Z Erziehungswiss (2022) 25:427–451
https://doi.org/10.1007/s11618-022-01093-0

SCHWERPUNKT

Identifying teachers' motivational profiles and their changes from teacher education into practice: A longitudinal study

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Received: 6 May 2021 / Revised: 12 November 2021 / Accepted: 21 January 2022 / Published online: 4 May 2022
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Abstract In the present study, we examined teachers' self-efficacy and enthusiasm as two motivational constructs and assessed how they are organized and change over time, using a sample of 662 participants from the end of pre-service teacher education up to two years after entering the teaching profession. We first used latent profile analyses to identify teachers' motivational profiles. Quantitative motivational profiles were found for those concluding their teacher education, enabling low, medium, and high motivation to be distinguished. Two years after entering the profession, these profiles were no longer clearly identifiable. To investigate the change in the motivational variables, we applied a latent change score model. Finally, we examined whether social support from colleagues, a resource, could explain the change in motivational variables. A significant decrease over time was found for self-efficacy for classroom management and enthusiasm for teaching, while enthusiasm for the subject increased. No significant change was detected for general self-efficacy. Additionally, we found no evidence that social support influences these changes.

Keywords Latent profile analysis · Motivation · Social support · Teacher education

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Identifikation und Veränderung von Motivationsprofilen. Eine Längsschnittstudie von der Lehrerausbildung in den Beruf

Zusammenfassung Der Beitrag untersucht das Zusammenspiel der motivationalen Konstrukte Selbstwirksamkeit und Enthusiasmus von Lehrkräften und deren Veränderung über die Zeit. Dafür wurde eine Stichprobe von 662 angehenden Lehrkräften vom Ende des Vorbereitungsdienstes bis zwei Jahre nach Berufseintritt untersucht. Die latenten Profilanalysen zur Identifikation der Motivationsprofile legen am Ende des Vorbereitungsdienstes drei quantitative Profile nahe, die in niedrig, mittel und hoch motiviert eingeteilt werden können. Zwei Jahre nach Berufseinstieg konnten keine Profilunterschiede mehr ermittelt werden. Um die Veränderung der einzelnen Skalen im Detail zu untersuchen, wurde ein latentes Veränderungsmodell berechnet und danach überprüft, inwiefern die soziale Unterstützung durch Kolleg*innen die Veränderung beeinflusst. Es zeigte sich ein signifikanter Rückgang bei Selbstwirksamkeit bzgl. Klassenführung und Enthusiasmus für das Unterrichten, während für Fachenthusiasmus ein signifikanter Anstieg erfolgte. Kein signifikanter Unterschied über die Zeit zeigte sich für allgemeine Selbstwirksamkeit. Insgesamt gibt es keinen Hinweis darauf, dass die soziale Unterstützung die Veränderung beeinflusst.

Schlüsselwörter Latente Profilanalyse · Lehrerausbildung · Motivation · Soziale Unterstützung

1 Introduction

Teacher motivation is viewed as playing a central role in teaching behavior and, in turn, student achievement (Caprara et al. 2006; Fauth et al. 2019). Teachers who perceive their job as enjoyable and intrinsically rewarding are more satisfied with their job (e.g., Klassen and Chiu 2010; Kunter et al. 2011) provide more support to students and influence their students' motivation (Frenzel et al. 2009). Teacher motivation constitutes a heterogeneous higher-order construct that subsumes a variety of constructs, such as self-efficacy, enthusiasm, goal-orientation, interest, self-regulatory skills, and autonomous motivation. Although research on teacher motivation is flourishing, most studies have investigated motivational factors separately, leaving the following question unexplored: are self-efficacious teachers also enthusiastic toward their teaching, or are there subgroups of teachers with high levels of one motivational variable, but low levels of another? To better understand the interplay between different motivational constructs, the present study takes a person-centered approach, which has the benefit of identifying significant patterns in the data. In particular, we examine teacher self-efficacy and enthusiasm as prominent indicators of teacher motivation that originate from various theories. Self-efficacy is theoretically embedded in theories focusing on expectancies of success (Eccles and Wigfield 2002), such as social cognitive theory (Bandura 1997). Enthusiasm can be justified by theories of intrinsic motivation (e.g., Csikszentmihalyi 1996; Krapp 2002) and is thus connected with theories focusing on the subjective task value (Eccles and Wigfield 2002). The expectancy-value theory (Eccles and Wigfield 2002) combines

both expectations of success and subjective task values. It states that motivation is characterized by the high expectation of success and high subjective task value.

Our study will address this interplay of the variables self-efficacy and enthusiasm and aims to reveal intra-individual differences in teacher motivation profiles, thereby indicating heterogeneity in teacher motivation. In addition to the possible interplay between multiple motivational variables, teacher motivation can be regarded as malleable (Kunter et al. 2013; Locke and Latham 2004) and may change over time. The transition phase from the end of pre-service teacher education to in-service teaching may be crucial for teacher motivation, because it is often perceived as highly stressful and is associated with a reality shock (e.g., Dicke et al. 2015; Voss and Kunter 2020). As a consequence, the attrition rate is particularly high in the first five years of teaching (Ingersoll 2012). In the present study, we therefore examine how teacher motivation changes from the end of pre-service teacher education to in-service teaching. Further, we aim to examine resources to foster teacher motivation in order to avoid dropout in this early professional phase. Both the expectation of success (self-efficacy) and the subjective value attributed to a task (teacher enthusiasm) are influenced by individual characteristics and contextual factors (e.g., Eccles and Wigfield 2002). Our study relies on the contextual factor social support from colleagues, seen as a resource from the social environment that could affect the expectation of success and the subjective task value.

