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Preservice Teachers' Self-Efficacy: Predicting Changes over the Internship Period through Attributional Styles and Implicit Theories of Intelligence

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Abstract This study focuses on preservice teachers' self-efficacy and its development throughout the course of a school-internship. Based on previous findings, we expected that preservice teachers' self-efficacy would increase during their internship. Moreover, we argued that this initial development of self-efficacy would be associated with the way the first teaching experiences are attributed to different causes as well as to preservice teachers' implicit theories of intelligence. To this end, surveys with $N = 162$ German preservice teachers were conducted at the beginning and at the end of their 17-week internship. Results revealed an increase of self-efficacy throughout the course of the internship. Using a structural equation model, self-efficacy at the end of the internship was significantly predicted by self-efficacy at the beginning as well as by attributing successes to internal, stable, and controllable causes, but not by an incremental theory of intelligence. Implications for further research and teacher education are discussed.

Keywords Self-efficacy · Attribution · Implicit intelligence theories · Teacher education

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Selbstwirksamkeitserwartungen von Lehramtsstudierenden: Vorhersage von Veränderungen während des Semesterpraktikums durch Attributionsmuster und implizite Intelligenztheorien

Abstract Diese Studie adressiert die Selbstwirksamkeitserwartung von Lehramtsstudierenden sowie ihre Entwicklung während des Semesterpraktikums. Basierend auf den Forschungsergebnissen vorheriger Studien wurde ein Anstieg der Selbstwirksamkeitserwartung vermutet. Darüber hinaus wurde ein Zusammenhang dieser anfänglichen Entwicklung der Selbstwirksamkeitserwartung mit den Attributionsmustern, mit welchen die ersten Unterrichtserfolge erklärt wurden, sowie den impliziten Intelligenztheorien der Studierenden erwartet. Zu diesem Zweck wurden Fragebogenerhebungen mit $N = 162$ Lehramtsstudierenden aus Deutschland zu Beginn und am Ende ihres 17-wöchigen Schulpraktikums durchgeführt. Dabei zeigte sich ein Anstieg der Selbstwirksamkeitserwartung über den Praktikumszeitraum. In einem Strukturgleichungsmodell wurde die Selbstwirksamkeitserwartung am Ende des Praktikums signifikant von der Selbstwirksamkeitserwartung zu Beginn des Praktikums sowie von der Attribuierung von Erfolgen auf internale, stabile und kontrollierbare Ursachen vorhergesagt, nicht aber von einer veränderbaren Intelligenztheorie. Abschließend werden Implikationen für die weitere Forschung sowie die Lehrerbildung diskutiert.

Schlüsselwörter Selbstwirksamkeitserwartung · Attribution · Implizite Intelligenztheorien · Lehrerbildung

Teachers' self-efficacy beliefs (Bandura 1977a, 2012; Tschannen-Moran et al. 1998) play a crucial role in the motivational part of teachers' professionalism (Baumert and Kunter 2013). Four decades of research have revealed many different areas in daily school life which are affected by teachers' self-efficacy (e.g., Gibson and Dembo 1984; Klassen et al. 2011; Zee and Koomen 2016). Because self-efficacy seems to be mainly influenced by initial experiences and tends to change only a little over time (Bandura 2012; Woolfolk Hoy and Spero 2005), it is important to take a closer look at teachers' self-efficacy at the early stages of its development during teacher education. In the current study, following the identification of mastery experiences as the most important source of self-efficacy (Bandura 1977b), we focus on preservice teachers' school-internship, when the first teaching experiences are made.

