIS_{T3}$ | | | $TSESE_{T4}*$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | SE | p | β | SE | p | β | SE | p | β | SE | p |
| $Sex_{T1}$ | .10 | .18 | .554 | .04 | .18 | .840 | .27 | .16 | .094 | .07 | .16 | .680 |
| $EK_{T1}$ | -.22 | .20 | .264 | -.07 | .19 | .712 | -.06 | .19 | .734 | **-.40** | **.20** | **.043** |
| $PE_{T1}$ | .09 | .19 | .630 | .13 | .19 | .501 | .21 | .17 | .220 | .21 | .20 | .308 |
| $TSESE_{T1}$ | .28 | .16 | .082 | .07 | .17 | .683 | .19 | .16 | .236 | **.51** | **.15** | **.001** |
| $QPF_{T2}$ | .05 | .24 | .842 | .11 | .22 | .624 | .19 | .19 | .310 | .20 | .17 | .250 |
| $CES_{T3}$ | | | | | | | | | | .01 | .20 | .951 |
| $CCM_{T3}$ | | | | | | | | | | .06 | .14 | .671 |
| $CIS_{T3}$ | | | | | | | | | | .20 | .17 | .887 |

*Note.* *for all models of teacher self-efficacy subscales and dimensions of teaching behaviour, the values of the covariates are represented for the teaching behaviour dimension emotional support cause the values are similar. Sex = student teachers' gender; EK = educational knowledge; PE = previous pedagogical experiences; QPF = quality of peer feedback; TSEES = teacher self-efficacy for student engagement; CES = CLASS emotional support; CCM = CLASS classroom management; CIS = CLASS instructional support; T1 = at the beginning of the semester; T2 = after presenting the lesson plan in the course; T3 = after teaching; T4 = at the end of the semester.

## 5. Discussion

This study aimed to identify longitudinal relations between different dimensions of self-efficacy of student teachers and their teaching behaviours in the classroom, assessed by external observers using the CLASS-S scoring system. Key findings were that observer-rated teaching behaviours predicted student teachers' self-efficacy beliefs – more specifically, observer-rated effective classroom management mid-semester predicted an increase in student teachers' self-

efficacy for classroom management and for instructional strategies across the semester. Observer-rated instructional support positively predicted an increase in student teachers' self-efficacy for classroom management. We did not find, however, that student teacher self-efficacy at the beginning of the semester predicted effective teaching behaviours mid-semester. We discuss our findings and their implications for research on student teachers and for teacher education in the next sections.

## 5.1 Student Teachers' Self-Efficacy: Changes and Sources

Our findings confirmed our expectations (Hypothesis 1) about the increase of student teacher self-efficacy during practical periods of teacher education across the semester only partially. We found the expected significant increase in teacher self-efficacy for classroom management and for student engagement, but not in self-efficacy for instructional strategies. One possible explanation for this finding might be that the consequences of effective classroom management or effective motivational enhancement in class can be directly perceived by student teachers, whereas the consequences for effective instruction in terms of adequate explanations are more difficult to capture. For example, student teachers might be able to directly perceive the consequences of effective versus ineffective classroom management during their practical experiences by being confronted with the reactions of students to their handling of classroom disturbances. The consequences of effectively providing adequate examples (as an indicator of effective instruction), however, might not be as easy to perceive because such effective instruction might be established over the long-term, rather than during short practical experiences in class. Another explanation for the different changes in student teachers' self-efficacy facets might be that student teachers were more focused on classroom management and the motivation of their students during their practical experiences because the enhancement of teaching quality and students' motivation was one central topic of the seminar in which student teachers participated.

The specific contribution of this study is that we extend knowledge on the development of different student teacher self-efficacy facets in one semester of teacher education that includes systematic practical experiences. In the context of teacher education, little is known about changes in student teacher self-efficacy beliefs (Seethaler, 2012). Our findings support the theoretical assumption that mastery experiences in terms of practical experiences play an important role as a source of changes in student teachers' self-efficacy (Bandura, 1997), and beyond that show that different facets of student teachers' self-efficacy develop differently across time.

## 5.2 (Student) Teachers' Self-Efficacy, Teaching Behaviours and Feedback

Contrary to our expectations (Hypothesis 2), we did not find that student teachers' self-efficacy predicted observer-rated teaching behaviour. Contrasting findings for in-service teachers (Burić & Kim, 2020; Hettinger et al., 2021; Oppermann & Lazarides, 2021), the self-efficacy of student teachers does not seem to be a central predictor of effective teaching behaviours for student teachers. However, some, previous studies have also shown that for in-service teachers, teacher self-efficacy does not predict teaching behaviours (Holzberger et al., 2013). Our findings for student teachers point in this direction. A possible explanation for our finding that the competence beliefs of student teachers are not yet valid predictors of their behaviours, is that they do not result from prior experience or from their own actions in the classroom, and thus might reflect unproven assumptions about their own skills rather than accurate competence validations (Römer et al., 2018).

The results of our study mostly confirmed our expectations (Hypothesis 3) about the effects of observer-rated teaching behaviour at the middle of the semester on changes in self-efficacy of student teachers across the semester. We showed that observer-rated classroom management predicted increases in student teacher self-efficacy for instructional strategies and that effective observer-rated classroom management and instructional support predicted increases in student teacher self-efficacy for classroom management. These findings indicate that student teachers who were able to manage classrooms effectively and who thus maximized time on tasks and students' on-task attention (classroom management) felt competent in providing effective instruction (self-efficacy for instructional strategies), managing students' behaviours (classroom management) and engaging students in higher-order thinking (instructional support). These results confirm the findings of previous studies that focused on in-service teachers (Holzberger et al., 2013; Jang et al., 2019) and that also showed that teacher self-efficacy is significantly predicted by mastery experiences in terms of successful teaching behaviours. However, we did not find any effects of observer-rated emotional support on student teachers' self-efficacy beliefs which might be due to the different capture by the measurement of self-efficacy and emotional support. Our results thus suggest that student teachers' successful supportive behaviours in class did not influence their competence perception in this field – maybe because the student teachers were not able to realize the consequences of their positive social interactions in the short time of their teaching experience. Another reason for the non-significant effect of emotional support on student teachers' self-efficacy might be a different understanding of emotional support between external observers and student

teachers (Lazarides & Schiefele, 2021) – well-trained external observers might have concluded that student teachers successfully supported their students in terms of academic and emotional needs, whereas student teachers might not have shared this impression. One reason for why we did not find effects from teacher self-efficacy in instructional strategies and the observer-rated teaching behaviour might be a non-correspondence of measures because teacher self-efficacy for instruction refers to teachers' beliefs about their ability to enhance knowledge transfer by using different strategies in class (Tschannen-Moran & Woolfolk Hoy, 2001) whereas instructional support as defined in CLASS refers to engaging students in higher-order thinking (Pianta et al., 2012). However, to test this assumption, it would also be needed to assess the ratings of student teachers regarding their own teaching behaviours in future studies.

Regarding the expected positive effect of peer feedback on the self-efficacy of student teachers and on effective teaching (Hypothesis 4), our findings showed that perceived quality of peer feedback had a positive effect on the increase in student teachers' self-efficacy for classroom management, but not on the increase on the other subscales of teacher self-efficacy nor on observer-rated teaching quality of the student teachers. Our results are consistent with the findings of previous studies, namely that peer feedback is associated with an increase in self-efficacy of student teachers during practical phases (Pfitzner-Eden, 2016b). It is interesting that peer feedback had an effect particularly on classroom management self-efficacy – although we do not have qualitative data on the content of the peer feedback, it might be assumed that much of the feedback from their peers was about the student teachers' effective use of time in class, which is a component of classroom management (Pianta et al., 2012). The correlations between peer feedback and self-efficacy are positive but not significant, indicating that the negative correlation is a method artifact because peer feedback is highly correlated with another construct in the model.

## 5.3 Limitations

Our study has several strengths, which are the longitudinal nature of the data assessment, allowing us to test which factors are related to changes in self-efficacy, and the assessment of teaching behaviours through observer ratings. However, there are also several limitations. First, our sample size is small and future studies need to test the generalizability of the findings using larger and more representative samples. Second, we did not assess the content of the peer feedback and thus we do not know whether the peer feedback was focused on specific topics which then impacted specific sub-facets of student teacher self-efficacy. Third, we do not know whether

observer-rated teaching quality aligns with student teachers' perceptions of their teaching behaviours because we do not have reports from them on their own perceived teaching quality, and future studies might consider assessing teaching behaviours using multiple methods (Tillema, 2009). Furthermore, it is possible that the period of intervention over one semester is not sufficient for higher self-efficacy beliefs of student teachers, which at the same time goes hand in hand with higher teaching quality (Holzberger et al., 2013).

## 5.4 Implications and Conclusions

Our findings emphasize that mastery experiences in terms of practical experiences in authentic classroom situations are important sources of self-efficacy in student teaching programs, but that self-efficacy might, at least in our study which focused on student teachers in their bachelor study program, not be a valid source of effective teaching behaviours. An important question for future research might be how different types of feedback such as, for example, video-based feedback and video-based and observer-rated teaching quality, relate to student teachers' self-efficacy and teaching behaviours (Gröschner et al., 2018). Practical implications of our study are that rather than fostering self-efficacy beliefs only through interventions that aim to reflect on one's own strengths and weaknesses, student teachers should be provided with opportunities to teach in authentic classroom situations – which in turn positively influence their self-efficacy beliefs. Future studies should focus on the question of how the quality, duration and type of such teaching experiences relate to changes in self-efficacy of preservice teachers (Cantrell et al., 2003; Clark & Newberry, 2019).

# Appendix

**Table A**

*Measurement Invariance Test for Teacher Self-Efficacy for Instructional Strategies*

| Step | $\chi^2$ | df | CFI | $\Delta$CFI | RMSEA | $\Delta$RMSEA | SRMR | $\Delta$SRMR |
|------|------|----|-------|-------|-------|-------|-------|-------|
| 1 | 11,37 | 10 | 0,978 | | 0,062 | | 0,159 | |
| 2 | 11,37 | 10 | 0,978 | 0,000 | 0,062 | 0,000 | 0,159 | 0,000 |
| 3 | 12,69 | 12 | 0,989 | 0,000 | 0,040 | 0,022 | 0,178 | 0,019 |

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual, 1 = item3 excluded; 2 = loadings invariant across levels and for enjoyment across time; 3 = intercepts invariant across levels and self-efficacy for instructional strategies across time.

**Table B**

*Measurement Invariance Test for Teacher Self-Efficacy for Classroom Management*

| Step | $\chi^2$ | df | CFI | $\Delta$CFI | RMSEA | $\Delta$RMSEA | SRMR | $\Delta$SRMR |
|------|------|----|-------|-------|-------|-------|-------|-------|
| 1 | 2,21 | 1 | 0,989 | | 0,183 | | 0,015 | |
| 2 | 2,72 | 2 | 0,993 | 0,004 | 0,100 | 0,083 | 0,069 | 0,054 |
| 3 | 2,72 | 3 | 1,000 | 0,007 | 0,000 | 0,100 | 0,068 | 0,001 |

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual, 1 = parceled T1/5: item 1 with item 4, item 2 with item 3; 2 = loadings invariant across levels and for self-efficacy for classroom management across time; 3 = intercepts invariant across levels and self-efficacy for classroom management across time.

**Table C**

*Measurement Invariance Test for Teacher Self-Efficacy for Student Engagement*

| Step | $\chi^2$ | df | CFI | $\Delta$CFI | RMSEA | $\Delta$RMSEA | SRMR | $\Delta$SRMR |
|------|------|----|-------|-------|-------|-------|-------|-------|
| 1 | 0,00 | 1 | 1,000 | | 0,000 | | 0,000 | |
| 2 | 0,39 | 2 | 1,000 | 0,000 | 0,000 | 0,000 | 0,062 | 0,062 |
| 3 | | | | | | | | |

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual, 1 = parceled T1: item 1 with item 4, item 2 with item 3, T5: item1 with item 2, item 3 with item 4; 2 = loadings invariant across levels and for self-efficacy for student engagement across time; 3 = intercepts invariant across levels and self-efficacy for student engagement across time.

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# *Study 3*

## Video-based reflection in teacher education: comparing virtual reality and real classroom videos

# Video-based reflection in teacher education: comparing virtual reality and real classroom videos

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## Highlights

- We designed video-based reflection activities for student teachers

- We compared reflections using VR versus reflections using real classroom videos

- Reflection-related self-efficacy beliefs increased in the VR group only

- VR recordings stimulate the reflection process

**Abstract**

 While previous studies have examined the use of real-world classroom videos to support the development of student teachers' reflective skills, there has been little research to date on the use of virtual reality (VR) videos in teacher education to provide opportunities for authentic reflection. This mixed-methods study investigated changes in reflection-related self-efficacy and differences in written reflection processes using a quasi-experimental design with two types of reflection stimuli. One group of 46 student teachers used a VR-based video to reflect on instruction while another group of 23 student teachers used a real classroom video. We found an increase in reflection-related self-efficacy over time among participants in the VR group only. We also found that VR videos triggered similar reflection processes to real classroom videos. This study shows, for the first time, that video-based reflection on VR classroom videos produced comparable results to reflection on real classroom videos. This indicates that VR can be used successfully in teacher education and that it offers a useful learning tool for teacher education programs.

## 1. Introduction

Teachers' ability to reflect on their teaching is an important prerequisite for their individual professional development (Schön, 1983; Vermunt & Endedijk, 2011). Teacher education programs therefore seek to provide student teachers with the skills to reflect effectively on their teaching experiences. Literature reviews have shown that videos are helpful in developing teachers' abilities to reflect on their teaching skills (e.g., Gaudin & Chaliès, 2015; Hamel & Viau-Guay, 2019). In particular, videos of student teachers teaching have been found to be beneficial for teacher reflection (Kleinknecht & Gröschner, 2016; Tripp & Rich, 2012). However, recording real classroom videos can be challenging due to concerns about data privacy and the condition of voluntary participation by the individual teacher (Derry et al., 2010). This challenge became more pronounced during the COVID-19 pandemic, when schools were closed or not accessible to student teachers (La Velle et al., 2020).