Adopting a longitudinal design, we examined how teacher motivation changed at the end of teacher education until two years after entering the profession. We further investigated a supportive mechanism, namely the effects of collegial resources, and examined whether social support explained a change in motivational variables.

1.1 Motivational profiles comprised of teacher self-efficacy and enthusiasm

In order to investigate how different motivational constructs are organized within teachers, in the present study we focused on two constructs that stem from different theoretical conceptualizations and cover different aspects of motivation. In their overview of motivational theories, Eccles and Wigfield (2002) distinguish between theories of expectancy and theories of engagement (value). Self-efficacy represents a competence belief with a strong cognitive component (Bandura 1997) and focuses on the expectancy of success, whereas enthusiasm represents a value-related belief that is more affective in nature (Kunter and Holzberger 2014; Kunter et al. 2008). In the context of teaching, self-efficacy is a teacher's belief in his or her abilities to teach successfully and perform all actions associated with teaching, including the ability to influence student outcomes, such as learning and engagement, persists even in difficult situations or when experiencing setbacks (Klassen and Chiu 2010; Tschannen-Moran and Woolfolk Hoy 2001, 2007).

Within general self-efficacy in teaching, various domain-specific facets can be distinguished, such as self-efficacy in instruction, student engagement, and classroom management (e.g., Tschannen-Moran and Woolfolk Hoy 2001). In addition to general teacher self-efficacy, this study also examines teacher self-efficacy for classroom management, which is described as the judgment of one's own ability to deal with challenging situations in the classroom and includes, for example, dealing

with disruptive behavior, planning and organizing lessons, and setting rules (e.g., Tschannen-Moran and Woolfolk Hoy 2001). Effective classroom management is especially relevant for beginning teachers (Dicke et al. 2015), since avoiding disruptions in the classroom has an impact on teacher's identity and leads to teaching quality (Lazarides et al. 2020). Additionally, the meta-analysis by Aloe et al. (2014) found that self-efficacy for classroom management was significantly related to all three burnout dimensions and thus may be decisive for teachers remaining in their profession.

Teacher enthusiasm can be described as the joy or excitement of teaching as an activity-related part of the teaching profession (Keller et al. 2016; Kunter et al. 2008). Since enthusiasm for teaching and for the subject are based on different mechanisms, it is important to examine enthusiasm in a differentiated way. While enthusiasm for teaching points to the joy a teacher experiences in the classroom, enthusiasm for the subject refers to the subject's content (Kunter et al. 2011). Conceptualized as such, teacher enthusiasm can be regarded as a value component.

In the expectancy-value theory (Eccles and Wigfield 2002) task values can be further differentiated into four components. (1) intrinsic value (the degree of personal enjoyment), (2) attainment value (the personal importance of doing a task well), (3) utility value (the perceived usefulness for future goals), and (4) cost (focusing on the competition with other goals). As such, teacher enthusiasm can be referred to an intrinsic value.

To sum up, self-efficacy and enthusiasm are motivational constructs that can be theoretically distinguished. The question is how the more cognitive (self-efficacy) and the more affective (enthusiasm) motivational variables are interrelated. Studies that have addressed the correlation between self-efficacy and enthusiasm found predominantly positive relationships between the variables (Burić and Moè 2020; Decker et al. 2015; Fauth et al. 2019; Kunter et al. 2011; Lazarides et al. 2021; Praetorius et al. 2017; Thommen et al. 2021). However, variable-centered approaches that investigate the interrelations between variables do not reveal how the variables are organized within persons. In line with the prediction of expectancy-value theory (Wigfield and Eccles 2000) that motivational constructs do not act independently, a person-centered approach is useful in investigating them in combination. Only a few studies have examined motivational profiles from a person-centered perspective. Rodriguez et al. (2014) examined university teachers' self-efficacy and identified three profiles: teachers with high, medium, and low self-efficacy. Thommen et al. (2021) investigated the interplay between enthusiasm, self-efficacy, and goal orientation and found a three-profile solution that only varied in terms of goal-orientation. Holzberger et al. (2021) included motivational-affective constructs and cognitive characteristics and found another three profiles: (1) highly knowledgeable and engaged, (2) below-average knowledge, and (3) below-average beliefs, motivation, and self-regulation. In the present study, we examined whether teachers' self-efficacy and enthusiasm are organized similarly within teachers or whether there are teachers with low self-efficacy and high enthusiasm or the obverse.

1.2 Changes in teacher self-efficacy and enthusiasm from teacher education to practice

Teacher motivation in general is perceived not as stable but as rather malleable over time (Kunter et al. 2013; Locke and Latham 2004). When examining the changes in teacher motivation, the transition from teacher education into practice may be of particular interest, because starting to work at school is often associated with a "reality shock" (e.g., Dicke et al. 2015). Additionally, previous research reported that teacher attrition, which may be caused by a decrease in motivation, is especially high during the first five years of teaching in schools (Ingersoll 2012). Therefore, the entry into the teaching profession plays a particularly important role.

Self-efficacy is also thought to be malleable, particularly at the beginning of teacher education and during the first years of teaching, strengthening as teachers gain experience (e.g., Fives et al. 2007; Tschannen-Moran and Woolfolk Hoy 2007). Bandura (1997) suggests that four sources may change self-efficacy beliefs: (1) *Mastery experience,* often considered the strongest source, refers to actual teaching experience. If teaching is perceived as successful, the expectation is built up that future teaching performance will also be successful. (2) *Vicarious experience* can be made by observing an experienced teacher (or other colleagues) teach. If the teacher's performance is perceived as good and identification is high, the observer's teacher self-efficacy can be increased. (3) *Social/verbal persuasion* refers to feedback, e.g., from colleagues and mentors. Finally, (4) *physiological arousal* covers the attributions of palpitations and excitement. Tschannen-Moran and Woolfolk Hoy (2007) and Wolters and Daugherty (2007) suggest that beginning teachers start with lower self-efficacy expectations, which increase over time through teaching experience and, possibly, favorable contextual factors. Studies that examine teachers over a very long period report a nonlinear or u-shaped relationship of teacher self-efficacy (Klassen and Chiu 2010). These trajectories are characterized by an initial rise in self-efficacy expectations until mid-career (0 to 23 years of experience), followed by a flattening out (Klassen and Chiu 2010).