   The aim of this study was therefore, to investigate the relationship between attributional patterns, theories of intelligence, and the development of preservice teachers' self-efficacy during their first teaching experiences. To this end, we conducted a longitudinal study over a 17-week internship, collecting questionnaire data first at the beginning of the internship and second at the end of it. We assumed that the way early teaching experiences are made and interpreted is affected by preservice teachers' implicit theories about the malleability of intelligence (e.g., Dweck et al. 1995) and their individual attributional styles for explaining successes and failures in teaching (Abramson et al. 1978; Peterson et al. 1982; Weiner 1985). For example, the impact of a successfully taught lesson on self-efficacy should be stronger if it

is explained by ability or effort instead of good luck. Therefore, we supposed that favorable success attributions as well as an incremental theory of intelligence at the beginning of the internship would predict higher levels of self-efficacy at the end of the internship. As Fives (2003) noted, a great deal of research has revealed relationships between self-efficacy and important educational outcomes, but there is a desideratum of research into ways of enhancing teachers' self-efficacy already during their teacher education. Both of these concepts, attributions as well as implicit theories of intelligence, could possibly be used as simple but effective starting points for supporting preservice teachers' self-efficacy underway with their teacher education, as there are already intervention programs that could be integrated in university courses or—to some extent—in supervision at school (e.g., Blackwell et al. 2007; Weiner 1985).

1 Theoretical framework

1.1 Teachers' self-efficacy

Teachers' self-efficacy is based on the social cognitive theory of Bandura (1977b, 2012) and is defined as "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (Tschannen-Moran et al. 1998, p. 233). There has been ample research done into the importance of teachers' self-efficacy for daily school life: Teachers with a higher self-efficacy showed a higher job satisfaction and commitment (Zee and Koomen 2016), lower stress perception (Schwarzer and Hallum 2008), better psychological and physiological health (Wang et al. 2015), a greater openness towards new teaching methods, instructions of a higher quality (Allinder 1994), and a less custodial but a more supportive and humanistic control ideology (Künsting et al. 2016; Leroy et al. 2007; Woolfolk et al. 1990). A meta-analysis carried out by Klassen and Tze (2014) also revealed a positive relationship between teachers' self-efficacy and their teaching performance, as well as their students' academic performance.

1.1.1 Preservice teachers' self-efficacy

Due to the assumption that self-efficacy is mainly influenced by initial experiences (Bandura 2012; Künsting et al. 2016; Woolfolk Hoy and Spero 2005), school-internships during teacher education, when preservice teachers' first teaching experiences take place, appear to be especially important. Several studies have already addressed changes in self-efficacy during student teaching. Although they are difficult to compare because of different structures of degree courses at various universities, most studies revealed an increase: For example, in studies by Knoblauch and Woolfolk Hoy (2008) as well as by Knoblauch and Chase (2015) in the USA, preservice teachers' self-efficacy increased during a 16-week internship. Likewise, Fives et al. (2007) found an increase during a 12-week internship, and Flores (2015) found an increase during a 5-week internship. Woolfolk Hoy and Spero (2005) revealed

an increase during a 10-week internship, but a decrease during the first year of teaching. In Germany, Bach (2013) and Schulte (2008) found increased self-efficacy during 4- and 5-week periods of student teaching, respectively. In contrast, Pendergast et al. (2011) found a decrease in preservice teachers' self-efficacy during a 7-week internship in Australia.

In order to provide information about possibilities of further enhancing preservice teachers' self-efficacy, it is necessary to take additional factors into account, and to investigate their relationship with the development of self-efficacy. Regarding contextual factors, researchers found that positive relationships existed between preservice teachers' self-efficacy and the guidance of their cooperating teachers (Fives et al. 2007), the estimated level of their cooperating teachers' self-efficacy (Knoblauch and Woolfolk Hoy 2008), the support they received by colleagues, administrators, parents, the community, and provided resources (Woolfolk Hoy and Spero 2005), and the school settings, whereby suburban settings seemed to be slightly more beneficial than urban settings (Knoblauch and Chase 2015; Knoblauch and Woolfolk Hoy 2008). Regarding personal factors, there is still a need for studies investigating how the change of preservice teachers' self-efficacy is affected by their personal beliefs and perceptions.