Virtual reality (VR) offers a way around the difficulties of capturing video in real classrooms by providing student teachers with opportunities to practice and observe themselves teaching in a school-like environment with virtual student avatars. Moreover, fully immersive VR classrooms allow student teachers to have authentic classroom experiences independent of school closures and logistical difficulties such as privacy protection and classroom access

(Wiepke, Richter, Zender, & Richter, 2019; Wiepke et al., 2021). VR also makes it easy to record student teachers' classroom experiences directly from their own perspectives. The unique capacity to produce *first-person-perspective* videos, in which a scene is viewed from the individual's own perspective as opposed to a *third-person perspective* (Fiorella et al., 2017; Vogeley et al., 2004), is a crucial justification for using VR technology to facilitate teacher reflection. However, because the use of VR technology in teacher education is still incipient, there is a lack of research on the effectiveness of first-person-perspective VR videos in learning and practicing video-based reflection during the initial phase of teacher education (Huang et al., in press).

This study aimed to fill this gap and to contribute to the existing literature on student teachers' reflective skills and the use of videos in teacher education. First, we investigated the influence of reflective activities using either VR or real classroom videos on changes in student teachers' reflection-related self-efficacy beliefs. Second, we compared characteristics of the written reflections by student teachers in the VR and real classroom video groups. Our results extend prior knowledge on the use of VR classroom videos to provide opportunities for video-based reflection in the context of teacher education by illuminating the effects of VR videos on student teachers' reflection-related self-efficacy beliefs.

## 1.1 Reflecting as a core practice of teachers

Dewey (1933) described reflection as a form of systematic problem solving that takes into account underlying beliefs about the problem and possible solutions. Building on this idea, Tripp and Rich (2012) defined reflection in the context of teacher education as "a self-critical, investigative process wherein teachers consider the effect of their pedagogical decisions on their situated practice with the aim of improving those practices" (p. 678). In this context, teacher reflection generally refers to the degree to which teachers systematically, consciously, and critically examine their own teaching practices (Korthagen, 2010; Lohse-Bossenz et al., 2019).

Reflection has been established as a crucial component of teachers' professional development (Cowan, 2014; Korthagen, 2014) as it enables student teachers and in-service teachers to transform their classroom experiences into insightful and valuable learning experiences (Svojanovsky, 2017). Through reflection, teachers observe, evaluate, and conceptualize their experiences. This process can lead to a greater awareness of their feelings, beliefs, and assumptions and thus enhance the development of an analytical perspective on their (teaching) experiences (Kolb, 1984). Against this backdrop, Berliner (2004) argued that reflection is an important source of what he described as the "wisdom of practice" (p. 206).

Different theoretical frameworks define the process of reflection in various ways, some based on teachers' description of their teaching and others based on an in-depth analysis of classroom situations. Some of these focus on critical events, while others focus on a series of questions or prompts (e.g., Hsu et al., 2022; Korthagen & Kessels, 1999). However, most theories of reflection concur with the idea that reflective practice is a process that involves different steps (*reflection activities*) and relates to different objects (*reflection content*) (Wyss, 2018). Regarding reflection activities, Kleinknecht and Gröschner (2016) differentiated three steps: 1) student teachers describe a situation (*description*), 2) they justify and evaluate their own actions (*interpretation*), and 3) they formulate alternative strategies for action *(alternatives)*. Regarding reflection content, Lohse-Bossenz et al. (2019) postulated that reflections might refer to the teacher's actions, the students' actions, or the learning environment. These processes have been investigated empirically through content analysis of student or in-service teachers' written reflections on a specific teaching experience (e.g., Santagata & Guarino, 2011; Sherin & van Es, 2009).

Studies investigating the consequences of teachers' reflections have identified positive effects at the teacher and the student level. Gold et al. (2017) demonstrated that when teachers analyzed and reflected on videos of themselves as well as other teachers in the classroom, this resulted in an increase in their self-efficacy for classroom management. Kersting et al. (2012) also discovered a positive relationship between student achievement in mathematics and the student teachers' capacity to consider alternate instructional strategies when analyzing classroom videos. They also found that both the depth of reflection and the exploration of alternative teaching strategies were related to student teachers' teaching quality (see also Roth et al., 2011). In sum, this strand of research has shown that reflective practices can improve student teachers' instructional quality and even impact their students' learning outcomes.

Another strand of research has focused on the characteristics of teachers who engage more frequently in reflective practices. According to Lohse-Bossenz et al. (2019), teachers' engagement in reflective practices is influenced by motivational factors such as reflection-related self-efficacy. According to social cognitive theory (Bandura, 1978), self-efficacy describes teachers' beliefs in their ability to successfully accomplish a particular task. Applied to the practice of reflection, Lohse-Bossenz et al. (2019) showed that reflection-related self-efficacy can be distinguished from general teacher self-efficacy. They also showed that reflection-related self-efficacy was negatively related to teachers' emotional exhaustion. Given its important role in teachers' instructional practice, we focused on reflection-related self-efficacy to determine whether it can be fostered through different learning opportunities.

*1.2 Does video-based reflection increase student teachers' ability to reflect?*

Many authors have argued that video-based reflection may be a beneficial strategy to help student teachers learn to reflect (Fuller & Manning, 1973; Sun & van Es, 2015; Tripp & Rich, 2012). For student and in-service teachers, videos can serve as "springboards for analysis and discussions about teaching and learning" (Borko et al., 2011, p. 184). There is a large body of research demonstrating the benefits of using video in teacher education to promote reflective skills (e.g., Hamel & Viau-Guay, 2019; Tripp & Rich, 2012). Stockero (2008) found that student teachers who participated in a video-case-based university course engaged in deeper reflection when analyzing, for instance, how instruction influenced student thinking. The potential of video-based reflection is also evident in studies comparing reflection on videos with reflection on other media. Rosaen et al. (2008) showed that video-based reflection, as compared to recall-based reflection, facilitated a shift in the focus of reflection in pre-service teachers from superficial features of the classroom to pedagogical issues.

While video usage appears to enhance student teachers' reflective skills, we know very little about what makes student teachers reflect. In this context, Seidel et al. (2011) demonstrated that teachers' video-based reflection on their own teaching enhances motivation. In addition, Kleinknecht and Schneider (2013) showed that video-based reflection of classes of unknown teachers was associated with higher emotional-motivational involvement. While these results are more general in nature, it is still unclear whether the use of video-based reflection can foster reflection-related self-efficacy beliefs. This question is important, however, because self-efficacy beliefs are related to effective teaching (Klassen & Tze, 2014). The present study therefore aimed to investigate whether the use of classroom videos or VR videos may increase individuals' reflection-related self-efficacy beliefs.

*1.3 Which reflection processes does video-based reflection trigger?*

Studies comparing teachers' processes of reflection on their own classroom to processes of reflection on other teachers' classrooms show inconsistent findings overall. Kücholl & Lazarides (2021), for example, found no differences across the three different reflection activities of describing, interpreting, and formulating alternative strategies when comparing student teachers' written reflections on their own videos with their written reflections on other teachers' videos. In contrast, Seidel et al. found that teachers who analyzed their own teaching were less likely to comment critically and offered fewer alternatives than teachers who analyzed another teacher's teaching (Seidel et al., 2011). Kleinknecht and Schneider (2013) found that teachers who focused their written reflections on another teacher's classroom video more often included thoughts about alternative strategies for dealing with negative events and

also reported on the activities of the filmed teacher in more detail than teachers who focused on their own teaching. In sum, the findings from the aforementioned studies do not provide a clear picture about the differences between reflections on a teacher's own classroom and reflections on other teachers' classrooms.

While both a teacher's own and other teachers' videos are frequently used for reflection purposes in teacher training, obtaining real classroom videos can be challenging. This is due, first, to ethical considerations and the condition of voluntary participation by the student teachers (Derry et al., 2010). Furthermore, when filming students in the classroom, parental consent is also required. Second, rigorous plans are needed to ensure privacy and data security, as the non-anonymous nature of video poses a potential risk when students are videotaped (Derry et al., 2010). Recordings of virtual classrooms could circumvent these problems while still capturing authentic teacher behaviors for reflection purposes.

*1.4 Using virtual reality for reflection purposes*

VR technology creates "synthetic, highly interactive three-dimensional (3D) spatial environments" (Mikropoulos & Natsis, 2011, p. 769) that can simulate real or non-real classroom situations. It is used in many professional fields for training procedural and situational knowledge as it provides two major advantages for learning (Jensen & Konradsen, 2018): presence and agency (Makransky & Petersen, 2021). Presence can be considered an experience of "being there" (IJsselsteijn & Riva, 2003), while agency can be described as the feeling of initiating and commanding actions at one's own will (Moore & Fletcher, 2012). Both presence and agency have been found to be positively related to factors that contribute to learning (Merchant et al., 2014; Parong & Mayer, 2018), such as motivation and enjoyment in learning (Makransky & Lilleholt, 2018) or self-efficacy (Huang et al., in press; Gegenfurtner et al., 2014). Moreover, VR is not only an environment that provides numerous authentic learning opportunities, but also a means of avoiding real-world issues such as field access and data security.

Professional trainings in various occupations employed VR environments (for a review, see Jensen & Konradsen, 2018). However, the use of VR classrooms in teacher education is still fairly new, and only began in the last decade (Huang, Richter, Kleickmann, & Richter, 2021; McGarr, 2020). VR classrooms have been developed by different companies and research groups including simSchool (Deale & Pastore, 2014), TLE TeachLivE™ (Dieker et al., 2015), Mursion (Kaufman & Ireland, 2016), Breaking Bad Behaviors (Lugrin et al., 2016; Seufert et al., 2022) and VR Klassenzimmer (translation: "VR classroom", Wiepke et al., 2019; Wiepke et al., 2021). Such VR classrooms allow student teachers and in-service teachers to a)

carry out authentic teaching practices in a simulated and safe setting; and b) develop skills with configurable training programs that could be standardized or individualized (Huang et al., in press). Unlike teaching sessions in real classrooms, instruction in the VR classroom can be easily recorded and used for further training purposes such as reflection.

Although the characteristics of VR videos suggest that they may be useful for reflection purposes in teacher education, there is little evidence to date to support this. Two recent review articles examining the use of VR systems in teacher education reported a very limited number of studies that addressed reflection, with a complete lack of studies comparing VR videos to real classroom videos (Huang et al., in press; Snelson & Hsu, 2020). Recent research on 360-degree video in teacher education showed that the use of VR headsets allowed student teachers to engage in nuanced reflection on microteaching (Walshe & Driver, 2019) and was positively received for reflective purposes (Feuerstein, 2019). This in line with Seufert et al. (2022), who found that student teachers rated VR as useful for reflecting on their teaching and assessing their personal strengths and weaknesses. In addition, Stavroulia and Lanitis (2019) compared self-reported attitudes toward reflection by student teachers with at least one year of teaching experience who were trained either in a real classroom or in a VR classroom. They found that the student teachers in the VR environment showed a higher rate of willingness to reflect. Aside from these studies, however, there is a paucity of research on the effects of video-based reflection with VR videos and on how well VR videos trigger reflective processes when compared with real classroom videos. It is also unclear whether video-based reflection with VR videos is related to emotional-motivational processes such as increasing reflection-related self-efficacy.

## 2. Present study

The present study aimed to close this gap in the research by comparing the effects of reflection on videos recorded in a VR classroom to the effects of reflection on videos recorded in a real classroom. To this end, we used a pretest-posttest quasi-experimental design before and after a reflection task. During the reflection task, student teachers either watched their own teaching in a virtual classroom (intervention group, IG; see 3.1 Study context and design for details) or watched an unknown teacher teaching in a real classroom (control group, CG). Our study is a first step toward generally comparing VR and video-based reflections in teacher education without analyzing the related psychological processes in detail. We sought to answer the following two research questions:

**RQ 1.** How does student teachers' reflection-related self-efficacy change in the IG compared to the CG from the beginning of the reflection task ($t_1$, week 10) to the end of the reflection task ($t_2$, week 14)?

Regarding the first research question, we hypothesized that student teachers' reflection-related self-efficacy would increase in both groups, as previous research has shown that video-based reflection is related to the development of reflective skills (e.g., Rosaen et al., 2008). Due to the lack of prior research, we could not make a prediction on whether the change in the IG would differ from the change in the CG. We assumed similar increases in self-efficacy, as the student teachers used videos in both conditions.

**RQ 2.** Are there differences in the quality of the written reflections in the IG compared to the CG in terms of reflection activities (description, interpretation, and alternatives), and reflection content (whether student teachers refer to the learning environment, the teacher, or the student in their reflections)?

We did not formulate a clear assumption about differences between the IG and the CG in the reflection activities and reflection content because this was the first study to compare the two types of reflection settings. Thus, we only explored potential differences.