To date, only a few studies have investigated the variability of teacher enthusiasm, and few predictors are known to influence and shape enthusiasm (Burić and Moè 2020; Kunter et al. 2011). When studying changes in teacher enthusiasm, it is imperative to distinguish between the dimensions of enthusiasm for teaching and enthusiasm for the subject. While enthusiasm for teaching is considered dependent on the school and class context (Keller et al. 2016), enthusiasm for the subject is considered context-independent and primarily related to a person's individual interest in the teaching subject (Krapp 2002). As a consequence, enthusiasm for the subject may be rather stable (Kunter et al. 2011), whereas external factors influencing enthusiasm for teaching are classroom variables such as student interaction, student motivation and performance (Frenzel et al. 2009), class size, class composition, discipline, and class behavior.

In the transition from pre-service teacher education to school, a change in contextual variables takes place. Classroom variables, new teaching experiences, changes in the reference group (being new in an existing collegium), and other school context variables (e.g., size and location of the school) all lead to teacher self-effi-

cacy adjustments (Holzberger et al. 2013; Wolters and Daugherty 2007) as well as changes in teaching enthusiasm (Keller et al. 2016). Based on inconclusive findings, an increased demand exists for longitudinal studies that provide information about the development of motivational scales (Klassen and Chiu 2010; Tschannen-Moran and Woolfolk Hoy 2007), including different phases of teacher education (Tschannen-Moran and Woolfolk Hoy 2007). The aim of this study is to investigate the relationship between self-efficacy (in general and for classroom management) and enthusiasm (for teaching and for the subject), and their change, over different phases in teachers' careers. Moreover, it is crucial to identify support resources from the school environment, particularly for phases in which it is challenging to keep motivated teachers in the profession.

1.3 Social support as a potential resource

In addition to the change of motivational variables across phases, empirical studies hardly address contextual variables and their relationship with teacher motivation (e.g., Holzberger and Prestele 2021). Nevertheless, contextual variables are often supposed to predict both, expectation of success and the subjective value attributed to a task (Bandura 1997; Chen and Kanfer 2006; Wigfield and Eccles 2002). Thus, in the present study, we focus on teachers' colleagues as one relevant aspect of a teacher's professional context and examine whether social support from colleagues can constitute a possible resource for motivation (Chen et al. 2020), for example, by helping to cope with challenging situations. In teacher education, social support is seen as an interactive process and can take the form of collaboration with colleagues or vicarious observation of teaching situations (Woolfolk Hoy and Burke Spero 2005). Conventionally, social support covers three dimensions—informational, instrumental, and emotional—each with a different function. Experts usually provide *informational support*, which includes information and advice (e.g., Schwarzer et al. 2003). *Instrumental support* provides concrete materials (e.g., Richter et al. 2011), while *emotional support* offers comfort in the form of closeness (Richter et al. 2011), thereby calming the other person (Schwarzer et al. 2003). Specifically, emotional support leads to emotional well-being and includes encouragement, listening, and mutual care (e.g., Kassis et al. 2019).

Adler-Constantinescu et al. (2013) found a positive correlation between self-efficacy and perceived social support, which is generally valid for adulthood. Evidence indicates that teachers who were supported socially during their first year of teaching developed higher teacher self-efficacy (Chen et al. 2020), agreeing with Woolfolk Hoy and Burke Spero (2005) findings that perceived social support positively affects perceived self-efficacy. Zhao and Zhang (2017) found that a lack of support leads to negative outcomes for beginning teachers during the pre-service phase.

In addition to the relationship between social support and self-efficacy, there also seems to be a connection between social support and enthusiasm. Previous research indicates that enthusiasm for teaching is particularly influenced by variables from the school context, e.g., disruption or student behavior in the classroom (Keller et al. 2016). In line with those assumptions, Cobb and Foeller (1992) found a positive relationship between support from colleagues and teacher enthusiasm. Richter et al.

(2013) demonstrated that, especially for beginning teachers, enthusiasm correlates with mentoring.

Thus, in the present study, we investigated whether social support from the social work environment can explain a change in motivational variables.

2 Focus and research questions

This study used latent profile analyses at two measurement points to identify motivational profiles and examine their stability. Both competence-related beliefs (self-efficacy scales) and value-related beliefs (enthusiasm scales) were considered. Prior studies examined these variables primarily with a variable-centered approach by investigating how facets of motivation individually are related to outcome variables (e.g., Keller et al. 2018; Rodriguez et al. 2014). While a person-centered approach allows the relationships of variables to be examined comprehensively and identifies significant patterns in the data, the often-used variable-centered approach requires the subgroups to be defined in advance, which requires knowledge about how the variables interact with each other. In addition, the variable-centered approach requires a substantial sample size, which increases with the number of predictor variables. One advantage that was crucial for our analyses is the exploratory nature of latent profile analysis, in which relationships and interactive effects between variables can be captured simultaneously. Our goal was to use a person-centered approach to find out more about the relationship between the variables within a motivation profile. Subsequently, we investigated whether the pattern is invariant over time and examined the change of motivational variables from the end of teacher education up to two years into the teaching profession. Finally, social support from a professional work environment is viewed as an essential component of the social learning environment and may be related to teacher motivation. These assumptions allow us to evaluate the following research questions (RQ):

RQ I What kind of motivational profiles were observed at the end of pre-service teacher education (time 1)?