1.1.2 Structure and development of preservice teachers' self-efficacy

The importance of preservice teachers' perception of their first teaching experience for the development of their self-efficacy can be explained by the development and structure of self-efficacy. Bandura (1977a, 2012) identified four sources of self-efficacy: The most important source are enactive mastery experiences, followed by, with decreasing influence, vicarious experiences, verbal persuasion or similar social influence, and physiological or affective states that influence people's judgments about their own ability. In general, success experiences should increase self-efficacy, whereas failures should reduce self-efficacy. The influence is assumed to be of a particular strength during the initial development of self-efficacy, when it is easily modifiable. With a growing store of experiences, the impact of a single experience is supposed to become reduced in strength. This reasoning is supported by a study by Tschannen-Moran and Woolfolk Hoy (2007), in which mastery experiences were shown to explain greater variance of novice teachers' self-efficacy than variance of experienced teachers' self-efficacy. Furthermore, the subjective explanation of a success or failure experience seems to be decisive for its influence on self-efficacy. Tschannen-Moran et al. (1998) even expected "attributional analysis and interpretations of the four sources of information about efficacy" to be the main influences on self-efficacy (p. 227). Following the assumption that people differ regarding their attributional styles (Abramson et al. 1978), these subjective attributional patterns of success or failure experiences might be a starting point for supporting preservice teachers' self-efficacy during their early internship period.

1.2 Attribution

People's explanations of their success and failure experiences showed a clear influence upon their affective reactions and their future expectations (Weiner 1985, 1994a). In general, it is supposed that crucial factors in this process constitute perceived characteristics of the cause regarding its locus (external vs. internal), stability (variable vs. stable), and controllability (uncontrollable vs. controllable). The locus dimension is theorized to impact mainly on self-directed affects such as self-esteem and pride, whereas the stability dimension is supposed to affect success expectancies in future situations (Weiner 1985). According to the controllability dimension, Weiner (1985) mainly refers to social emotions in case of failure, such as shame or guilt as self-directed affects, and pity or anger (or gratitude in case of a success) towards others. In contrast, Bandura (2012) refers the controllability dimension to self-efficacy and reasons that people with high self-efficacy consider their attainments as more controllable. Furthermore, some researchers (e.g., Abramson et al. 1978; Peterson et al. 1982) argued for a globality dimension (specific vs. global), which is of particular interest in the context of learned helplessness. However, Weiner (1994b) included characteristics of globality in the stability dimension and persisted with three dimensions (Weiner 2014). In general, the cause "effort" is mostly perceived as an internal, unstable, controllable cause, while "ability" or "intelligence" are often experienced as internal, stable, uncontrollable. However, these classifications are not the only possibilities. People might experience intelligence as something to work on and therefore as an unstable and controllable cause (Bandura 2012; Pintrich and Schunk 1996). This subjective perception is important, because it seems not to be the cause itself that influences emotions and expectations, but rather the extent to which the cause is experienced as internal or external, stable or variable, and controllable or uncontrollable, that really matters. Regarding intelligence (and ability as well), there has been done a lot of research on how changeable and controllable intelligence is perceived or, more specifically, on two different implicit theories of intelligence (e.g., Blackwell et al. 2007; Dweck et al. 1995; Hong et al. 1999).

1.3 Implicit theories of intelligence and self-efficacy

The concept of implicit theories of human features such as intelligence distinguishes between beliefs about intelligence as a fixed capacity and beliefs about intelligence as something that is malleable. These different beliefs are supposed to relate to different patterns in cognition and behavior (e.g., Dweck et al. 1995). An incremental theory of intelligence was found to be associated with a stronger interest in learning opportunities (e.g., Burnette et al. 2013; Dinger and Dickhäuser 2013), a higher level of effort valuation (Blackwell et al. 2007), less helpless attributions after failure (Blackwell et al. 2007), more positive emotions in the academic context (King et al. 2012), and higher success expectations (Burnette et al. 2013). Moreover, it seems very reasonable that the belief in the possibility of enhancing one's own intelligence goes along with a stronger belief in one's own capability to master job related challenges. Indeed, a positive relationship between self-efficacy and an incremental theory of intelligence among students was found by Diseth et al. (2014).