**Table 1**

Coding scheme adapted from the German version by Kücholl & Lazarides (2021).

| Reflection activities | Definition | Examples |
|---|---|---|
| **Content of reflection: Learning environment** | | |
| **Description** | Name and describe the **organizational structure / teaching methods / social design of the learning environment** that are designed to foster engagement with learning content and interaction processes | Aside from being in the position of spectators, the students are playing a relatively passive role. |
| **Interpretation** | Justify and evaluate the instruction(s) in terms of **organizational structures / teaching methods / social design of the learning environment** that are designed to foster engagement with learning content and interaction processes | I also think it is intended to create a somewhat relaxed atmosphere since learners can get up out of their seats. |
| **Alternatives** | Formulate alternative **organizational structures / methods / social design of the learning environment** that are designed to foster engagement with learning content and interaction processes | In the case of the two students chatting, it would have worked to have a brief talk with them like the teacher did with the two female students. |
| **Content of reflection: Teacher** | | |
| **Description** | Name and describe the **teacher's actions** and states of mind regarding organizational structures / teaching methods / social design of the learning environment and engagement with learning content and interaction processes | While the teacher was speaking, S. and T. started hitting each other right in front of the teacher. The teacher reacted by coming over and standing next to the two students. |
| **Interpretation** | Justify and evaluate the **teacher's actions** and states of mind regarding organizational structures / teaching methods / social design of the learning environment and engagement with learning content and interaction processes | My focus on the disruption negatively affected my teaching. My intention was to get the attention of the two students and make sure they listened to me actively. |
| **Alternatives** | Formulate alternative **teacher actions** regarding forms of organizational structures / teaching methods / social design of the learning environment and engagement with learning content and interaction processes | Rather than moving, the teacher could have spoken a little more loudly and made eye contact with the girls in a more direct way. |
| **Content of reflection: Students** | | |
| **Description** | Name and describe **students' actions** and states of mind regarding organizational structures / teaching methods / social design of the learning environment and engagement with learning content and interaction processes | The students' answers are often short and concise. |
| **Interpretation** | Justify and evaluate **students' actions** and states of mind regarding organizational structures / teaching methods / social design of the learning environment and engagement with learning content and interaction processes | The assignment is not challenging enough for some students. Some finished and had nothing else to do. |
| **Alternatives** | Formulate alternative **teacher actions** regarding organizational structures / teaching methods / social design of the learning environment and engagement with learning content and interaction processes | I would probably react similarly to the teacher and ask specific questions, since having students return to their seats and then introducing the evaluation criteria would waste too much time. |

**3. Methods**

*3.1 Study context and design*

We used a mixed-method pretest-posttest quasi-experimental design with two groups to investigate the change in reflection-related self-efficacy and the quality of student teachers' _written reflections. Participants in this study were enrolled in the teacher education program at a large public university in Germany. All participants were bachelor students and had attended one of two classes in a module on school-based educational research, each of which focused on aspects of instructional quality. During the class, the IG used VR for practicing teaching in a virtual classroom (Wiepke et al., 2019). The teaching exercise included a presentation on a topic (COVID-19 vaccines) in a virtual classroom and was completed by student teachers individually. During this exercise, student teachers observed the student avatars in the classroom and intervened when misbehaviors occurred. The teaching exercise was recorded for about 15 min and used for the reflection task afterwards. The design of the virtual classroom, which included 30 student avatars arranged in five rows and three columns, was modeled after typical upper secondary German classrooms (Wiepke et al., 2021). The physical attributes of the student avatars varied, and they performed scripted actions such as writing on the notebook, asking questions, and chatting with neighbors (see Huang, Richter, Kleickmann, Wiepke, & Richter, 2021 for more details). The duration and the avatar behaviors were pre-programmed in order to standardize the VR exercise (see Table A1 in Supplementary Material for the script). However, student teachers were able to stop misbehaving student avatars by, for example, moving to the student avatar that was misbehaving. Participants were immersed in the VR classroom through the HTC VIVE Pro Eye system which enables sensory immersion and free movement. Participants in previous studies with this VR classroom reported it to be realistic and authentic (Wiepke et al., 2019; Huang et al., 2021). On the other hand, the CG did not use VR at all during the semester. However, student teachers in CG had prepared a lesson plan with the goal of motivating their future students. Both groups received an introduction to the topic of video-based reflection. The study design included three steps in both groups (see Fig. 1). *1)* Following the VR teaching exercise in the IG in week 5 of the semester, at week 10 (*t*1; pre-test), all participants in both the IG and the CG completed an online questionnaire about their reflection-related self-efficacy beliefs. *2)* At week 13 of the semester, all participants completed a video-based reflection task. The videos for the reflection task were made available via the online learning platform Moodle and viewed individually. Those in the IG watched the videos recorded in week 5 of themselves teaching in a virtual classroom from a first-person perspective (Fig. 2). Those in the CG used a real classroom video of an unknown teacher recorded from a third-person perspective (see Fig. 3). Participants in

both groups selected one positive and one challenging situation in the video-based classroom. For both of the selected situations, students were asked to use the three-step reflection procedure (Kleinknecht & Gröschner, 2016). To ensure a high level of standardization, both groups received an identical input on the three-step reflection prior to the reflection task. The instructions for the written reflection task included the following: "1) Describe the teaching situation, the behaviors, and the interactions of the teacher or individual objectively, without evaluating or explaining them.", "2) Explain the causes and possible intentions that may have contributed to the classroom situation or the behaviors and interactions of the teacher or individual in the classroom. Evaluate the teacher's behavior with regard to his or her handling of the situation and with regard to the characteristics of effective teaching.", and "3) Please identify alternative ways the teacher could have handled this situation". *3)* After the reflection task, all participants completed a second online questionnaire about their reflection-related self-efficacy at week 14 (t2; post-test).
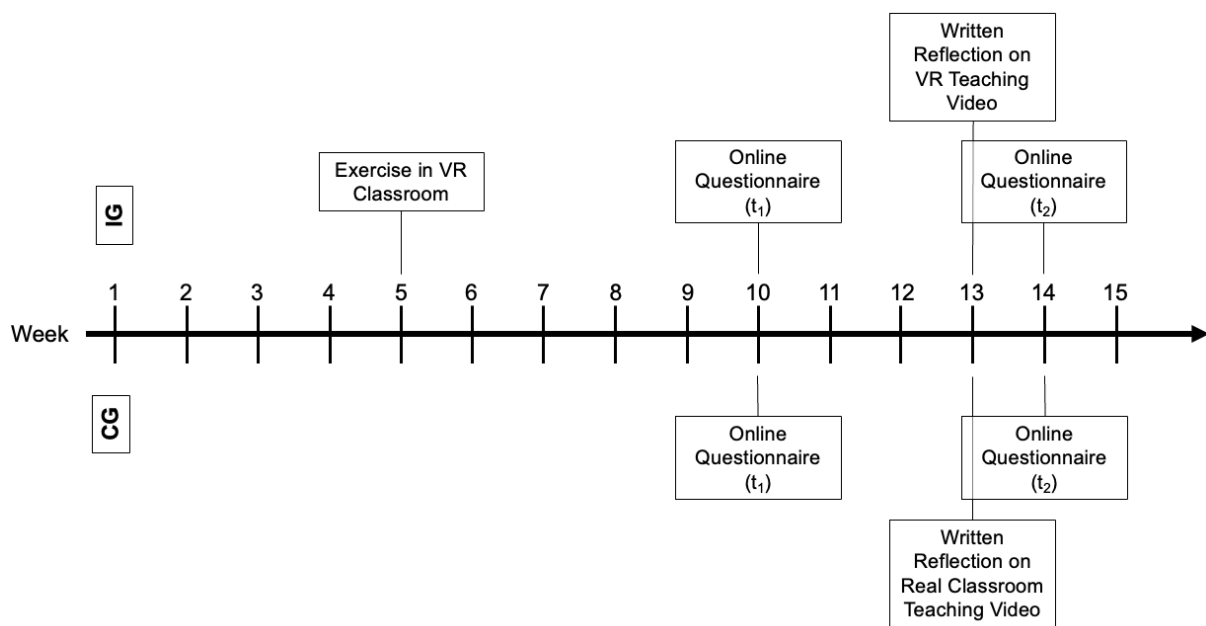


**Fig. 1** Study design for data collection in the intervention group and the control group
*Notes.* IG = intervention group. CG = control group. The upper part of the figure displays the activities in the IG and the lower part displays the activities in the CG.

**Fig. 2.** Screenshot of the first-person perspective in the virtual classroom videos used in the IG for video-based reflection



**Fig. 3.** Screenshot of the third-person perspective in the classroom video of an unknown teacher used in the CG for video-based reflection

*3.2 Participants*

The present study used data of $N = 69$ student teachers at a large public university in Germany (42.0% female). Participants in the IG ($N = 46$ student teachers, 45.7% female, $M_{age}$ = 24.44, $SD = 4.31$) and members of the CG ($N = 23$, 34.8% female, $M_{age}$ = 25.13; $SD = 5.71$) were, on average, enrolled in their fifth semester of the bachelor program (IG: $M = 4.87$; $SD = $ 1.56; CG: $M = 5.30$; $SD = 3.51$). The student teachers in the IG were mainly studying to teach

German (17.4%), math (17.4%), and biology (13.0%), and the student teachers in the CG studied were mainly studying to teach German (17.4%), math (17.4%), and Spanish (13.0%).

## 3.3 Measures

To address our research questions, we used two different sources of data: online questionnaires and written reflections. The online questionnaire included questions about student teachers' demographic characteristics (gender, age), and student teachers' reflection-related self-efficacy beliefs.

### 3.3.1 Quantitative study (RQ1)

Reflection-related self-efficacy was measured using a well-established and valid instrument by Lohse-Bossenz et al. (2019). The original German scale was measured with a total of 13 items. An example item is: "I am good at assessing how my actions positively influence a classroom situation." Respondents were asked to rate all items on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Reliability, as measured by internal consistency, was found to be satisfactory ($t_1 \alpha = .85$; $t_2$: $\alpha = .82$). The full instrument is provided in the Supplementary Material (Table A.2).

### 3.3.2 Qualitative study (RQ2)

We additionally collected participants' written reflections after watching either first-person-perspective videos of themselves teaching in the virtual classroom (IG), or a third-person-perspective video of an unknown teacher in a real classroom situation (CG). The instructions for the written reflections are described in chapter 3.1. We collected a total of $n = 68$ written reflections, 45 reflections from the IG and 23 reflections from the CG. One IG member did not submit written reflections. All written reflections on a positive and a challenging situation in the video consist of $n = 481.4$ ($SD = 187.4$) words on average.

## 3.4 Data analysis

To answer the two research questions, we used quantitative and qualitative research methods.

### 3.4.1 Quantitative study (RQ1)

We conducted a two-way repeated measures ANOVA to assess differences in the change of reflection-related self-efficacy between the IG and the CG. The partial eta squared was used to determine the effect size for the change over time.

*3.4.2 Qualitative study (RQ2)*

We adopted a multistage procedure to analyze the written reflections by the student teachers. In a first step, we developed a coding ystem, which was partly based on studies by Kleinknecht and Grːöschner (2016), and Kücholl & Lazarides (2021) (Table 1). Our coding system distinguished between the two dimensions of reflection introduced in the literature review: reflection activities and reflection content. Both reflection dimensions included three subcategories that were coded for each student. For the reflection activities, we differentiated between description, interpretation, and alternatives. For the reflection content, we coded whether each participant referred to the learning environment, the teacher, or the student.

In a second step, we applied the coding scheme to analyze the written reflections of the student teachers. We conducted a content analysis (Mayring, 2015) using the software MAXQDA (Kuckartz & Rädiker, 2014). Sentences were chosen as the coding unit, determining the smallest part of the text to be analyzed. Coding for the data in our study was carried out by two independent raters. To measure inter-coder reliability, we used a subsample of 50 percent of the written reflections that were double-coded by both raters. Differences in the coding were solved through discussion between the two coders. The remaining 50 percent of the written reflections were evaluated by only one of the two coders. The overall inter-coder reliability, as measured by Cohen's kappa, showed satisfactory agreement between the two coders ($\kappa$= 0.93). A total of 1.366 codes were assigned.

In a third step, we used the 1.366 codes for additional data analysis. We performed nonparametric tests based on chi-square statistics to compare the differences in the frequencies of reflection activities and reflection content in the IG and the CG. A separate test of independence was conducted as an equivalent to post-hoc tests in which the adjusted standardized residual (z-score) for each case was calculated and compared with the critical value (±1.96) to assess the difference between the expected and the actual frequency in each case. In general, a negative z-score value indicates fewer observed cases than expected and a positive value more cases than expected. Finally, Cramer's V was reported and interpreted as the effect size measure, and the range is from 0 to 1 (Gravetter & Wallnau, 2007; Kline, 2004). As Cohen (2013) suggested, for chi-square tests with two degrees of freedom, a value of Cramer's V within the range of .07–.21 indicates a small effect, a value within the range of .21–.35 indicates a medium effect, and a value larger than .35 indicates a large effect.

**4. Results**

*4.1 Preliminary analysis*

We first examined differences in the pretest scores of reflection-related self-efficacy, gender, and age between IG and CG. No statistical differences were found in the multivariate analysis of variance (MANOVA) between IG and CG participants in terms of gender and age at $t_1$. However, we found statistically significant differences in student teachers' self-efficacy in favor of the CG. Data were checked for outliers using the mean absolute deviation (MAD) method. One participant was excluded from further analysis due to extreme outliers, following Leys et al. (2013) who "strongly recommend the median plus or minus 2.5 times the MAD method for outlier detection."

*4.2 Quantitative study (RQ1)*

To assess how reflection on classroom videos (CG, IG) differed in terms of student teachers' reflection-related self-efficacy, differences between the groups were examined using a two-way analysis of variance (ANOVA) with repeated measures (Table 2). We used IG and CG as a between-subject factor and time as a within-subject factor with two measurements ($t_1$: before and $t_2$: after a reflection task).

**Table 2**
Results of two-way repeated measures ANOVA.

|  | $t_1$ | $t_2$ | Multiple Comparison | | | | Interaction effect | | |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  | Group x Time | | |
|  | *M (SD)* | *M (SD)* | $\Delta_{t2\text{-}t1}$ | SE | *p* | $\eta_p^2$ | *F* | *p* | $\eta_p^2$ |
| **IG** | 4.03 (.35) | 4.15 (.29) | 0.12 | 0.04 | .02 | 0.09 | 0.19 | .67 | .01 |
| **CG** | 4.22 (.30) | 4.29 (.40) | 0.07 | 0.06 | .23 | 0.02 |  |  |  |

*Note*. IG = intervention group; CG = control group. The reflection-related self-efficacy of student teachers increased after the video reflection task in both groups, the IG and the CG ($M_{\text{IG } \Delta t1, t2} = 0.12$; $M_{\text{CG } \Delta t1, t2} = 0.07$). Using a post-hoc test for multiple comparisons, we found that the mean score of reflection-related self-efficacy for the IG increased significantly from $t_1$ to $t_2$ at a medium effect size. A post hoc power analysis showed that we had an adequate sample size and revealed a power of 95%. For the CG, the increase was not significant. However, the analysis showed no significant interaction effect of time and intervention.