RQ II How do motivational profiles change after entering the teaching profession (time 2)?

RQ III Does colleagues' social support predict the change in teacher's motivation from time 1 to time 2?

3 Methods

3.1 Participants and data collection procedures

This study's sample ($N = 662$) covered two measurement points: the end of pre-service teacher education (t1, $n = 662$) and two years after entering the teaching profession (t2, $n = 204$).

All data came from a large German research program (Kunter et al. 2017) with currently six measurement points covering the time span from the beginning of pre-service teacher education until seven years after entering the teaching profession. The first measurement point took place on site at teacher-training institutes and maps the population of beginning teachers in pre-service teacher education in North Rhine-Westphalia ($N = 1763$). At this measurement point the participation rate was over 90%. After this full survey, a reduced but representative subsample was followed up longitudinally. To enable a representative sample equal consideration of school tracks and regions was taken into account. Participation in the survey was voluntary. Basis for this study are the measurement points at the end of pre-service teacher education (time 1) and two years after entering the teaching profession (time 2). For detailed information to the teacher education system in Germany, see the Appendix (p. 1). 77% of the participants were female, and 23% were male. At the first measurement point, participants were on average of 28.14 years old ($SD = 3.31$), with 41.3% teaching in academic schools and 52.8% in non-academic schools. A well-known problem in longitudinal studies is missing data (e.g., Graham 2009). Due to the longitudinal design and the transition phase, which is considered stressful, there is a high dropout from t1 to t2. The results of dropout analyses showed no significant differences between demographic variables (Appendix: Table A1–A3, p. 2). Additionally, we found no differences between motivational variables. Thus, it can be assumed that the dropout is random. The analyses were estimated using the full information maximum likelihood approach (Enders and Bandalos 2001), which ensured that all participants who provided data on at least one measurement point can be included in the analyses (Parker et al. 2015). This study's data were deposited at the Research Data Center at the Institute for Educational Quality Improvement Germany, for which access can be requested for secondary analyses. The syntaxes of the analyses are available through the Open Science Framework:

https://osf.io/qyhaz/?view_only=ac0af5cb9cf140699f19f6884c5cc01d

3.2 Instruments

Teacher candidates rated the four motivational constructs and their support from colleagues on a questionnaire. We calculated manifest scales to include the variables in the latent profile analyses. The manifest scales' psychometric properties are provided in Table 1. For the longitudinal analysis (measurement invariance and latent change score models), we also ran confirmatory factor analyses. Results from the confirmatory factor analyses are presented in the Appendix (Table A4–A5, p. 3).

The participants rated their *general self-efficacy* using the Teacher Self-Efficacy Scale (Schwarzer et al. 1999), which was based on Bandura (1997) and contains

10 items on a four-point Likert scale (from 1 = does not apply to 4 = does apply) with Cronbach's alpha coefficients of 0.805/0.786 (t1/t2). The scale includes various job skills that are related to quality teaching, namely, job accomplishment, skill development on the job, interactions with students, parents, and colleagues, and coping with stressful situations in the teaching profession. An example item for job accomplishment is: "I am convinced that I am able to successfully teach all relevant subject content to even the most difficult students."

S*elf-efficacy for classroom management* includes eight items and is a subscale of the Teachers' Sense of Efficacy Scale, developed by Tschannen-Moran and Woolfolk Hoy (2001). The response categories were structured on a six-point Likert scale (from 1 = very little to 6 = very much) with alpha coefficients 0.852/0.900 (t1/t2). An example item is: "How well can you respond to defiant students?"

Enthusiasm for teaching and *enthusiasm for the subject* were based on the Teacher Enthusiasm Scale associated with the COACTIV project (Kunter et al. 2011). Both scales were comprised of four items rated on a four-point Likert scale (from 1 = does not apply to 4 = does apply). The alpha coefficients for the scale enthusiasm for teaching were 0.794/0.810 (t1/t2). An example item for enthusiasm for teaching is: "I teach with great enthusiasm." An example item for enthusiasm for the subject is: "I am enthusiastic about my subject." The alpha coefficients for the scale enthusiasm for the subject were 0.715/0.699 (t1/t2).

Social support by colleagues was adapted by Richter et al. (2011). Altogether, 14 items comprise the emotional, instrumental, and informational support domains. An example item for emotional support is: "I can talk with colleagues about the daily problems of professional life" (from 1 = does not apply to 4 = does apply). Social support from colleagues was recorded only at t2 because the social environment in pre-service teacher education (t1) is different and includes mainly peers or mentors. Through confirmatory factor analyses, we replicated three subfactors, but removed three items for this study's analyses. Alpha coefficients at t2 were 0.867.

Covariates. We included gender, school track, and age as covariates in our analyses. Gender (coded as 0 = *female*, 1 = *male*) and school track (0 = *non-academic track*, 1 = *academic track*) were viewed as binary variables.

3.3 Analytic strategy and data modeling

We used the statistical modeling program Mplus 8.3 for the profile analyses (Muthen and Muthen 2017). Latent change models were conducted with R Version 4.0.2, using the package lavaan (Rosseel 2012). The overall significance level was defined at $\alpha = 0.05$.