Furthermore, Chen and Tutwiler (2017) found higher self-efficacy in self-regulation in science among students with an incremental theory of ability. Also Tabernero and Wood (1999) found self-efficacy to be associated with an incremental theory of ability. Likewise, Leroy et al. (2007) found a relationship between teachers' self-efficacy and an incremental theory of students' ability. Based on these findings, we supposed that an incremental theory of intelligence would predict a positive development of preservice teachers' self-efficacy in the course of their internship. To the best of our knowledge, this has not been empirically addressed so far.

1.4 Self-efficacy and attribution

A few experimental studies investigated the relationship between self-efficacy and attribution. Schunk (1983) revealed in experiments with children solving mathematics problems that self-efficacy increased after children received feedback which explained their progress with their ability, their effort, or their ability *and* effort, whereby the highest increase was found after ability feedback. McAuley et al. (1989) found more stable and controllable, but not internal, success attributions for performances on the bicycle ergometer by children with higher self-efficacy. Likewise, Silver et al. (1995) found there to exist an effect of self-efficacy on attribution and vice versa in experiments with business students; higher self-efficacy was related positively to stable success attributions, but not to internal attributions. Additionally, self-efficacy was related to external and variable failure attribution. Houston (1995) observed that self-efficacy moderated effects of attributions on mood response after failures by students, but not the other way round. In summary, these findings are in line with the notion of reciprocal causality between attributional styles and self-efficacy: On the one hand, self-efficacy is assumed to be mainly based on attributed (and thereby often biased) information of mastery experiences (e.g., Bandura 2012). On the other hand, self-efficacy is assumed to effect attributions, in particular the controllability dimension, as higher levels of self-efficacy are assumed to lead to more controllable attributions (Bandura 2012).

Regarding teachers, Neves de Jesus and Lens (2005) theorized a path model where teachers' attributional style would affect their self-efficacy but found no empirical evidence to support this claim. Fineburg (2010) found significant correlations between teachers' self-efficacy and their success attributions to internal, stable, and global causes, but no significant relationship between self-efficacy and failure attributions. Likewise, Ding et al. (2018) found an internal success attribution to predict higher self-efficacy in their cross-sectional study with preservice teachers. Furthermore, Wang et al. (2015) found weak negative correlations between self-efficacy and internal and stable stress attributions. Reyna and Weiner (2001) investigated attributions and responses of pre- and of in-service teachers regarding students' failures. They found that failures explained by causes controllable by the students led to more punitive responses, while uncontrollable causes led to more utilitarian responses, in particular if they were unstable. The authors assumed that unstable causes that are alterable led to higher influence efficacy and therefore to more utilitarian-driven responses.

To the best of our knowledge, there are no longitudinal studies which address the connection between self-efficacy and attributional style among preservice teachers in the context of their school-internship. Given the importance of the initial development of self-efficacy this is a major desideratum (Fineburg 2010). Furthermore, there is a need for longitudinal studies (Hirschy and Morris 2002) to investigate the relationship of self-efficacy and attribution over time. Such research could provide knowledge about the long-term effects of attribution on self-efficacy or vice versa.

1.5 Research questions and hypotheses

This study centers on the research question:

> Do preservice teachers' attributional styles and their theories of intelligence at the beginning of the internship predict the development of their self-efficacy during the course of the internship?

As a preliminary step, we wanted to know whether preservice teachers' self-efficacy changes during the internship. We expected an increase of self-efficacy throughout the internship. For the following reasons it was likely that our preservice teachers would experience more successes than failures: The preservice teachers in our study received a lot of guidance by a mentor in school and in three accompanying courses at university during their internship. Furthermore, they had already completed an initial 2-week internship where they had prepared and taught one lesson by themselves. This should help them to assess challenges ahead.

Regarding the main research question, we had two hypotheses: First, based on previous research results (e.g., Fineburg 2010; McAuley et al. 1989; Schunk 1983) we expected an internal, stable, and controllable attributional style for successes at the beginning of the internship to predict higher self-efficacy at the end of the internship. We anticipated this attributional pattern to enhance perceived pride, optimistic future expectations, and the feeling of control and competence (Bandura 2012; Weiner 1985), which should be beneficial for self-efficacy.