The reflection-related self-efficacy of student teachers increased after the video reflection task in both groups, the IG and the CG ($M$IG $\Delta$t1, t2 = 0.12; $M$CG $\Delta$t1, t2 = 0.07). Using a post-hoc test for multiple comparisons, we found that the mean score of reflection- related self-efficacy for the IG increased significantly from *t*1 to *t*2 at a medium effect size. A post hoc power analysis showed that we had an adequate sample size and revealed a power of 95%. For the

CG, the increase was not significant. However, the analysis showed no significant interaction effect of time and intervention.

*4.3 Qualitative study (RQ2)*

The second research question focused on how student teachers reflected on the videos in the IG and CG. We therefore analyzed the student teachers' written reflections and compared the reflections in the IG with the reflections in the CG. Table 3 shows the relative frequency of the codes in the reflections. The chi-square test was conducted to investigate differences between IG and CG for reflection activities and reflection content. The comparison between IG and CG showed no differences in the reflection activities. In terms of reflection content, our analysis showed that student teachers in the IG reflected less frequently than those in the CG on the learning environment but reflected more frequently than those in the CG on the teacher in the video. Participants in the CG, on the other hand, reflected more frequently on the learning environment and less frequently on the teacher teaching in the video than the participants in the IG.

**Table 3**
Content analysis of student teachers' video reflections and chi-square test results.

| | | Reflection activities | | | χ2 (*df*) | *p* | Cramer's V |
|---|---|---|---|---|---|---|---|
| | | **Description** | **Interpretation** | **Alternatives** | | | |
| IG | % | 39.40 | 41.20 | 19.40 | 0.52 (2) | .76 | .02 |
| | *z-score* | -0.30 | 0.30 | 0.00 | | | |
| CG | % | 41.30 | 39.30 | 19.40 | | | |
| | *z-score* | 0.40 | -0.40 | 0.00 | | | |

| | | Reflection content | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Learning environment** | **Students** | **Teacher** | | | |
| IG | % | 19.20 | 26.00 | 54.80 | 42.10 (2) | <.001 | .21 |
| | *z-score* | **-3.10** | 0.30 | **2.00** | | | |
| CG | % | 38.90 | 24.30 | 36.80 | | | |
| | *z-score* | **4.40** | -0.40 | **-2.90** | | | |

*Note*. IG = intervention group; CG = control group; z-score = adjusted standardized residual

**5. Discussion**

The present study investigated the effects of reflection on videos recorded in a VR classroom (IG) compared to videos recorded in a real classroom (IG) on student teachers'

reflection-related self-efficacy. In addition, we aimed to identify differences in the reflective process between the two groups to assess whether VR videos can be considered a valuable tool for reflection tasks in teacher education. Thus, the study contributes to the growing literature on VR as a tool in teacher education (Huang et al., in press).

The results regarding the first research question show that student teachers in the IG experienced an increase in reflection-related self-efficacy from the pretest to the posttest while those in the CG did not. Thus, our results generally support the findings of previous research demonstrating the benefits of using video in teacher education to promote reflective skills (e.g., Hamel & Viau-Guay, 2019; Tripp & Rich, 2012). In addition to confirming existing findings, our results are novel: Although there was no statistically significant group difference between IG and CG in our study, the results still show that this increase in reflection-related self-efficacy was statistically significant only for the IG that used VR classroom videos for reflection. The results therefore also support Seufert et al. (2022), who found that VR experiences are suitable for reflection processes. In addition, because of the significant increase in reflection-related self-efficacy in the CG, our findings are in line with those of Stavroulia and Lanitis (2019), who showed that participants who were trained in a VR environment had a higher willingness to reflect than participants who were trained in the classroom. One explanation for this could be that VR teaching experiences are perceived by student teachers as similar in authenticity to real teaching experiences, as VR provides users with presence and agency (Makransky & Petersen, 2021; Petersen et al., 2022). This is consistent with a recent study using a VR environment in teacher education, which found that high levels of presence led student teachers to perceive VR as realistic and contributed to development of classroom management skills (Seufert et al., 2022).

Regarding the second research question, we found slight differences between the written reflections of the individuals in the IG and the CG. Compared to the CG teachers, the student teachers in the IG were more likely to reflect on the teacher teaching in the videos and less likely to reflect on the learning environment. However, significant parts of the reflections did not differ between the two groups, as we found no differences in the three reflection activities (description, interpretation, alternatives). Since there are no studies to date that have compared written reflections based on VR or real classroom videos, we situate our findings against the backdrop of previous research on the use of videos to show teachers either their own or other teachers' teaching experiences. In this regard, our findings are consistent with those of Kücholl & Lazarides (2021), who also examined student teachers' written reflections either on their own or another teacher's teaching. However, it is also worth noting that Kleinknecht and Schneider (2013) and Seidel et al. (2011) found that student teachers who

reflected on another teacher's teaching experiences were more likely to think about alternative ways of dealing with negatively perceived events. One possible explanation for the difference in results goes hand in hand with a major disadvantage of VR: Student teachers may be able to teach in VR similarly to how they would in a real classroom, but depending on the VR software used, they are always more constrained in their behavior than they are in reality. Because of this limitation, they may be more likely to be prompted to think about what they could have done rather than just describing what they did.

*5.1 Limitations*

Although our study provides new insights into how VR could be used in teacher education, there are some limitations that need to be considered. First, our study was limited in terms of sample size in general and non-random assignment of IG and CG courses with different sample sizes. In addition, we only studied student teachers at one university who were enrolled in the bachelor's program. These issues limit the broader implications that can be drawn from our findings. A second limitation arises from the study design. The IG, on the one hand, reflected on their own teaching experiences in a virtual classroom. The CG, on the other hand, reflected on an unfamiliar teacher's teaching in a real classroom. While acknowledging this limitation, we would like to point out that our study offers high ecological validity, as this type of video is frequently used in teacher education for a variety of purposes. Third, we also want to reflect on data quality. We rely on self-reports to measure reflection-related self-efficacy. Although the accuracy of self-reported data is debated in papers on research methods with regard to their measurement quality (Gonyea, 2005), educational researchers often rely on such measures in studies of self-efficacy (Klassen et al., 2011). Therefore, we consider our methodological approach to measure reflection-related self-efficacy to be consistent with established research practice. In terms of the written reflection data, we used for our qualitative analysis, it could be possible that members of the two groups differed in their reflection abilities. However, to assure a comparable level of reflection, we ensured that all student teachers received an introduction to writing a reflection prior to the reflection task.

*5.2 Implications*

Our current research supports the implementation of VR in teacher education as a versatile and efficient tool to provide opportunities for reflection. VR can be used as a safe environment to learn and practice teaching. Student teachers can hone specific skills, derive individual development goals, and reflect on their own experiences and progress (Lamb & Etopio, 2019).

Although we demonstrated in this study that the use of VR is associated with student teachers' professionalization, their cognitive, motivational, and emotional learning processes remain a black box. In order to use VR in a targeted and sustainable way in teacher education, a better understanding is needed of how student teachers learn in VR environments. In this context, future research should study, for example, what features of VR promote student teacher learning and how they do so. A potential analysis framework is provided by the cognitive affective model of immersive learning (CAMIL; Makransky & Petersen, 2021).

## 6. Conclusion

The use of videos to reflect on and analyze teaching practices is a valuable tool in teacher education (Sun & van Es, 2015). The results of this study build on this existing knowledge and show that video-based reflection using VR classroom videos has positive learning outcomes in terms of student teachers' reflective self-efficacy beliefs. We found that student teachers reflected in similar ways regardless of whether their reflection was based on VR or real classroom videos. This makes VR a learning opportunity that could be equivalent or even better than video – it could provide a standardized patient model and be adapted as culture, trends, and practices change, whereas video and the content it presents are static and should be re-recorded to fit the times. Thus, our study makes an important contribution to research on the use of VR in teacher education.

### Credit author statement

**Eric Richter**: Conceptualization, Investigation, Methodology, Formal analysis, Writing – original draft, **Isabell Hußner**: Conceptualization, Investigation, Methodology, Formal analysis, Writing – review & editing, **Yizhen Huang**: Investigation, Data curation, Writing – review & editing, **Dirk Richter**: Conceptualization, Resources, Writing – review & editing, **Rebecca Lazarides**: Conceptualization, Investigation, Methodology, Resources, Writing – review & editing

### Data availability

The authors do not have permission to share data.

**Appendix**

**Table A.1**

Behavior Script of Student Avatars

| Event ID | Time in seconds | Avatar location | Behavior | Category |
|----------|-----------------|-----------------|----------|----------|
| 01 | 330 | 02L | Play with a pen | off-task |
| 02 | 345 | 02L | Write on the notebook | on-task |
| 03 | 350 | 11R | Chat with the neighbor | off-task |
| 04 | 365 | 11L | Write on the notebook | on-task |
| 05 | 365 | 11R | Idle | |
| 06 | 365 | 13R | Eat an apple | off-task |
| 07 | 380 | 13R | Idle | |
| 08 | 380 | 03R | Chat with the neighbor | off-task |
| 09 | 395 | 03L | Idle | |
| 10 | 395 | 03R | Idle | |
| 11 | 380 | 14R | Stare outside the window | off-task |
| 12 | 395 | 14R | Idle | |
| 13 | 380 | 11L | Stare outside the window | off-task |
| 14 | 395 | 11L | Idle | |
| 15 | 400 | 01R | Hit the neighbor | off-task |
| 16 | 415 | 01R | Idle | |
| 17 | 415 | 01L | Idle | |
| 18 | 420 | 05L | Throw paper balls | off-task |
| 19 | 435 | 05L | Idle | |
| 20 | 440 | 10R | Raise the arm | on-task |
| 21 | 442 | 10R | Ask a question | on-task |
| 22 | 448 | 10R | Idle | |
| 23 | 470 | 12L | Eat an apple | off-task |
| 24 | 485 | 12L | Idle | |
| 25 | 480 | 11R | Chat with the neighbor | off-task |
| 26 | 495 | 11R | Write on the notebook | on-task |
| 27 | 495 | 11L | Idle | |
| 28 | 500 | 02L | Play with a pen | off-task |
| 29 | 515 | 02L | Idle | |
| 30 | 515 | 13L | Hit the neighbor | off-task |
| 31 | 530 | 13R | Idle | |
| 32 | 530 | 13L | Write on the notebook | on-task |
| 33 | 525 | 03L | Chat with the neighbor | off-task |
| 34 | 540 | 03R | Idle | |
| 35 | 540 | 03L | Write on the notebook | on-task |
| 36 | 540 | 10R | Raise the arm | on-task |
| 37 | 542 | 10R | Ask a question | on-task |
| 38 | 548 | 10R | Idle | |
| 39 | 560 | 07R | Stare outside the window | off-task |
| 40 | 575 | 07R | Idle | |
| 41 | 575 | 10R | Stare outside the window | off-task |
| 42 | 590 | 10R | Idle | |
| 43 | 575 | 11L | Stare outside the window | off-task |
| 44 | 590 | 11L | Idle | |

| 45 | 580 | 15R | Eat an apple | off-task |
| 46 | 595 | 15R | Idle | |
| 47 | 580 | 12L | Eat an apple | off-task |
| 48 | 595 | 12L | Idle | |
| 49 | 600 | 05L | Throw paper balls | off-task |
| 50 | 615 | 05L | Idle | |

*Note.* Idle is the default behavior pattern when not specified. When idle, avatars would sit naturally in various neutral poses and move their eyes or body to follow the users around.

**Table A.2**

Items Assessing Reflection-related Self-efficacy by Lohse-Bossenz et al. (2019) (Translation from German into English)

| **Reflection-related Self-efficacy** | |
| --- | --- |
| Item1 | Even when several children are involved in a situation, I can remember actions of individual children. |
| Item 2 | Even when the situations are over, I can be aware of my actions. |
| Item 3 | Even though the lesson planning was done some time ago, I can justify the scaffolding of the planned lesson well. |
| Item 4 | I can evaluate well to what extent my actions were suitable to positively influence a teaching situation. |
| Item 5 | I find it easy to give explanations for actions of individual students. |
| Item 6 | Although several children are involved in a teaching situation, I am able to evaluate the actions of individual children in the classroom. |
| Item 7 | In spite of the complexity of teaching situations, I am able to identify reasons for my actions in the classroom. |
| Item 8 | I am able to exactly describe teaching situations in the classroom. |
| Item 9 | Based on specific teaching situations, it is easy for me to derive general approaches to designing teaching situations. |
| Item 10 | I'm good at developing alternatives for designing teaching situations. |
| Item 11 | Although teaching situations are complex, I manage to make an evaluation of the situations. |
| Item 12 | Although there are always many ways to change one's actions in certain situations, I am good at settling on a specific aim for change. |
| Item 13 | Although classroom situations are complex, I am good at thinking about how I would react differently next time. |

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*Study 4*


**Reflect on Your Teaching Experience: Systematic Reflection on Teaching**

**Behaviour and Changes in Student Teachers' Self-efficacy for Reflection**

# Reflect on Your Teaching Experience: Systematic Reflection on Teaching Behaviour and Changes in Student Teachers' Self-efficacy for Reflection

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**Abstract**

Reflecting on teaching experience is meaningful in teacher education because it enables student teachers to evaluate their professional behaviours in the classroom and develop new instructional strategies. Little is known, however, about the motivational aspects of the reflection process, such as self-efficacy for reflection. Self-efficacy is an important resource in teacher education which relates negatively to stress and burnout, and positively to professional behaviour. This longitudinal intervention study with data from $N = 600$ student teachers investigates how self-efficacy for reflection can be enhanced over the course of one semester. Our findings show that self-efficacy increased significantly during a semester in an intervention

group in which student teachers systematically reflected on teaching situations. There was no increase in self-efficacy in the control group in which student teachers did not teach in schools, nor systematically reflect. The increase in self-efficacy for reflection in the intervention group was moderated by previous pedagogical experiences of student teachers. Our findings are discussed for further development in teacher training.