3.3.1 Latent profile analyses

To identify teachers' motivational profiles (RQ I), we examined how teacher candidates differed in teacher self-efficacy (generally and for classroom management) and enthusiasm (for teaching and the subject) at the end of pre-service teacher education. Latent profile analyses (LPAs) were used to determine subgroups with similar characteristics (e.g., Nylund et al. 2007). Nylund et al. (2007) strongly recommend

interpreting multiple criteria to find the best number of profiles. We included fit indices such as the Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-size adjusted Bayesian information criterion (SABIC). Models with lower values indicate a better model fit. We also included the Lo-Mendell-Rubin test (LMR LR), which compares the model fit between models with k and k-1 profiles. Statistically significant values indicate that the empirical data are represented significantly better than a comparative model with one less profile. Entropy was used to measure the latent profile model's classification quality, which should be >0.80 (Celeux and Soromenho 1996). Finally, the average latent class probabilities for the most likely class memberships were used, which should be >0.80 (Collins and Lanza 2010). For our study, we ran models based on four different variance-covariance matrices (class-invariant diagonal, class-varying diagonal, class-invariant unrestricted, class-varying unrestricted), which differ in whether the variance across classes is homogeneous or heterogeneous and whether or not covariance of the indicator variables is allowed. Following this, model comparisons were used to decide which one best fit the data (Masyn 2013). After profile analyses, we conducted a MANOVA with Tukey post hoc comparisons to verify whether the profiles differed significantly from each other. The covariates gender, school track and age were included in the analyses using a three-step approach.

3.3.2 Longitudinal analyses

Our further research interest was to investigate the change in motivational variables after entering the teaching profession (RQ II). There are different methods of dealing with longitudinal data (e.g., latent-transition analyses or latent change score models). A prerequisite for longitudinal analyses is measurement invariance. Using a stepwise approach, we tested the motivational indicator variables for measurement invariance across time (t1 to t2). We investigated whether the data structure (configural invariance), the loadings (metric invariance), and the intercepts (scalar invariance) stayed the same for both measurement points (e.g., Davidov et al. 2014). For further information on measurement invariance, we added Table A6 to the Appendix. From a person-centered perspective, one can calculate latent transition analyses (LTA), provided that the cross-sectional LPAs reveal the same number of profiles across measurement points. If the requirements for a latent transition analysis are not met, from a variable-centered approach one can apply latent change score models (LCSM: e.g., McArdle 2009). Besides the latent motivational variables at t1 and t2, the model includes a latent modeled change variable, which represents the average change from t1 to t2. This change variable provides insights into within-person differences.

Since our study did not meet the conditions for a latent transition analysis were computed a latent change score model to investigate the change in motivational scales and to investigate the relationship of the variables (see Fig. 1 for a schematic overview of the model).

For model evaluation, we used fit indices (CFI, TLI, RMSEA, SRMR) according to Hu and Bentler (1999). Finally, we included social support as a predictor into

the latent change score model to assess whether colleagues' social support has an impact on motivation (RQ III).

4 Results

Correlation analyses were conducted to investigate the relationship between the variables under investigation (see Table 1). All correlations were positive and in the expected direction. Generally, our four scales' mean levels indicated that our sample's participants seem highly motivated and supported on average.

4.1 Latent profile analyses

To examine the motivational profiles at the end of pre-service teacher education (RQ I), we started by evaluating a one-profile model and increased the number of profiles in the estimation up to five profiles. First, the variance-covariance matrix that best fit the data was selected (Appendix: Table A7–A8, p. 7 f.), which was class-invariant unrestricted. With this option, the underlying assumption is variance homogeneity, but the indicators are allowed to covary. Table 2 gives an overview of unstandardized and z-standardized means of the latent profiles and Table 3 provides the tested models' fit statistics. After considering the statistical results, we selected the three-profile solution due to fit indices, profile sizes, and the theoretically best fit. The mean probability of profile membership can be classified as high in this solution (92–99%). In terms of content, we identified *low, medium,* and *high* motivation profiles (see Fig. 2). The low profile covers only six people and is characterized by low levels of self-efficacy and enthusiasm. The medium profile ($N = 162$) indicates stable values in the areas of self-efficacy, while enthusiasm for teaching also has a lower mean value. The high profile ($N = 490$) remains relatively stable on all scales and has the highest mean scores compared with the others. Additionally, the MANOVA with Tukey post hoc comparisons indicated that the profiles differ significantly from each other (Appendix, p. 8). The analyses' results with covariates can be found in the Appendix (Table A9, p. 9).

4.2 Longitudinal analyses

4.2.1 Latent profile analyses at T2

A similar procedure was used to address RQ II: How does the motivational profile change after entering the teaching profession? We again conducted models from one to five profiles for a measurement point that occurred two years later. For the assessment fit indices, mean probability, entropy, and the Lo-Mendell-Rubin-Test were used. For the career-entry phase, the profiles are not significantly separable from each other (see Table 3). Since no patterns are found in the data at t2, the conditions for a latent transition analysis are not met. For this reason, a latent change score model was used to examine the change in motivational variables in more detail.