Second, based on results by Diseth et al. (2014) and Leroy et al. (2007), we expected an incremental theory of intelligence at the beginning of the internship to effect the development of self-efficacy positively. We hypothesized that believing in the malleability of intelligence goes along with a stronger confidence to be able to meet job related challenges, as this belief highlights the possibility to work on and improve one's own abilities through addressing challenges. Moreover, believing that intelligence is incremental was associated with a larger interest in learning opportunities (e.g., Burnette et al. 2013; Dinger and Dickhäuser 2013), a greater appreciation of effort (e.g., Blackwell et al. 2007; Hong et al. 1999) and is supposed to reduce the threat of potential failures (Dweck et al. 1995), which we considered to be beneficial for the development of self-efficacy.

2 Method

2.1 Data collection

We collected the data at a University of Education in the south-west of Germany during the Winter Semester 2016/17. At this university, preservice teachers have to complete three internships. In our study, we focused on the development of self-efficacy during the second internship, the longest and most intense (17 weeks). Preservice teachers have to teach at least 30 lessons during this internship, take part in all daily activities at school, and attend three accompanying courses at university. In one of these obligatory courses, data collections took part. In consultation with the lecturers, we came into the courses with our paper-and-pencil survey and asked the students to participate. There were two data collections, a first questionnaire survey at the beginning of the internship and a second one at the end of the internship.

2.2 Participants

The participation was voluntary and did not include any monetary incentive. All present preservice teachers ($N = 191$) agreed to participate in our pre and post questionnaires. However, at the second data collection 29 participants were not present, which is why we had to exclude them. Thus, our analysis included pre and post questionnaires of $N = 162$ preservice teachers that were matched by individual anonymous codes. Our sample consisted of 120 women and 42 men who were between 21 and 31 years old ($M = 22.86$, $SD = 1.94$), and studied in their 4th–9th semester ($M = 5.38$, $SD = 0.81$).

2.3 Instruments

2.3.1 Preservice teachers' self-efficacy

Preservice teachers' self-efficacy was measured using the scale by Schwarzer and Schmitz (1999). This scale consists of 10 items, of which each should be answered on a 4-point Likert scale, from 1 *"not true at all"* to 4 *"exactly true"*. An example of the items listed on the scale is: "When I try really hard, I am able to reach even the most difficult students." Schwarzer and Schmitz (1999) reported reliabilities of the scale between $\alpha = 0.76$ and 0.82, whereas in this present study α_{pre} was 0.62 and α_{post} was 0.66, which can be considered to be acceptable. Retest-reliability with an interval of 17 weeks was $r = 0.52$.

2.3.2 Attributional style

Preservice teachers' attributional style was measured using a modified version of the "Attributional Style Questionnaire" by Peterson et al. (1982). This scale describes different success situations, which we transferred to the school context. Each of these three situations should be explained by one major cause, located on the three dimensions "external vs. internal" and "variable vs. stable" and "uncontrollable vs.

Table 1 Means, Standard Deviations, Reliabilities, and Correlations between Self-Efficacy, Attribution, and Implicit Theory of Intelligence

	Number of Items	M (SD)	α	1	2	3
1 Pre Self-Efficacy	10	2.97 (0.29)	0.62	–	–	–
2 Post Self-Efficacy	10	3.21 (0.29)	0.66	0.52***	–	–
3 Pre Attribution	9	5.88 (0.67)	0.83	0.28***	0.37***	–
4 Pre Theory of Intelligence	3	2.74 (0.67)	0.81	0.17*	0.19*	0.08

N = 162
*p < 0.05, **p < 0.01, *** p < 0.001

Table 2 Model Fit Statistics for Testing Measurement Invariance over Time for Self-Efficacy