**Zusammenfassung**

Die Reflexion von Unterrichtserfahrungen ist in der Lehrkräftebildung von hoher Bedeutung, da sie es den Lehramtsstudierenden ermöglicht, ihr professionelles Verhalten im Unterricht zu bewerten und neue Unterrichtsstrategien zu entwickeln. Es ist jedoch wenig über die motivationalen Aspekte des Reflexionsprozesses bekannt, wie z. B. die reflexionsbezogene Selbstwirksamkeit. Selbstwirksamkeit ist eine wichtige Ressource in der Lehrerkräftebildung, die sich negativ auf Stress und Burnout und positiv auf professionelles Verhalten auswirkt. Diese längsschnittliche Interventionsstudie mit Daten von $N = 600$ Lehramtsstudierenden untersucht, wie die reflexionsbezogene Selbstwirksamkeit im Laufe eines Semesters verbessert werden kann. Unsere Ergebnisse zeigen, dass die Selbstwirksamkeit in einer Interventionsgruppe, in der Lehramtsstudierende Unterricht systematisch reflektierten, signifikant anstieg. In der Kontrollgruppe, in der die Lehramtsstudierenden weder in Schulen unterrichteten noch systematisch reflektierten, war keine Zunahme der Selbstwirksamkeit zu verzeichnen. Der Anstieg der Selbstwirksamkeit in der Interventionsgruppe wurde durch pädagogische Vorerfahrungen im Unterrichten moderiert. Unsere Ergebnisse werden für die Weiterentwicklung der Lehrkräftebildung diskutiert.

## 1 Introduction

Reflective processes are a key concern of educational research because reflection is assumed to lead (student) teachers to reflect on their own beliefs about effective teaching, and, through this, improve their teaching in practice (Schön 1987; Rahm and Lunkenbein 2014). Whereas the importance of reflection for the development of professional competence in schools has been widely discussed in theoretical and empirical work (e.g., Babaei and Abednia 2016; Weß et al. 2017; Hußner, Lazarides & Westphal, 2022), there is a lack of research on the motivational aspects of reflective processes. It is currently not well understood which

psychological processes drive teachers' willingness to reflect and to perceive reflection as an important personal goal. The present study addresses this gap by investigating how self-efficacy for reflection developed over the course of one semester. We compared the change in self-efficacy for reflection in an intervention group in which student teachers systematically reflected on videotaped or protocol-based teaching experiences, and in a control group in which systematic reflection and micro-teaching experiences did not take place. Assuming that mastery experiences are an important source of self-efficacy beliefs (Bandura 1997), we also examined how prior pedagogical practice in schools was associated with changes in student teacher self-efficacy for reflection. Our findings inform educational research about the changes in student teachers' self-efficacy beliefs in the area of reflection and about the role of systematic reflection in enhancing student teachers' self-efficacy for reflection.

## 1.1 Reflection on Teaching Practice

On a conceptual level, reflective thinking has been defined as conscious and aimed reflection which involves a) a state of doubt or mental difficulty in which thinking arises and b) an act of searching and investigating to find material that removes doubt, clarifies, and eliminates perplexity (Dewey 1933). In this theoretical context, reflection has been described as a mental process that includes the structuring or restructuring of insights, experiences, problems or existing knowledge (Korthagen 2001). Schön (1987) differentiated between *reflection-on-action* and *reflection-in-action*. *Reflection-in-action* refers to spontaneously arising actions in the classroom that prompt a reframing of the situation and happen automatically, affecting teaching behaviour during the situation at hand (Schön 1987). This kind of reflection, however, presupposes pedagogical experience and is therefore not suitable for novices (Hatton and Smith 1995). In contrast, *reflection-on-action* is an intentional process initiated after a teaching situation in which an unexpected situation appeared during a routine action, prompting the practitioner to reconsider his or her actions after the situation in order to develop adaptive behaviours for future teaching actions (Schön 1987). Therefore, reflection-on-action can be stimulated by different actions; for example, research describes *reflection-generating activities* referring to actions that initiate reflective processes, such as discussing case studies, writing journal entries, audio- or video-recordings, and analysing lessons in teacher education and teaching practice (Jaeger 2013). In this process, pre-service or established teachers take on the role of a *reflective practitioner* because their teaching practice is reflected upon.

The process of reflection itself can be divided into three steps (Van Es 2009; Seidel and Stürmer 2014): (1) *describe* (2), *evaluate* and *explain,* and (3) develop *alternative teaching strategies* to improve the teaching practice (Kleinknecht and Schneider 2013; Kleinknecht and

Gröschner 2016). In our study, we focus on reflection-generating activities, in our case reflection on the lessons taught in class using videos or protocols, that include the three steps of reflection. Thus, our work refers to reflection-on-action rather than to reflection-in-action.

## 1.2 Motivational Aspects of Reflection: Self-efficacy for Reflection and its Sources

Self-efficacy beliefs are a core aspect of motivational processes (Bandura 1997), and in the context of teacher education they have been defined as a judgment of one's own capability to bring about desired outcomes of student engagement and learning, even when experiencing challenges (Tschannen-Moran and Woolfolk Hoy 2001). This definition has also been used in research involving student teachers (Eisfeld et al. 2020; Hußner, Lazarides & Westphal, 2022). In addition to the general self-efficacy facets, specific facets of self-efficacy beliefs have also been identified in recent research (e.g., teacher self-efficacy for classroom management, etc.). Self-efficacy for reflection can be understood as the belief that one is able to overcome challenging reflections on the basis of one's own abilities (Lohse-Bossenz et al. 2019).

Referring to socio-cognitive theory (Bandura 1989), the four sources of self-efficacy beliefs are *mastery experiences* (one's own teaching experiences), *vicarious experiences* (observations of others' teaching), *verbal persuasion* (feedback), and *physiological and affective states* (arousal in situations where the ability in the area concerned is demonstrated) (cf. Morris et al. 2017). Applied to the context of teaching, important sources of teachers' self-efficacy beliefs are one's own practical experiences (*mastery experiences*) as the strongest source of self-efficacy – for example in schools – and the observation of expert teachers in classrooms *(vicarious experiences),* which has also been empirically analysed for pre-service teachers in the context of teacher education programs (Martins et al. 2015). Prior research, however, is inconclusive. Some studies show an increase in self-efficacy of student teachers after practical phases (Ronfeldt and Reininger 2012; Eisfeld et al. 2020). Other findings indicate that student teachers' self-efficacy does not increase in practical phases in which student teachers do not teach a lot (Schüle et al. 2017). Therefore, the design (duration, scope) of the practical phase may be crucial for its effectiveness. When student teachers have the chance to teach and reflect on their own teaching experiences in classrooms during school internships in teacher education, their self-efficacy for reflection increases during the semester (Hußner, Lazarides, Symes et al, 2022). One question that remains is whether student teachers' self-efficacy also increases during their university studies when no practical phases are involved. Research suggests that particularly in the first semester of their studies, self-efficacy of student teachers increases even without practical experiences (Lamote and Engels 2010). Taken together, it might be assumed that student teachers' self-efficacy increases during their

studies – especially after a practicum or with the help of vicarious experiences through case studies.

If real-life experiences cannot be provided in teacher education, there might be other learning opportunities that contribute to an increase in student teacher self-efficacy for reflection. One factor might be pedagogical experiences that student teachers have outside of university. Findings show that previous pedagogical experiences in the context of school practicums during teacher training do not have a significant effect on the change in student teachers' self-efficacy beliefs (Meschede and Hardy 2020). In the context of a 5-month practical phase, Oesterhelt et al. (2012) found no significant difference between high and low levels of student teachers' previous out-of-school pedagogical experience and their self-perceived competencies, assessed in the form of competence aspects of teaching and educating with a focus on practice-relevant learning situations.

Another option to gain pedagogical experiences more indirectly is to reflect on classroom videos. Reflecting on such videos is expected to enhance the positive development of student teachers' and teachers' self-efficacy (Gold et al. 2017; Naidoo and Naidoo 2021). On a theoretical level, videotaped observations of one's teaching behaviour might be a source of self-efficacy beliefs in the sense of mastery learning (Gold et al. 2017). Research has accordingly showed a positive trend of changes in teacher self-efficacy in a group of teachers who reflected on videos of their own or another teacher's classroom behaviours compared to teachers who exchanged their experiences verbally but did not reflect on their own or others' teaching based on videos (Gröschner et al. 2018). Moreover, in the context of education programs, results of Karsenti and Collin (2011) show that pre-service teachers who learned with simulated video recordings increased their self-efficacy as assessed by the adapted scale of Friedman and Kass (2002).

## 1.3 Self-efficacy for Reflection and Individual Characteristics of (Student) Teachers

Bandura's social cognitive theory (Bandura 1986) describes how the learning environment and individual factors have an effect on behaviour and development. Student teachers' individual characteristics may therefore influence the extent to which student teachers benefit from learning opportunities (see also Voss et al. 2015). Given that mastery experiences are an important source of self-efficacy beliefs (Bandura 1997) – which is also true for the teaching context (e.g. Pfitzner-Eden 2016b) – it is assumed that prior teaching performances have a positive effect on teachers' self-efficacy beliefs. Empirical evidence has shown accordingly that prior educational experiences in private or professional contexts have an important and

positive association with preservice teachers' self-efficacy (Bruinsma and Jansen 2010; Kücholl et al., 2019).

Besides prior experience, another individual factor that might be crucial for the development of student teachers' self-efficacy is their professional knowledge. Both professional knowledge and competence beliefs are described as key components of teachers' professional competence (Baumert and Kunter 2006). Findings regarding the relation between self-efficacy and pedagogical knowledge in experienced teachers suggests that general, not task-specific, teacher self-efficacy is positively associated with general pedagogical knowledge (Lauermann and König 2016). In regard to student teacher self-efficacy for reflection, results show that self-efficacy for reflection is positively associated with pedagogical knowledge, which in turn is significantly related to reflective performance (Stender et al. 2021). However, recent research on the relation between self-efficacy and general pedagogical knowledge shows no clear pattern of results, as some studies did not find systematic associations for student teachers (König et al. 2012), pre-service teachers (Depaepe and König 2018) or teachers (Lazarides & Schiefele, 2021).

## 2. The Present Study

Reflection is a core prerequisite for the development of (student) teachers' professional behaviours. Despite its importance, little is known about the motivational aspects of reflection on teaching. In this study, therefore, we examine how self-efficacy for reflection can be enhanced in teacher education. In doing so, we focus on (i) changes in student teachers' self-efficacy for reflection from the beginning (Time 1) to the end (Time 2) of a semester in the intervention and the control group; (ii) the differences in changes in self-efficacy for reflection between an intervention group that reflected on practical experiences versus a control group that did not teach and did not reflect; and (iii) whether the change in self-efficacy for reflection (Time 1 to Time 2) is related to pedagogical knowledge and previous pedagogical experiences of student teachers in the intervention and control groups. More concretely, we investigated the following research questions and hypotheses:

*Research question 1*: How does student teacher self-efficacy for reflection change across the course of a semester?

*Hypothesis 1a*: We expect a general increase in student teachers' self-efficacy for reflection during teacher education.

*Hypothesis 1b*: Because student teachers' self-efficacy can be enhanced by mastery experiences (Schüle et al. 2017; Hußner, Lazarides & Westphal, 2022) as the strongest source of self-efficacy beliefs (Bandura 1997), we assumed that the proposed increase in student

teachers' self-efficacy for reflection is stronger for student teachers who gain practical experience in teaching.

*Research questions 2*: How are prior pedagogical experiences in teaching and pedagogical knowledge related to changes in student teachers' self-efficacy for reflection in the context of video-based or protocol-based reflection?

*Hypothesis 2a:* Prior pedagogical experiences can be a source of mastery experiences (Capa-Aydin et al., 2018), but current empirical research has shown no significant relation between prior pedagogical experiences in teaching and the change in student teacher self-efficacy (Oesterhelt et al. 2012; Meschede and Hardy 2020) – we therefore tested whether previous pedagogical experiences outside of university practicums were interrelated with changes (Time 1 to Time 2) in self-efficacy for reflection of student teachers over one semester who taught and reflected on teaching situations.

*Hypothesis 2b:* Moreover, research about the relation between teacher self-efficacy and professional knowledge is inconsistent, with some studies indicating positive associations (e.g., Stender et al. 2021) and other studies indicating no systematic relationship (e.g., Lauermann and König 2016). We therefore tested whether pedagogical knowledge is interrelated with changes (Time 1 to Time 2) in self-efficacy for reflection of student teachers who taught and reflected on teaching situations throughout one semester.

## 3. Methods

### 3.1 Sample

In this study, we used data from $N = 600$ student teachers (intervention group (IG): $n = 248$; control group (CG): $n = 352$) at one German university (52.7% female; 91% born in Germany) who participated in an online questionnaire that assessed student teachers' motivation and emotion at the beginning (Time 1) and end (Time 2) of one semester (summer term 2019: $n = 44$, winter term 2019/2020: $n = 31$, winter 2021/2022: $n = 47$, summer term 2021: $n = 29$, $n = 1$ missing). Student teachers were on average 24 years old ($M = 24.24$, $SD = 4.78$) and in their fifth bachelor semester ($M = 4.93$, $SD = 2.61$). The three subjects most studied by the student teachers were German (19.5%), Sports (13.0%), and English (12.8%). A minority of the student teachers (22.3%) already had previous pedagogical experiences ($M = 10.5$ months, $SD = 14.88$), such as working in schools during their studies. Student teachers in the intervention group ($n = 248$, missing values for $n = 52$) reflected on their teaching experience by (a) watching a video of their own teaching practice ($n = 98$), (b) watching a video of another

student teacher's teaching practice ($n = 65$) or (c) reading a written teaching protocol of their own teaching lesson ($n = 33$).