Table 1 Means, correlations of the study variables at time 1 and time 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. General self-efficacy t1 (F1)	1.00															
2. General self-efficacy t1 (F2)	**0.54**	1.00														
3. General self-efficacy t2 (F1)	**0.57**	**0.31**	1.00													
4. General self-efficacy t2 (F2)	**0.36**	**0.56**	**0.52**	1.00												
5. Self-efficacy CM t1 (F1)	**0.52**	**0.43**	**0.41**	**0.39**	1.00											
6. Self-efficacy CM t1 (F2)	**0.42**	**0.33**	**0.30**	**0.27**	**0.65**	1.00										
7. Self-efficacy CM t2 (F1)	**0.41**	**0.32**	**0.58**	**0.45**	**0.55**	**0.30**	1.00									
8. Self-efficacy CM t2 (F2)	**0.28**	**0.32**	**0.49**	**0.38**	**0.47**	**0.38**	**0.73**	1.00								
9. Enthusiasm teaching t1	**0.38**	**0.38**	**0.29**	**0.31**	**0.44**	**0.34**	**0.40**	**0.34**	1.00							
10. Enthusiasm teaching t2	**0.24**	**0.29**	**0.45**	**0.48**	**0.30**	**0.24**	**0.40**	**0.28**	**0.60**	1.00						
11. Enthusiasm subject t1	**0.21**	**0.28**	0.12	**0.26**	**0.24**	**0.17**	0.07	0.09	**0.52**	**0.44**	1.00					
12. Enthusiasm subject t2	**0.16**	**0.36**	**0.20**	**0.41**	**0.15**	**0.17**	0.11	**0.16**	**0.32**	**0.53**	**0.69**	1.00				
13. Support colleagues t2	**0.19**	**0.30**	**0.18**	**0.28**	**0.19**	**0.25**	0.12	0.11	**0.26**	**0.31**	**0.17**	**0.16**	1.00			
14. Age t1	0.06	0.05	–0.05	0.02	–0.05	–0.07	–0.11	**–0.14**	–0.08	–0.09	–0.03	0.01	–0.12	1.00		

Table 1 (Continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
15. School type	**0.09**	**0.13**	0.01	0.15	**0.11**	0.09	0.06	0.07	0.05	0.08	0.07	0.15	**0.19**	–	1.00	
16. Gender	0.04	0.05	0.04	0.05	0.06	0.07	**0.18**	0.08	**0.15**	**0.24**	0.05	0.10	**0.19**	–	–	1.00
M	3.12	3.13	3.15	3.10	4.75	4.67	4.71	4.53	3.59	3.51	3.28	3.30	3.21	28.14	–	–
SD	0.46	0.50	0.44	0.54	0.61	0.73	0.68	0.76	0.44	0.47	0.50	0.51	0.52	3.30	–	–
Range	1–4	1–4	1–4	1–4	1–6	1–6	1–6	1–6	1–4	1–4	1–4	1–4	1–4	24–51	–	–

Note: Correlation coefficients of the indicator variables. Significant variables ($p < 0.05$) are printed in bold

4.2.2 Latent change score analyses

In order to investigate research question II in more detail, and to find out more about the change in motivational variables, we applied a latent change score model with multiple indicators to map the change over time. For each motivational scale the model consist of latent variables (t1 and t2) and a latent change factor that captures the change between t1 and t2 (see Fig. 1). McArdle and Prindle (2008) define change as "the basis of the sequential influences of one variable on another over time" (p. 704). In addition to the change over time, the relationship of all motivational variables was examined.

Descriptive results of the latent change score models are presented in Table 4. Since the CFAs assume two separate factors for general self-efficacy as well as for self-efficacy for classroom management (Appendix, p. 3), we included separate factors in the overall model. Factor one, general self-efficacy, is measured with regard to problematic students and parents, while factor two focuses on innovative teaching

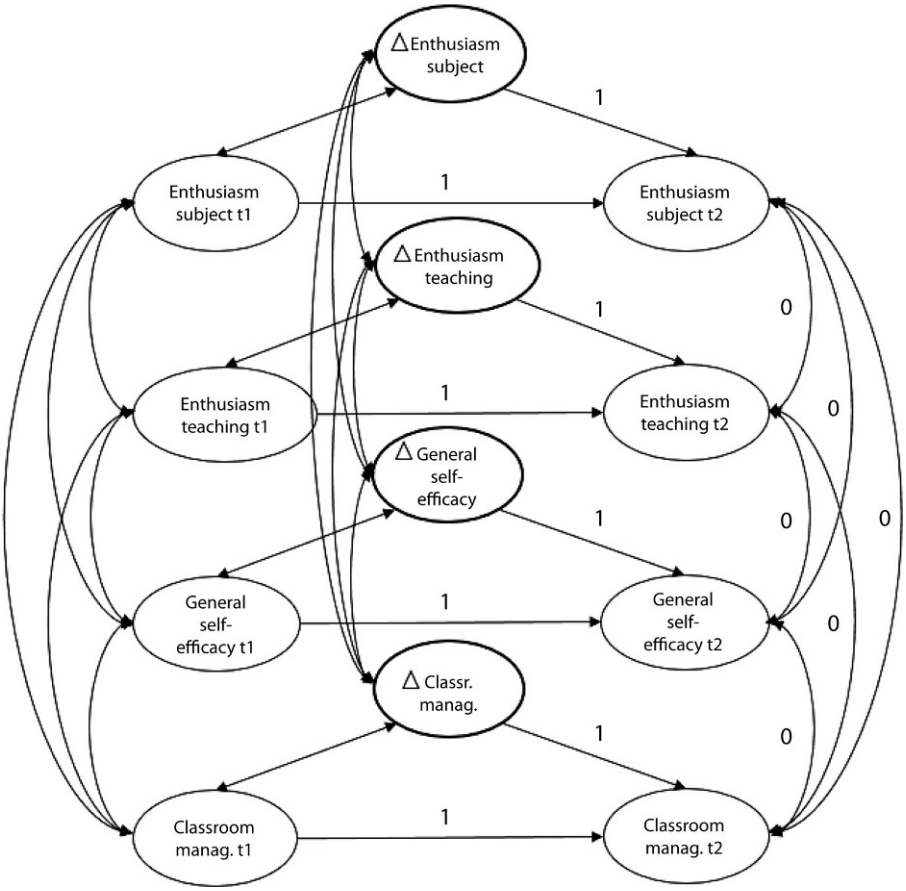

Fig. 1 Simplified schematic representation of the latent change score model. The overall model includes different factors for general self-efficacy and self-efficacy for classroom management