Model	χ^2	df	p	CFI	ΔCFI	RMSEA [90% CI]	ΔRMSEA
Configural Invariance	67.175	58	0.192	0.969	–	0.022 [0.000, 0.043]	–
Metric Invariance	76.534	67	0.199	0.968	0.001	0.021 [0.000, 0.041]	0.001
Scalar Invariance	168.698	77	0.001	0.695	0.273	0.062 [0.049, 0.074]	0.041
Partial Scalar Invariance	83.099	70	0.136	0.956	0.012	0.024 [0.000, 0.043]	0.003

N = 158

controllable". In the original version of the questionnaire by Peterson et al. (1982) the third attributional dimension askes for the globality of the cause. However, we assumed the controllability dimension to be more relevant for our research interest (Bandura 2012) and this was also in line with Weiner's (1985, 2014) theory of three main dimensions as described in the theoretical framework section.

All dimensions have a range from 1 corresponding to *"external", "variable",* and *"uncontrollable"* to 7 corresponding to *"internal", "stable",* and *"controllable"*. An example of the success situation is: "You prepared and taught your first lesson successfully." Using IBM SPSS Statistics 23, we conducted a principle axis factor analysis with one extracted factor, which explained 43.48% of the variance. Factor loadings ranged from 0.49–0.72 and reliability was α = 0.81.

2.3.3 Implicit theories of intelligence

For measuring the implicit theories of intelligence, we used the German translation by Spinath (2001) for the original scale developed by Dweck et al. (1995). This translated scale consists of three items that should be answered on a 4-point Likert scale, from 1 *"exactly true"* to 4 *"not true at all"*. We reduced the original 6-point scale to ensure consistency with the self-efficacy scale. An example of the items listed on the scale is: "You have a certain amount of intelligence and you really can't do much to change it". The reliability of the scale was reported with α = between 0.94 and 0.98, in the present study α = 0.81.
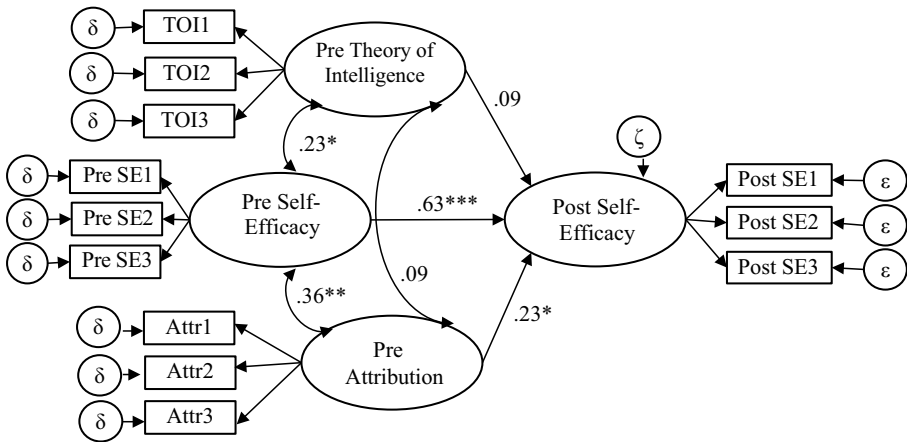
Fig. 1 Structural equation model for predicting post self-efficacy by pre theory of intelligence, pre self-efficacy, and pre attribution ($N = 162$, *$p < 0.05$, **$p < 0.01$, *** $p < 0.001$)

Table 3 Standardized Regression Weights of the SEM for Predicting Post Self-Efficacy by Pre Theory of Intelligence, Pre Self-Efficacy, and Pre Attribution

	β	SE	p
Pre Implicit Theory of Intelligence	0.09	0.03	0.322
Pre Self-Efficacy	0.63	0.22	0.001
Pre Attribution	0.23	0.03	0.023

$N = 162$

3 Results

3.1 Descriptive results

The descriptive statistics are shown in Table 1. The mean values of self-efficacy, especially at the end of the internship, and attribution were quite high, while the standard deviations were rather low. Although the skewness of the data distribution for the attribution measures was slightly negative, and the kurtoses of post self-efficacy, attribution, and implicit theories of intelligence were slightly flat, the scores of all four variables did not significantly differ from a normal distribution.