The students in our sample participated in courses in their teacher education program that focused on the enhancement of student motivation in school. Students in the intervention group participated in courses that provided them with the opportunity to develop lesson plans, teach lessons based on their lesson plans in authentic classrooms, and reflect on their lessons based on videos of their own teaching, the teaching of other student teachers, or on a lesson protocol. In the lesson protocol, the student teachers wrote down chronologically the teaching activities they observed in the classroom. Students in the control group attended courses without such practical experiences and without the associated opportunities for reflection, but with the focus on instructional development through case studies. The intervention is described in further detail in the Design and Procedure section. A total of $n = 248$ teacher students were in the intervention group (50.5% female, 88.5% born in Germany). These student teachers were on average 24 years old ($M = 23.99$, $SD = 4.63$) and in their fifth bachelor semester ($M = 5.14$, $SD = 2.54$) when they participated in the survey. The most-studied subjects in the intervention group were German (19.5%), English (13.0%), Ethics (13.0%), and Sports (13.0%). About one-third (27.5%) of the students in the intervention group had previous pedagogical experiences ($M = 7.98$ months, $SD = 10.35$). A total of $n = 352$ student teachers (53.1% female, 93.8% born Germany) were in the control group and were on average 24 years old ($M = 23.98$, $SD = 4.42$) and in their fifth semester at the time of the survey ($M = 4.74$, $SD = 2.66$). The three most-studied subjects in the control group were German (18.5%), History (13.4%), and English (12.8%). About one-fifth of the student teachers (19.0%) already had previous pedagogical experiences ($M = 12.61$ months, $SD = 19.14$).

## 3.2 Design and Procedure

Our study examines student teachers who participated in bachelor courses in educational science covering topics related to motivating teaching strategies and teaching quality. Student teachers were either in courses that included micro-teaching sessions in secondary classrooms (intervention group) or in courses that were based on cooperative group work without pedagogical practices in schools (control group). Students assigned themselves to one of the courses provided in the study plan at the end of the bachelor's degree in the teacher education program. In the intervention group, student teachers were assigned a supervising teacher, developed a lesson plan for one 45-90-minute lesson, and taught this lesson in a school. Student teachers prepared this lesson on their own or in teams by putting into practice the theoretical

input that was taught in earlier weeks of the course on motivational psychology. Before teaching, student teachers presented their lessons to the other student teachers in the course and the lecturer in order to receive feedback. The student teachers also sent their lesson plans to the supervising teacher for feedback. To get to know the classroom in which they were going to teach, the student teachers observed one lesson by their supervising teacher in that classroom. Finally, student teachers taught their lesson and videotaped it if such was permitted by the school and if consent was provided by the children and parents. Using the video of their own teaching, a video of another student teacher, or a lesson protocol, student teachers systematically reflected on the lessons by means of a written reflection task. In this task, they were requested to select a challenging teaching situation (duration ~ 5-10 minutes) from the video and reflect on this situation using the three-step reflection process that included 1) a *description* of the situation, 2) an *interpretation* (evaluation and explanation) of the situation and 3) some *alternatives* for action (Kleinknecht and Gröschner 2016). Once this was completed, student teachers were requested to select a positive teaching situation (duration ~ 5-10 minutes) and reflect on it as well. The student teachers in the control group did not teach as part of their course and were not provided with opportunities to systematically reflect. Instead, they worked with classroom video data and engaged in practical tasks such as simple classroom observation activities or developing solutions to problematic classroom situations.

## 3.3 Measures

The student teachers were surveyed online at the beginning (Time 1) and end of the semester (Time 2). The survey assessed student teachers' self-efficacy for reflection, pedagogical knowledge, and previous pedagogical experience in months. The item wordings from the online survey and the reliabilities ($\alpha$) for reflection-related self-efficacy, teaching behaviour, and educational knowledge are reported in Table 1.

*Self-efficacy for reflection* at the beginning and end of the semester was assessed using a scale developed by Fraij (2018). The response format ranged from 1 (strongly disagree) to 6 (strongly agree).

*Previous pedagogical experience* (as a substitute teacher or assistant teacher) was captured according to König et al. (2013), adding up the number of months of experience.

*Pedagogical knowledge* was assessed using the 23-item subscale *classroom instruction* from the original German version of the standardized knowledge test *Bilwis*s (Kunina-Habenicht et al. 2020). The standardized test includes subdimensions consisting of 23 multiple-choice items, 16 items with a binary response format ("true" / "not true"), and seven items with

a four-category response format as a multiple-choice question. The test assesses teachers' knowledge of different areas of teaching, such as questions on classroom management or cooperative learning. Test scores range from 0 (minimum) to 23 (maximum). The sum of all test items represents the individual knowledge level. In this study, student teachers achieved a minimum of 0.25 to a maximum of 21.25 points.

**Table 1**

*Measurement Instruments, Sample Items and Statistics for Reflection-related Self-Efficacy and Pedagogical Knowledge*

| Scale | Short label of construct | Subscales, example items | Internal consistency |
|---|---|---|---|
| Previous pedagogical experiences (adapted to: König et al., 2013) | $PE_{T1}$ | *The following questions refer to your previous teaching experience outside of your teacher training programme. Please indicate to what extent the statements apply to you: own teaching activity at a school outside of studies (e.g., substitute teacher): duration in months (e. g. 10):* | - |
| Pedagogical knowledge (Kunina-Habenicht et al., 2020) | $PK_{T1}$ | *„In Helmke's offer-use model (German: Angebot-Nutzungsmodell), what aspects belong to the level of use of learning opportunities on the part of the student(s)?* | $\alpha_{T1}= .75$ |
| Self-Efficacy for reflection (Fraij, 2018) | SER | *„If there is a problem, I can critically examine my own actions."* | $\alpha_{T1} = .83$; $\alpha_{T3} = .84$ |

## 3.4 Statistical Analyses

In the first step, we evaluated measurement invariance of self-efficacy for reflection using a stepwise procedure followed by (Chen 2007). Measurement invariance of the overall sample was confirmed in our study; the results of the testing procedure are reported in the Appendix.

To test Hypothesis 1a, we applied an unconditional latent change model (LCM) testing the changes in self-efficacy for reflection from the beginning (Time 1) to the end of one semester (Time 2) for all student teachers in the intervention and the control group (McArdle 2009). To examine Hypothesis 1b, we used the Wald Chi Square Test (Asparouhouv and Muthén 2007) to examine differences in change scores between the intervention and control groups. To test Hypotheses 2 a and b, we extended the unconditional LCM and added previous pedagogical experiences (Hypothesis 2a) and pedagogical knowledge (Hypothesis 2b) as predictors of the change in self-efficacy for reflection. All analyses were carried out in M*plus* version 8.6 (Muthén and Muthén, 1998–2015). In line with Hu and Bentler (1999), for the

model fit for TLI and CFI, values of .90 or higher are considered satisfactory, while values above .95 are considered excellent. For the RMSEA, values ≤.05 represent a good fit, values between .05 and .08 an adequate fit, and values between .08 and .10 a poor fit (Browne and Cudeck 1993).

# 4. Results

## 4.1 Descriptive Statistics and Correlations

Mean scores for self-efficacy for reflection, previous pedagogical experiences, and pedagogical knowledge for the intervention and control groups are represented in Table 2. The correlations between the captured constructs were examined for student teachers in the intervention ($n = 248$) and the control group ($n = 352$).

**Table 2**

*Descriptive Statistics for all constructs for Student Teachers in the Intervention and the Control Group (N = 600)*

|  | Intervention group ($N = 248$) | | | | Control group ($N = 352$) | | | |
|---|---|---|---|---|---|---|---|---|
|  | **T$_1$** | | **T$_2$** | | **T$_1$** | | **T$_2$** | |
|  | **M** | **SD** | **M** | **SD** | **M** | **SD** | **M** | **SD** |
| Self-Efficacy for Reflection (SER) | 4.93 | 0.66 | 5.14 | 0.57 | 5.12 | 0.56 | 5.08 | 0.63 |
|  | **T$_1$** | | | | **T$_1$** | | | |
|  | **M** | **SD** | | | **M** | **SD** | | |
| Pedagogical knowledge (PK) | 12.82 | 3.59 | | | 13.85 | 3.08 | | |
| Previous pedagogical experiences in month (PPE) | 8.98 | 10.51 | | | 12.61 | 19.15 | | |

Correlations are represented in Table 3. There were positive and significant associations between self-efficacy for reflection at the end of the semester (Time 2) and previous pedagogical experiences (Time 1), but only for student teachers in the intervention group, which supports the finding that student teachers with more previous pedagogical experiences (Time 1) had high self-efficacy for reflection at the end of one semester (Time 2).

**Table 3**

*Correlations for student teachers in the intervention and the control group for self-efficacy for reflection, previous pedagogical experiences and pedagogical knowledge*

|              | $SER_{T1}$ | $SER_{T2}$ | $PPE_{T1}$ | $PK_{T1}$ |
|--------------|-----------|-----------|-----------|-----------|
| $SER_{T1}$   | 1         | .489**    | -.028     | .072      |
| $SER_{T2}$   | .501**    | 1         | .317*     | .030      |
| $PPE_{T1}$   | -.165     | .008      | 1         | -.090     |
| $PK_{T1}$    | .064      | -.061     | -.116     | 1         |

*Note.* Below the diagonal: control group/above the diagonal: intervention group. *$p$ < .05; **$p$ < .01. SER = Self-efficacy for reflection, PPE = Previous pedagogical experiences, PK = Pedagogical knowledge, T1 = Time 1, at the beginning of one semester, T2 = Time 2, at the end of one semester.

## 4.2 Latent Change Analysis

The unconditional latent change model showed that the change in self-efficacy for reflection was positive and significant for the sample as a whole ($M\Delta = 0.26$, $p < .001$). The model fit was good, CFI = 0.98, TLI = 0.97, RMSEA = 0.05, SRMR = 0.06.

To examine the change in self-efficacy for reflection between the intervention and the control group we used the Wald chi test, which showed a significant difference between in-group memberships, with the control group coded as "1" and the intervention group as "2", $\beta$ = 0.18, $SE = 0.07$, $p = .011$. The model fit was acceptable, CFI = 0.96, TLI = 0.96, RMSEA = 0.06, SRMR = 0.08.

The unconditional latent change model for student teachers in the intervention group showed a significant change in self-efficacy for reflection from the beginning to the end of the semester, $M\Delta = 0.23$, $p < .001$. The model showed a good model fit, CFI = 0.95, TLI = 0.95, RMSEA = 0.06, SRMR = 0.18. For student teachers in the control group, the self-efficacy for reflection did not change significantly from the beginning to the end of the semester, $M\Delta = 0.04$, $p < .305$. The model fit was good, CFI = 0.96, TLI = 0.96, RMSEA = 0.06, SRMR = 0.08.

We subsequently computed a conditional latent change model in which we included previous pedagogical experience and pedagogical knowledge (Time 1) as predictors of the change in self-efficacy for reflection for student teachers in the intervention group from the beginning to the end of one semester (Time 1 to Time 2). The results showed that previous pedagogical experiences (Time 1) were positively and significantly related to the average change in self-efficacy for reflection of student teachers over a semester (Time 1 to Time 2), $\beta$ = 0.74, $p < .001$. In contrast, pedagogical knowledge (Time 1) of student teachers in the intervention group was negatively but non-significantly associated with the change in self-efficacy for reflection of student teachers over one semester (Time 1 to Time 2), $\beta$ = -0.01, $p =$

.985. The model fit for the analysis was acceptable, CFI = 0.91, TLI = 0.89, RMSEA = 0.07, SRMR = 0.20.

Moreover, we subsequently computed three conditional latent change models in which we tested whether the reflection medium has an impact on the change in student teachers' self-efficacy for reflection in the intervention group over one semester (Time 1 to Time 2) – no significant effect was found for the reflection medium on the change in self-efficacy for reflection.[3]

## 5. Discussion

The aim of this study was to examine the change in self-efficacy for reflection in a group of student teachers who taught and reflected systematically on their own videotaped teaching experiences, on videotaped experiences of other student teachers or on a lesson protocol (the intervention group) and compare this to the change in self-efficacy for reflection in a group of student teachers who did not teach and did not reflect (the control group). We also investigated how individual characteristics of student teachers – more concretely, their previous pedagogical experiences and their pedagogical knowledge – were interrelated with changes in self-efficacy for reflection. In the following sections, we discuss our key findings in detail.

### 5.1 Motivational Aspects of Reflection: Changes in Self-efficacy for Reflection

In line with Hypothesis 1a, the results of this study showed a positive and significant change in self-efficacy for reflection in student teachers over the course of one semester. Our findings thus support those of recent studies that have shown an increase in student teachers' self-efficacy over the course of one semester when student teachers are involved in practical phases during teacher education programs (Ronfeldt and Reininger 2012; Eisfeld et al. 2020; Hußner, Lazarides & Westphal, 2022). However, other studies found that teacher self-efficacy decreased during practical periods (Lin and Gorrell 2001; Schüle et al. 2017) or did not change significantly for student teachers who could not teach because of the online semester during the COVID-19 pandemic (Hußner, Lazarides & Westphal, 2022). Reasons for the incoherent findings of the change in teacher self-efficacy might be the different operationalisation and conceptualisations of the examined constructs of teacher self-efficacy beliefs. This is the first study, to our knowledge, that examined changes in student teacher self-efficacy for reflection in the context of micro-teaching experiences. Our findings thus contribute to a better understanding of the motivational aspects of reflection processes and their developmental

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[3] Protocol: β = -0.17, *p* = .178; CFI = 0.91, TLI = 0.89, RMSEA = 0.08, SRMR = 0.23;
Own video: β = 0.17, *p* = .176; CFI = 0.91, TLI = 0.89, RMSEA = 0.08, SRMR = 0.24;
Videos of other's: β = -0.02, *p* = .852; CFI = 0.90, TLI = 0.89, RMSEA = 0.09, SRMR = 0.24

change in teacher education. Whereas theoretical work has described a decline in self-efficacy due to a *practical shock* (German: *Praxisschock*) (Richter et al. 2013) or *university shock* of student teachers in the first semester (Pfitzner-Eden 2016a), our results indicate that, in regard to self-efficacy for reflection, micro-teaching settings and systematic reflections implemented early in teacher education enable student teachers to perceive themselves as competent enough to reflect on their experiences.