Table 2 Unstandardized means and z-standardized scores for indicator variables time 1

Low motivation			Medium motivation		High motivation	
	M	*Z*	*M*	*Z*	*M*	*Z*
General self-efficacy	2.373	–1.772	2.860	–0.618	3.214	0.219
Self-efficacy for classroom-management	3.358	–2.278	4.405	–0.528	4.860	0.234
Enthusiasm for teaching	1.807	–4.014	3.002	–1.317	3.797	0.478
Enthusiasm for the subject	1.923	–2.719	2.961	–0.637	3.398	0.239

methods. Factor one of self-efficacy for classroom management deals with lesson procedures and factor two on disruptive behavior. For enthusiasm for teaching, as well as enthusiasm for the subject, four items load on one latent factor each.

The majority of latent mean scores indicate high self-efficacy and enthusiastic participants. Slightly lower values were found for general teacher self-efficacy (only for the factor problematic students and parents) and enthusiasm for the subject (self-efficacy for classroom management: range 1–6, all other scales: range 1–4).

The latent change score model shows acceptable fit indices ($X^2 = 1293.423$, $df = 940$, CFI = 0.950, TLI = 0.945, RMSEA = 0.024, SRMR = 0.058), and for the majority of the scales a significant change in the latent change score variable for means and variances (see Table 4). A significant and positive mean in the respective change score variable indicates that there is an increase from t1 to t2, whereas a negative mean indicates the opposite. A significant and positive mean difference can be reported for enthusiasm for the subject ($M = 0.155$, $SE = 0.061$, $p < 0.05$), while significant and negative mean differences were found for self-efficacy for classroom management (disruptive behavior: $M = -0.234$, $SE = 0.064$, $p < 0.05$), and enthusiasm for teaching ($M = -0.163$, $SE = 0.044$, $p < 0.05$). No sig-

Table 3 Fit indices for latent profile models at time 1 and time 2

k	*AIC*	*BIC*	*ABIC*	*Loglikelihood*	*LMR-LR (p-value)*	*Entropy*
Time 1						
1-profile	2881.821	2944.670	2900.220	–1426.911	–	–
2-profile	2753.740	2839.034	2778.709	–1357.870	0.0369	0.834
3-profile	**2673.108**	**2780.849**	**2704.648**	**–1312.554**	**0.0361**	**0.911**
4-profile	2640.219	2770.406	2678.330	–1291.109	0.4055	0.880
5-profile	2611.199	2763.831	2655.881	–1271.599	0.2980	0.892
Time 2						
1-profile	841.888	885.953	841.622	–406.944	–	–
2-profile	821.220	881.022	820.859	–391.610	0.2310	0.815
3-profile	790.926	866.466	790.470	–371.463	0.1033	0.913
4-profile	783.885	875.162	783.334	–362.943	0.5850	0.926
5-profile	770.870	877.885	770.225	–351.435	0.0968	0.945

Note. k Number of profiles, *AIC* Akaike Information Criterion, *BIC* Bayesian Information Criterion, SABIC Sample Size Adjusted Bayesian Information Criterion, *LMR-LR* Lo-Mendell-Rubin-Test. Final model is printed in bold

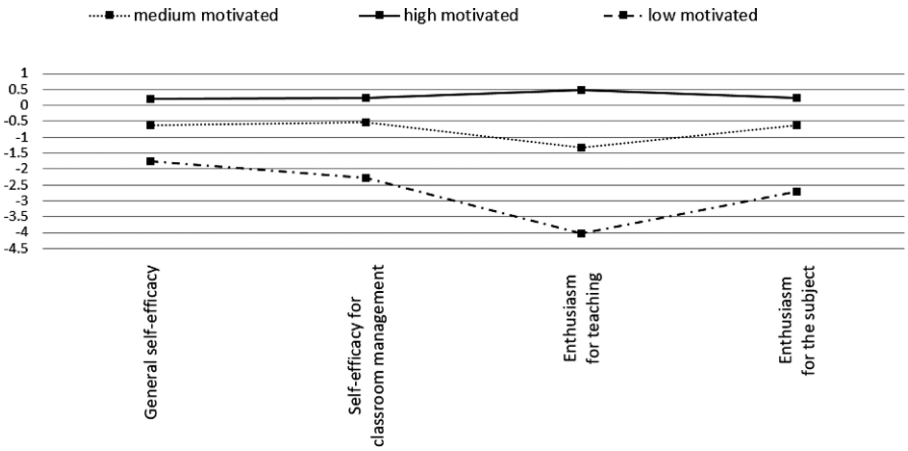

Fig. 2 Three-profile solution with standardized means on all indicators (t1)

Table 4 Descriptives of the latent change score model

	Mean T1 (latent)	*Mean T2 (latent)*	*Mean (change)*	*Variance (change)*
General self-efficacy (F1: Problematic students and parents)	2.611	2.662	0.051	**0.086**
General self-efficacy (F2: Innovative teaching methods)	3.172	3.161	–0.011	**0.112**
Self-efficacy for classroom-management (F1: Lesson procedures)	4.759	4.757	–0.002	**0.383**
Self-efficacy for classroom-management (F2: Disruptive behavior)	4.657	4.423	**–0.234**	**0.621**
Enthusiasm for teaching	3.633	3.470	**–0.163**	**0.169**
Enthusiasm for the subject	2.386	2.541	**0.155**	**0.037**