There were significant correlations between preservice teachers' attribution and their self-efficacy at both times of measurement (see Table 1). Furthermore, there were significant correlations between an incremental theory of intelligence and self-efficacy. Attribution did not correlate significantly with theory of intelligence.

3.2 Preliminary analysis

As a prerequisite, we tested self-efficacy for measurement invariance over time by conducting a multigroup confirmatory factor analysis with Maximum Likelihood Estimation using AMOS by IBM SPSS (see Table 2). First, we tested for configural

invariance to ensure the factor structure fits both times of measurement. Following recommendations by Hu and Bentler (1999) for cutoff values close to 0.95 for Comparative Fit Index (CFI) and 0.08 for Root Mean Squared Error of Approximation (RMSEA), we ensured a good model fit after allowing for justifiable correlated errors (Byrne et al. 1989). Second, we tested for metric invariance to ensure additionally invariant factor loadings. This next step of invariance is indicated by the change of CFI and RMSEA. Depending on the author cutoff values range from 0.01–0.02 for CFI and from 0.01–0.015 for RMSEA (Chen 2007; Cheung and Rensvold 2002; Schwab and Helm 2015). In accordance with these recommendations, metric invariance was reached. Third, we tested for scalar invariance which implies additionally invariant intercepts. Because the difference of CFI and RMSEA exceeded the cutoff values, we released step-by-step constraints in order to attain partial scalar invariance. This less strict form of invariance is met if at least two intercepts per factor are invariant (Byrne et al. 1989; Steenkamp and Baumgartner 1998). With three invariant intercepts we attained an acceptable model fit for partial scalar invariance.

3.3 Predicting preservice teachers' self-efficacy through attributions and implicit theories of intelligence

Using a paired-samples t-test, self-efficacy increased on average from the beginning to the end of the internship (see Table 1), and this difference, $M = -0.24$, BCa 95% CI [–0.27, –0.19], was significant, $t(161) = -10.42$, $p < 0.001$, $d = 0.81$.

For predicting post self-efficacy through pre self-efficacy, pre theory of intelligence and pre attribution we utilized a structural equation model (SEM) and parceled the items of the self-efficacy scale as well as the items of the attribution scale in order to reduce the estimated parameters and to fit our sample size (Little et al. 2002). As Little et al. (2002) proposed, we conducted parcels with three items each (one parcel with four items, respectively) and divided the items between the different parcels according to their factor loadings, starting with the highest and continuing in a zigzag formation to attain adequate balance. Regarding the directive of Hu and Bentler (1999), the indices of our model indicated a good fit to the data, χ^2 (48, $N = 162$) = 75.05, $p = 0.008$, SRMR = 0.047, CFI = 0.96, RMSEA = 0.059, 90% CI [0.031, 0.084] (see Fig. 1).

Post self-efficacy was significantly predicted by pre self-efficacy ($\beta = 0.63$) as well as by pre attribution ($\beta = 0.23$), but not by pre implicit theory of intelligence (see Table 3). In total, the model explained 60% of the variance of post self-efficacy. Additionally, pre self-efficacy was significantly correlated with pre theory of intelligence as well as with pre attribution, but there were no significant correlations between pre attribution and pre theory of intelligence.

4 Discussion

4.1 Increase in self-efficacy

According to the theoretical model by Baumert and Kunter (2013) and ample empirical evidence (e.g., Klassen and Tze 2014; Künsting et al. 2016; Wang et al. 2015; Zee and Koomen 2016), self-efficacy plays an important role in teacher professionalism and hence needs to be supported already during the phase of early teacher education. Therefore, the first interest of our study was to explore how preservice teachers' self-efficacy developed throughout the course of their school-internship. In line with our hypothesis, the data revealed a significant increase of self-efficacy on average. This result is also in line with the majority of previous research results (e.g., Flores 2015; Knoblauch and Chase 2015; Schulte 2008; Woolfolk Hoy and Spero 2005). Regarding teacher education, our result supports the relevance of active teaching experiences, especially for the purposes of increasing self-efficacy.