In line with Hypothesis 1b, our findings showed that self-efficacy for reflection of student teachers who taught and reflected on their teaching experiences systematically increased positively and significantly over one semester during a university course that included micro-teaching settings. Self-efficacy for reflection of student teachers who did not teach and who did not reflect did not change significantly over one semester. An explanation for the significant and positive change in self-efficacy for reflection of student teachers in the intervention group who taught and reflected on their teaching experiences might be that student teachers were asked to develop alternatives scenarios for classroom situations that went well for them, but also for experiences that did not go well. These reflective processes might have contributed to an increased perception of their mastery experiences. Interestingly, our additional analyses showed no significant differences in the change of self-efficacy for reflection between the different means of reflection (videos, protocols). Reasons for these findings might be that the means of reflection does not play the main role in the development of self-efficacy for reflection. However, it might be more relevant that student teachers' reflection processes are encouraged by means of teaching situations (Hußner, Lazarides, Symes et al., 2022).

## 5.2 Self-efficacy for Reflection, Prior Pedagogical Experiences, and Pedagogical Knowledge

Confirming our assumptions (Hypothesis 2a), the change in self-efficacy for reflection of student teachers in the intervention group was positively associated with prior teaching experiences that student teachers had outside of university in addition to the regular practical phases during their teacher education programs. Our findings are contrary to current findings of empirical research that show that student teachers' prior teaching experiences are not significantly associated with their self-efficacy beliefs (Oesterhelt et al. 2012; Meschede and Hardy 2020). Because mastery experiences are an important source of self-efficacy beliefs (Bandura 1997), prior experiences in teaching might play a relevant role in the context of effective performance in class, so that student teachers feel more confident in new and challenging classroom situations.

Confirming our assumptions (Hypothesis 2b) and recent research that found no association between professional knowledge and teacher self-efficacy beliefs (e.g., Lauermann and König 2016), the increase in self-efficacy for reflection of student teachers in the intervention group who taught and reflected on the teaching situations was not associated with their pedagogical knowledge. One explanation might be that, for experienced teachers, knowledge is predominantly a combination of theoretical knowledge and practical experience, as understood in the concept of *reflecting-in-action* (Schön 1987), thus knowledge has a stronger impact on self-efficacy for experienced teachers than for student teachers, who acquire theoretical knowledge as part of their studies but are less able to link it to practical experience (Lauermann and König 2016).

## 5.3 Limitations

Despite its contribution to recent research, our study has various limitations that need to be discussed. First, the sample includes student teachers from one German university –it is therefore necessary to evaluate the findings regarding the positive change in self-efficacy for reflection with samples of student teachers from different universities and with a larger sample to provide greater statistical power. A second limitation is that the content focus of the course and the pedagogical knowledge referred to different areas of teaching and questions about classroom management and cooperative learning of student teachers, whereas the intervention focused only on the reflection on micro-teaching experiences with regard to teaching strategies and motivating students in class. As a third limitation, we could have considered a third group of student teachers who went through the practical experiences without systematic reflection on them in order to identify the impacts of self-efficacy for reflection and practical experience, as opposed to reflection on the experience. A fourth limitation might be that in our study we did not assess whether the student teachers in either the intervention or the control group gained further practical experience in internships during the semester we examined, which could have thus contributed to the positive change in self-efficacy.

## 5.4 Conclusion

Our study proposes that micro-teaching experiences in teacher education programs and the systematic reflection on such are useful to enhance student teachers' self-efficacy for reflection. Moreover, the positive effect of previous pedagogical experiences on the change in student teachers' self-efficacy for reflection indicates that the chance to teach enables student teachers to feel confident that they can reflect on challenging situations in the classroom. In future studies, it might be important to examine student teachers' knowledge about reflection rather

than their pedagogical knowledge in general when aiming to examine interrelations between professional knowledge and self-efficacy for reflection. However, it might be interesting to see whether the positive change in self-efficacy for reflection in the context of reflection processes also applies to experienced teachers. Our findings yield implications for teacher education, as micro-teaching experiences and reflection on them offer the possibility to reinforce the transfer from theory to practice as well as student teachers' professional development.

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# Discussion

# 7. Discussion

Teachers' self-efficacy beliefs are important for their professional commitment (Coladarci, 1992), have a positive effect on students' learning (Tschannen-Moran et al., 1998) – such as a better perception of students' levels of control over their difficulties in the classroom (Woolfson & Brady, 2009) – and might reduce teachers' stress levels, leading to improved emotional stability (Schmitz & Schwarzer, 2002). In the context of teacher education, research has shown that prospective teachers with high self-efficacy beliefs have more positive emotions and fewer negative emotions (Brígido et al., 2013). Despite the large amount of research on teacher self-efficacy beliefs and their positive consequences, this dissertation highlights the lack of empirical findings regarding the sources of *student teachers' self-efficacy beliefs* and their individual characteristics, as well as a paucity of research on the role of learning environments in teacher education with respect to changes in student teacher self-efficacy. Against this background, Study 1 in this dissertation investigates the changes in student teachers' self-efficacy beliefs among student teachers physically present in university courses incorporating short-term teaching experiences, as well as student teachers remotely attending online university courses who did not teach due to the COVID-19 pandemic.

Another research gap addressed in the dissertation is the lack of empirical investigation into the relations between student teachers' self-efficacy beliefs and teaching quality. Thus, Study 2 examined the relation between student teachers' self-efficacy development and their (external observer-rated) teaching behavior in class during teacher education. Because prior research revealed that feedback serves as verbal persuasion, which is a potential source of self-efficacy beliefs (Pfitzner-Eden, 2016b), Study 2 also focused on the impact of the perceived quality of peer feedback regarding lesson plans on student teachers' teaching behavior in class and the changes in their self-efficacy beliefs over one semester of teacher education. To gain insights into the question of which individual characteristics of student teachers are related to their self-efficacy beliefs, their teaching behavior, and their perceived feedback from others in the course, Study 2 additionally examined the extent to which student teachers' prior pedagogical experiences, professional knowledge, and gender are associated with changes in their self-efficacy beliefs. Research on the development of student teachers' self-efficacy beliefs during teacher education especially in the context of practical experiences has revealed the importance of different learning environments, including reflective processes as a source of self-efficacy beliefs (Bernadowski et al., 2013; Tavyl, 2014). Therefore, Studies 3 and 4 explored the question of how systematic and guided reflection on teaching experiences can contribute to the promotion of self-efficacy during teacher education.

## 7.1 Summary and Interpretation of Results

### 7.1.1 Changes in Student Teachers' Self-Efficacy and Their Stress Levels

In the context of changes in student teachers' self-efficacy beliefs, the theoretical background outlines which factors enhance student teachers' self-efficacy beliefs during teacher education. Based on the assumption that self-efficacy only becomes more stable over time (Bandura, 1997), self-efficacy beliefs need to be strengthened during teacher training. Contrasting with the above is the theoretical assumption that student teachers experience a reality shock in their first teaching attempts, as they are confronted with the diverse demands of the teaching task (Pendergast et al., 2011; Tschannen-Moran et al., 1998). Most of the empirical studies examining changes in student teachers' self-efficacy support the finding that practical experiences in teaching during internships enhance the increase in student teachers' self-efficacy beliefs over time (Fives et al., 2007; McDonnough & Matkins, 2010; Pfitzner-Eden, 2016a; Yough, 2019). According to this prior evidence, the studies in this dissertation confirm that student teachers' self-efficacy beliefs increased during short-term practical experiences (Research Question 1), whereas the self-efficacy beliefs of student teachers who did not teach or reflect during the university course did not change significantly.

A major strength of this dissertation is the differentiated assessment of student teacher self-efficacy beliefs. Whereas many studies on teacher self-efficacy beliefs assess self-efficacy on a general level (i.e. Holzberger et al., 2013; Lazarides et al., 2021; Praetorius, Lauermann, et al., 2017), this dissertation investigates how task-specific self-efficacy beliefs of student teachers change across time. Studies 1 and 2 showed in this context different development trajectories of self-efficacy sub facets: Whereas the changes in self-efficacy for instructional strategies were not significant for either student teachers who had taught or for student teachers who had not taught, self-efficacy for classroom management and for student engagement changed across time. One possible explanation is that the effectiveness of student teachers' instruction in the classroom is not easy to capture or perceive during a short practical teaching experience. Whereas effective classroom management has short-term implications (in an ideal situation, the students in the class start to work quietly when the teacher rebukes them), it is more difficult to "see" the consequences of effective instructional strategies. A "take home" message of these findings for teacher education is that it seems particularly difficult to foster student teachers' self-efficacy beliefs for instructional strategies – and interventions might therefore aim to increase self-efficacy facets that are more malleable. However, it is also important in future research to identify didactic methods and course elements that might be

able to enhance particularly self-efficacy beliefs for instructional strategies – maybe through the use of classroom videos in teacher training.

Besides the changes in student teachers' self-efficacy beliefs during online versus face-to-face teaching that included practical teaching experiences, Study 1 examined the changes in student teachers' stress levels over one semester during university courses incorporating practical experiences in schools and in online courses during the pandemic. Theoretical and empirical research showed that student teachers potentially feel more stressed during internships (Dicke et al., 2015; Fives et al., 2007; Lampadan, 2014) and during online courses (Francisco et al., 2022; Kwaah et al., 2022; Ma et al., 2021). Our results from Study 1 showed that the emotional exhaustion of student teachers increased in both groups: during the online teaching and during the courses with practical experiences, whereas the depersonalization and professional effectiveness, the two other subdimensions of the burnout scale, did not change significantly over one semester. Due to empirical findings that showed that teachers are more stressed and may assess themselves as less self-efficacious than preservice teachers (Klassen & Chiu, 2011), further research may investigate to what extent potential interventions can help to reduce the stress levels of student teachers during teacher training.

### 7.1.2 (Prior) Teaching Experiences as a Source of Student Teachers' Self-Efficacy

In the theoretical introduction to this dissertation, I illustrated the development of self-efficacy beliefs through different sources such as mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal (Bandura, 1978), as well as the cognitive processing of knowledge and experiences (Fives, 2003). In the context of teacher education, only a few existing studies investigate the role of sources and potential learning environments that influence student teachers' self-efficacy beliefs during their teacher training (Clark & Newberry, 2019; Pendergast et al., 2011). Besides mastery experiences in terms of practical experiences in schools during teacher education, prior pedagogical experiences that are not related to university courses – for example, private tutoring activities – can be seen as a source of self-efficacy beliefs as well. Due to inconsistent findings regarding the relation between prior pedagogical experiences and student teachers' self-efficacy beliefs (increase: Cantrell et al. (2003), Kappler (2013); potential decrease: Ma and Cavanagh (2018)), further research is needed to evaluate the effect of prior pedagogical experiences on student teachers' self-efficacy beliefs (see Research Question 5).

Therefore, findings from Study 2 revealed that previous teaching experiences did not have a significant effect on student teachers' self-efficacy beliefs nor on the perceived quality

of peer feedback or observer-rated student teachers' teaching behavior. Student teachers were asked if they had previous pedagogical experiences (1 = yes; 2 = no), but most of the student teachers in this sample did not have any prior experiences teaching ($M = 1.20$; $SD$: 0.41), which might be the reason that no significant relation with student teachers' self-efficacy beliefs was found. Another explanation for the non-significant relation between student teachers' self-efficacy beliefs and prior teaching experiences might be that the previous experiences the student teachers did have were negative, which in turn led to a decrease in their self-efficacy beliefs (Ma & Cavanagh, 2018). To further examine the effect of prior teaching experiences, we assessed student teachers' pedagogical experiences according to the number of months of teaching experience they had already gained (Study 4). In contrast to findings from Study 2 and with respect to Research Question 5, the results of Study 4 showed that student teachers' previous pedagogical experiences measured in months were significantly and positively associated with the change in self-efficacy for reflection for student teachers who taught and reflected on their teaching experiences over one semester. Therefore, our findings support the results of previous research, which found that student teachers' self-efficacy beliefs are positively associated with their previous experiences teaching (Cantrell et al., 2003; Kappler, 2013). Reasons for the inconsistent findings of Studies 2 and 4 might be related to the different measurements of prior teaching experiences (yes/no vs. in months). However, another explanation might relate to the different foci of the studies, as Study 2 examined self-efficacy beliefs for instructional strategies, for classroom management, and for student engagement and Study 4 investigated self-efficacy for reflection. One "take-home" message for teacher education might be, however, that prior teaching experiences that student teachers gain outside of university are useful to enhance their self-efficacy beliefs (although not in relation to every self-efficacy facet) and should therefore be initiated, for example, through the systematic development of contacts between schools and student teachers early in their teacher training.

### 7.1.3 Peer Feedback as Source of Student Teachers' Self-Efficacy

Recent research has investigated different operationalizations of feedback and the association with student teachers' self-efficacy beliefs (e. g. Dempsey et al., 2009). Findings are, however, inconsistent and show, for example, positive effects of feedback on student teachers' self-efficacy beliefs (Akkuzu, 2014) but also conclude that feedback is a less likely source of teacher efficacy in teacher education (Poulou, 2007). The findings of this dissertation (Study 2) confirm the assumption of Research Question 2 by indicating that student teachers who rated the quality of peer feedback received on the lesson plan presented in the course and used later for teaching

at mid-semester as high also experienced an increase in their self-efficacy for classroom management over one semester. Therefore, it is assumed that during teacher education peer feedback can be seen as an important source of self-efficacy beliefs in terms of verbal persuasion. However, further research is needed to investigate the impact of feedback on student teachers' self-efficacy during short-term practical experiences in teacher training, because we only assessed peer feedback and not the feedback from other individuals such as mentoring teachers, students or university mentors. Further, it is puzzling why we found significant effects only on student teachers' self-efficacy for classroom management – and not on their self-efficacy for instructional strategies or their self-efficacy for student engagement. The student teachers presented their lesson plans in our courses, including materials, tasks, and digital tools that they were planning to make use of. The increase in self-efficacy for classroom management, however, might be explained through the content of the peer feedback, as most peers spoke about the effective time management included in the lesson plans, as student teachers also presented their structured lesson planning. More research is thus also needed to examine the role of the content of feedback for self-efficacy beliefs and not just the student teachers' satisfaction with the feedback received. The "take-home message" for teacher education here is that feedback from peers should be implemented in the context of teaching development and practical teaching experiences, because feedback is likely to enhance student teachers' self-efficacy beliefs during university courses.

## 7.1.4 Student Teachers' Teaching Behavior and Self-Efficacy Beliefs

The reciprocal relations between teaching behavior and teachers' self-efficacy beliefs have not yet been clearly proven in current research. Further, there are no existing studies that have investigated the relations between *student teachers' self-efficacy* and their behavior in class during teacher training, as until now studies have focused on in-service teachers. Additionally, the findings concerning the relation between teachers' self-efficacy and their teaching quality are inconsistent – some studies found a significant and positive association between students' perceived cognitive activation and teachers' perceived classroom management on teachers' self-efficacy (Holzberger et al., 2013), while others showed non-significant relations between teacher self-efficacy and changes in class-level student-perceived emotional support, classroom management or instructional clarity (Lazarides et al., 2021) and between teacher self-efficacy and student-rated classroom management, learning support or cognitive activation (Praetorius, Lauermann, et al., 2017). Therefore, the aim of Study 2 was to determine the relations between self-efficacy beliefs and teaching behavior of student teachers in the context

of practical experiences during teacher training. The results indicated that student teachers who were rated as being effective in their classroom management and instructional support at the middle of the semester during short teaching phases in schools also experienced an increase in their self-efficacy for classroom management across the semester. Moreover, the observer-rated classroom management at mid-semester predicted increases in student teachers' self-efficacy for instructional strategies and thus confirms the assumptions related to Research Question 2. Due to the fact that self-efficacy at the beginning of the semester does not predict the quality of teaching in the middle of the semester, it might be assumed that student teachers have only limited experiences teaching, which leads to low levels of confidence in their teaching competencies. Despite the posited reality shock in student teachers' first attempts at teaching, short-term teaching experiences in the context of a university seminar that allows student teachers to observe an experienced teacher and thus gain vicarious experience as a source of self-efficacy (Bandura, 1997) before teaching on their own in the classroom might reduce the risk of overestimating the complexity of the teaching task (Pendergast et al., 2011; Tschannen-Moran et al., 1998). Another explanation might be that student teachers were supported by the supervising teacher and received feedback on their lesson plans, which helped to counteract the fear of failure (Gresham & Burleigh, 2019) and thus served as a source of self-efficacy after the teaching experience. Therefore, further research may investigate the observation of an experienced teacher and the feedback from supervising teachers as sources of student teachers' self-efficacy beliefs. A reason for the non-significant link between the dimensions of teaching quality and self-efficacy for student engagement might be that short-term practical experiences are not sufficient to establish a relationship with the students in the class which in turn, makes it difficult to motivate the students and therefore student teachers are less able to feel effective in engaging the students in the class. The "take home" message for teacher education in this context might be to integrate short-term practical teaching experiences into teacher education on a regular and constant basis in order to foster the professional development of student teachers during their teacher training.

### *7.1.5 Individual Characteristics – Professional Knowledge, and Gender – and Student Teachers' Self-Efficacy*

Due to the inconsistency in empirical findings about the link between professional knowledge and self-efficacy beliefs of student teachers during teacher education programs (Brandon & Smith, 2009; Depaepe & König, 2018; Filatov & Pill, 2015), Studies 2 and 4 in this dissertation examined the relation between student teachers' pedagogical knowledge at the beginning of

the semester and the change in their self-efficacy beliefs across the semester. Findings showed that student teachers' pedagogical knowledge did not have an effect on the changes in their self-efficacy (for instructional strategies, for classroom management, for student engagement), their observer-rated teaching behavior in class (Study 2) or their reflection-related self-efficacy beliefs (Study 4). These results (Studies 2 and 4) are in line with studies that, for example, did not find a significant association between financial knowledge and prospective teachers' self-efficacy for teaching basic concepts in personal finance (Brandon & Smith, 2009) or between preservice teachers' general pedagogical knowledge and their self-efficacy (Depaepe & König, 2018). Reasons for the non-significant relation might be that student teachers did not have enough professional knowledge to rely on at the time of their first teaching attempts, because student teachers in both studies achieved only marginally more than half of the total score in the educational knowledge test (Study 2: $M = 14.72$, $SD = 4.36$; Study 4: $M = 12.82$, $SD = 3.59$; total score = 24). Another explanation might be that student teachers are less able to transfer their theoretical knowledge to the teaching process (Lauermann & König, 2016). Therefore, future research should examine the professional knowledge of student teachers in different states of their teacher training to evaluate at which point the connection between knowledge and practice is made. In addition, research on teachers' pedagogical knowledge could provide information on the extent to which the knowledge of student teachers differs from that of in-service teachers to identify learning settings that enhance student teachers' knowledge during teacher training.

In regard to student teachers' gender, recent research has indicated that male student teachers have higher self-efficacy beliefs than female student teachers (Cakiroglu & Isiksal, 2009; Klassen & Chiu, 2011), whereas other studies did not find a significant relation between the student teachers' gender and their self-efficacy beliefs (Aka, 2016). Therefore, Study 2 in this dissertation investigated the relation between student teachers' gender and changes in their self-efficacy (for instructional strategies, for classroom management, and for student engagement) over one semester. The results of Study 2 are in line with findings that showed no differences between the gender and self-efficacy beliefs of prospective teachers (Aka, 2016). The lack of gender differences is positive news, as gender does not seem to affect how student teachers evaluate their teaching skills.

Finally, further research is needed that empirically investigates the associations between student teachers' personal characteristics and their self-efficacy beliefs in order to develop possible interventions during teacher training that foster student teachers' self-efficacy.

*7.1.6 Reflection Processes, Innovative Teaching and Student Teachers' Self-Efficacy*

Empirically, it has been shown that in the context of teacher training the systematic and structured reflection on teaching experiences is useful to enhance different aspects of student teachers' professional development (Bernadowski et al., 2013; Rogers-Haverback & Mee, 2015; Tavyl, 2014). However, there is a lack of empirical research investigating the relations between reflection processes and the development of student teachers' self-efficacy beliefs for reflection during teacher training. Against this background, the aim of Studies 3 and 4 in this dissertation was to examine the role of systematic reflection on teaching experiences that might be a potential source of student teachers' self-efficacy beliefs for reflection.

The findings of Study 3 confirmed the assumptions related to Research Question 3 of this dissertation by showing an increase in reflection-related self-efficacy for student teachers in the IG who reflected on their own teaching in a VR learning environment as recorded in a VR video. Thus, student teachers' reflection on their own teaching experiences through a VR video provides the possibility to support the development of their self-efficacy for reflection. Reasons for the findings might be that the reflection-related self-efficacy refers to the self-assessment of one's own actions in different situations in class and, in contrast to student teachers in the CG, who did not teach during the seminar, student teachers in the IG were able to gather their own teaching experiences in the VR learning setting which might help them to reflect on their competence in terms of teaching. However, it cannot be definitely concluded that student teachers' reflection on the VR lessons or on their own actions in actual classrooms is responsible for the increase in their self-efficacy for reflection. Therefore, future research might be complemented by interviews with student teachers to identify the factors that are beneficial for changes in student teachers' self-efficacy for reflection.

In addition to the results regarding the relation between reflection processes and changes in student teachers' self-efficacy for reflection, Study 3 additionally included a qualitative analysis of the reflection texts, which indicated that student teachers who reflected on their own VR teaching videos (IG) and those who reflected on an authentic classroom video of an English teacher (CG) do not differ in terms of their reflection activities (description, interpretation, alternatives). In addition, results revealed that student teachers in the IG reflected more on their own videotaped behavior in the class, whereas student teachers in the CG reflected more on the learning environment. The reasons for the differences in the reflection activities might be that the VR setting offers only limited possibilities to act in the classroom and thus student teachers were thinking about further alternatives to act in the class. Another explanation might be that student teachers who reflected on the teaching of an unknown teacher

focused more on the learning environment in general, because the situations in the class were realistic and more detailed than the VR video used in the intervention group. However, there is a need to fill this research gap and study the links between student teachers' reflective activities and the potential of different reflective means in teacher education. The "take-home" suggestion for teacher education, therefore, is to implement teaching in VR classroom settings and the reflection on student teachers' own teaching using VR videos in university courses.

Furthermore, it is important to enable student teachers to reflect on their teaching experiences because it supports their self-regulated learning to constantly reorganize the learning process, which is considered an important competence in the context of teacher education (Imhof & Schlag, 2018). Self-efficacy beliefs for reflection are crucial in this process, as they might be related to preservice teachers' ability to effectively reflect on, manage, and solve problems that arise in the classroom (Yost, 2006). In this context, the results of Study 4 confirm the assumptions of Research Question 4, namely that the self-efficacy for reflection increased for student teachers who taught and reflected on teaching experiences, whereas the self-efficacy for reflection did not change for student teachers who did not teach or reflect during the course of one semester. Student teachers in the intervention group reflected through different means: their own teaching video, a video of others, or a lesson protocol of their own teaching. However, no significant differences in changes in student teachers' self-efficacy for reflection were found for the different means of reflection. In this context, future research should further investigate the impact of different means of reflection on the development of student teachers' self-efficacy for reflection. The "take-home" message for teacher education, therefore, is to establish learning environments that enable student teachers to reflect on their teaching experiences and additionally provide them the opportunity to gain short-term teaching experiences during their university courses to enhance their self-efficacy beliefs.

## 7.2 Limitations

Besides the valuable insights and findings from the four studies presented in this dissertation, the studies have several limitations as discussed below. Initially, in all studies the sample sizes are relatively small and it is unclear whether the findings are representative, because student teachers were assessed at one university in Germany only. Thus, future studies should validate the findings of this dissertation in larger and representative samples including student teachers from other universities in Germany or even from other educational systems. Moreover, another limitation involves the self-assessments of student teachers' self-efficacy beliefs, which could be supplemented by observations or, with regard to Study 2, the observer ratings could provide

information through the students' own assessments about the teaching experiences. Furthermore, we mainly used quantitative data on many aspects of the learning environment during teacher education (peer feedback, student teachers' teaching experiences, prior experiences teaching), but we do not definitively understand which factors of the learning environment enhance student teachers' professional development, which represents another limitation of the studies in this dissertation. In this regard, complementary qualitative data as in Study 3 would provide more insight into the learning process of student teachers and the changes in different dimensions of their self-efficacy beliefs during teacher education. Finally, another limitation of the four studies is that not all sources of self-efficacy are investigated, and therefore future research should examine vicarious experiences and emotional states as sources of student teachers' self-efficacy during their teacher education.

## 7.3 Perspectives and Implications

This dissertation clearly shows that improving the effectiveness of teacher education is possible through the implementation of systematic and structured short-term practical experiences in schools – when 'effectiveness' is understood as an increase in teaching-related self-efficacy beliefs. Consequently, it can be discussed as a consequence of these findings whether teacher training should include more short-term practical experiences in schools in order to promote the theory-practice transfer of prospective teachers. The evidence from the studies in this dissertation suggests that more systematic encouragement of cooperation between student teachers in terms of peer feedback in university courses might contribute to higher self-efficacy beliefs. Possible follow-up questions for further research include the role of the timing and duration of short-term internships during teacher training, as well as the effects of teaching tasks, reflection, and supervision at the school and university (Ding, 2020) for the professional development of student teachers. In this context, further empirical research is needed that examines how different types of feedback, such as video-based feedback or video-based and observer-assessed teaching quality, are related to student teachers' self-efficacy and teaching behavior (Gröschner et al., 2018). In addition, the studies presented the finding that systematic and video-based reflection on teaching experiences is beneficial for increasing the self-efficacy beliefs of student teachers, thus recommending that video-based reflection, e.g., using VR videos, are a beneficial tool in the teacher training program (Sun & Van Es, 2015). With regard to the influence of personal characteristics such as student teachers' professional knowledge or their prior pedagogical experiences explaining the development of student teachers' self-efficacy, further research is required to reveal the extent to which these relations explain an

increase in self-efficacy and, consequently, how teacher education can be designed to take into account the personal characteristics of student teachers.

## 7.4 Strengths of the Studies

The first strength to mention of the four studies included in this dissertation refers to the longitudinal examination of student teachers' self-efficacy beliefs, which were assessed with teaching-related task-specific measures. Further, besides addressing the task-specificity of student teachers' self-efficacy beliefs, this dissertation also considered the reciprocal nature of the relations between self-efficacy and teaching behavior. In particular, Study 2 addresses the research gap around the missing evidence indicating the direction of relations among self-efficacy beliefs of student teachers and their teaching behavior, and thus complements the current research. Another strength of the studies in this dissertation is the investigation of self-efficacy beliefs in the context of practical teaching experiences, which affirms that teaching experiences are crucial for student teachers' professional development during their teacher education (Makrinus, 2012). Moreover, the investigation of different learning environments such as reflection-related learning processes or feedback on lesson plans during teacher training represent another strength in the context of the findings of this dissertation.

## 7.5 Conclusions

In conclusion, there is still a need for research to understand the processes of changes in student teachers' self-efficacy beliefs and the effect of student teachers' individual characteristics and of the learning environment during teacher training. The overall aim of this research is to promote student teachers' self-efficacy in teacher training, especially during practical phases. Therefore, reflection processes on teaching experiences and feedback from peers during teacher education, especially in the context of lesson planning, should be implemented in teacher education. Moreover, previous pedagogical experiences support an increase in student teachers' competence beliefs, and teacher education should therefore emphasize constant cooperation with schools to enable student teachers to gain further practical experiences teaching. The present study has thus addressed existing research gaps and has been able to show that practical teaching experiences during teacher training are of high importance for student teachers' professional development.

## 7.6 References

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# Declaration

I confirm that the dissertation "Self-efficacy beliefs of student teachers in the context of teaching-related practical experiences in schools" was written independently and without the help of third parties and that all regulations of scientific standards were followed. I declare that the dissertation in its current version has not been submitted or is not available for review by any other university. I have not opened a doctoral procedure at any other university.

Berlin, 16.09.2022
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