4.2 Beneficial success attributions predicting increase in self-efficacy

Our main research interest addressed the relationship between preservice teachers' self-efficacy, their attributions, and implicit theory of intelligence.

Therefore, we used a SEM to predict post self-efficacy levels by initial levels of self-efficacy, pre attributions, and pre implicit theories of intelligence. In total, this model explained 60% variance of post self-efficacy, whereby a higher pre self-efficacy and pre attributions to internal, stable, and controllable causes significantly predicted post self-efficacy levels. Although a more incremental theory of intelligence correlated significantly with post self-efficacy, it was no longer significant in the SEM. These results confirm the hypothesis of a positive influence of beneficial success attributions on self-efficacy and are in line with the findings of previous research: Fineburg (2010) found teachers' self-efficacy to correlate with an internal, stable, and global success attributions. Moreover, Schunk (1983) found effort as well as ability feedback to increase self-efficacy. Ability is often seen as an internal, stable, and uncontrollable cause. However, people with an incremental theory of intelligence might perceive ability as more variable and controllable. Furthermore, Bandura (2012) claims that highly self-efficacious people perceive performances as more controllable, which was supported by finding by McAuley et al. (1989). Given the cyclical structure of self-efficacy described by Tschannen-Moran et al. (1998), our results are in line with the supposition that controllable success attributions also enhance self-efficacy.

4.3 Conclusions, limitations, and implications

The study revealed an increasing self-efficacy during student teaching and supports the assumption that internships can make a valuable contribution to motivational aspects of teachers' professional competence (Baumert and Kunter 2013).

Furthermore, the change in preservice teachers' self-efficacy over their internship in school was significantly predicted by their attributional style. A more internal,

stable, and controllable attribution at the beginning of the internship was related to a higher self-efficacy at the end. This longitudinal view is a clear strength of our study. However, a limitation is the exclusive focus on success attributions. Research on failure attributions would have been of particular interest regarding the relationship between failure attribution and implicit theories of intelligence. It would presumably be stronger than the relationship between implicit theories of intelligence and success attribution (Dweck et al. 1995). Believing in an incremental theory of intelligence is supposed to be related to attributing failures to behavioral causes, which allows to keep hoping for a success in the future (e.g., Blackwell et al. 2007; Hong et al. 1999). Even if failures are attributed to a lack of ability, an incremental theory might prevent negative effects on self-efficacy, because ability might be regarded as something that can be improved. It is also noteworthy that we ask for attributional styles by using questionnaires with hypothetical success situations. Success situations had been chosen after consulting with preservice as well as in-service teachers, but nevertheless they might differ from personal teaching experiences. Therefore, it could be also rewarding to take success and failure experiences of actual teaching performance into account. Following the assumption of Tschannen-Moran et al. (1998) that the attributional analysis of mastery experience (and of other sources of self-efficacy) has the major influence on self-efficacy, it could be tested, whether the attributional style moderates the effect of teaching experience on self-efficacy. A further limitation is the acceptable, but low internal consistency of the self-efficacy scale. In further studies, it could be considered to use self-efficacy scales that particularly address preservice teachers. In addition, the self-efficacy scale of Schwarzer and Schmitz (1999) is one-dimensional. As teachers' self-efficacy consists of various aspects, the use of a multidimensional instrument, for example the scale of Skaalvik and Skaalvik (2007) or the scale of Tschannen-Moran and Woolfolk Hoy (2001), could obtain more differentiated information. This would be of particular interest in regard to the initial development of self-efficacy. Moreover, our sample size was relatively small and consisted of students of only one university. Therefore, a replication with students of different universities would be desirable.

In conclusion, our study provides additional support for the assumption of a positive influence of internal, stable, and controllable success attributions on self-efficacy. In accordance with these findings, programs that are meant for improving attributions are potentially promising in supporting preservice teachers' self-efficacy already during the very first stages of its development. More research on those low-threshold possibilities of supporting preservice teachers' self-efficacy would be desirable, because self-efficacy is an important and precious aspect of teachers' professionalism.

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