Note. Significant means and variances are printed in bold ($p < 0.05$)

nificant changes over time can be reported for general self-efficacy (problematic students and parents: $M = 0.051$, $SE = 0.056$, $p = 0.365$; innovative teaching methods: $M = –0.011$, $SE = 0.048$, $p < 0.822$) and self-efficacy for classroom management lesson procedures ($M = –0.002$, $SE = 0.068$, $p = 0.973$). In addition to changes in means, significant differences in variances of the latent change score variable were found for all motivational scales, suggesting differences between individuals: General self-efficacy (problematic students and parents: $\sigma = 0.086$, $SE = 0.023$, $p < 0.05$, innovative teaching methods: $\sigma = 0.112$, $SE = 0.038$, $p < 0.05$), self-efficacy for classroom management (lesson procedures: $\sigma = 0.383$, $SE = 0.072$, $p < 0.05$, disruptive behavior: $\sigma = 0.621$, $SE = 0.098$, $p < 0.05$), enthusiasm for teaching ($\sigma = 0.169$, $SE = 0.041$, $p < 0.05$), and enthusiasm for the subject ($\sigma = 0.037$, $SE = 0.013$, $p < 0.05$). Results for the latent change score model with covariates can be found in the Appendix (p. 10 f.).

To address our third research question, whether colleagues' social support explains a change in motivation, we included support from colleagues as a predictor in the model. Model fit is sufficient ($X^2 = 1432.997$, $df = 1010$, CFI = *0.*941, TLI = 0.937, RMSEA = 0.025, SRMR = 0.083). Results indicated that the resource from the social work environment does not significantly affect the motivational change variables (Appendix: Table A12, p. 10).

5 Discussion

Most previous research used a variable-centered approach to study the relationship between self-efficacy and enthusiasm. While different motivational constructs indicate specific relationships with outcome variables, the question is how these motivational variables relate to each other for teachers. Therefore, this research used a person-centered approach and identified motivational profiles with indicators for self-efficacy and teacher enthusiasm. Then we reviewed their stability and change from pre-service teacher education up to two years into the teaching profession. This study also aimed to determine whether the resource social support from colleagues can explain a change in motivational variables.

5.1 Profiles at the end of pre-service teacher education

Our study builds on previous research by examining the interplay among various indicators of motivation with respect to an individual. Previous research has demonstrated that a positive relationship between motivational variables exists (e.g., Burić and Moè 2020; Fauth et al. 2019) and that the separate motivational variables—for example, high enthusiasm—lead to teachers' well-being (e.g., Aloe et al. 2014; Keller et al. 2016), as well as positive outcomes for students (e.g., Caprara et al. 2006). Regarding the intra-individual interplay, we found three motivational profiles at the end of pre-service teacher education (*low, medium,* and *high*). Although the motivational variables theoretically differ, quantitative rather than qualitative differences between the profiles indicated that the motivational variables coincided rather than diverged. Thus, teachers with high self-efficacy also rated themselves high in enthusiasm levels. Our finding is consistent with Thommen et al. (2021), who also used a person-centered approach to examine the interplay between enthusiasm, self-efficacy, and goal orientation with experienced teachers. Their profiles differed only in goal-orientation and also showed quantitative differences with regard to self-efficacy and teacher enthusiasm.

When interpreting the quantitative differences that exist between the profiles, one can conclude that the overall self-efficacy and enthusiasm levels were rather high (with only six participants in the low profile). Therefore, the finding suggests that beginning teachers enter the profession motivated.

An open question remains whether variables influence each other or whether the same underlying sources influences both. For example, does self-efficacy lead to an increase in enthusiasm, or vice versa? In their expectancy-value theory, Wigfield and Eccles (2000) assumed that motivational constructs cannot be viewed as independent

of each other. Regarding a shared underlying motivational dimension, future research should use experimental designs to investigate the direction in which the variables influence each other. Qualitative approaches can make interesting contributions to finding motivational variables' underlying mechanisms.

5.2 Profiles two years after entering the teaching profession

For the second measurement point, two years into the teaching profession, there is no evidence that the low, medium, and high motivation profiles differ significantly from each other. As a consequence, the motivational profiles become more homogeneous. Taking a closer look at the one profile solution at time 2 reveals that the values of all motivational scales reach a level between the medium and the high profile, compared with time 1. A unique characteristic of the new professional phase is the change in conditions. The pre-service phase is characterized by a combination of theoretical units and practical phases. It is characterized by the fact that there is still a lot of control and feedback by the seminar teacher that can influence self-efficacy and enthusiasm. In the later occupational phase, the teachers are completely on their own and teach independently. It is assumed that these conditions may particularly influence the sources of self-efficacy. While the pre-service teacher education promoted vicarious experience (i.e., role models), working at school, teaching independently, dealing with classroom disruptions, etc., offers mastery experience.

The stabilization of the one-profile solution at a level between the originally medium and high profile shows that the requirements of career entry are positively met. Declining values result mainly for participants who were classified in the high motivation profile. As an explanation, it can be mentioned that they are highly motivated from the pre-service teacher education, they did not have problems meeting the requirements, and they may have underestimated the actual challenges of starting the teaching profession at a school. However, it must be noted that the characteristics of the one-profile solution are still above average.

Our research is a valuable extension of the previous literature, in which motivational changes usually refer to students' motivation (e.g., Holzberger et al. 2021; Rodriguez et al. 2014) or to in-service teachers (e.g., Keller et al. 2018). We aimed to fill research gaps by examining career entry with a longitudinal person-centered approach.

5.3 Longitudinal analyses

As already stated, previous studies have predominantly examined self-efficacy and enthusiasm in a variable-centered approach and based on cross-sectional designs. Only a few extant longitudinal studies have addressed the transition from teacher education to in-service teaching (e.g., Holzberger et al. 2021; Voss and Kunter 2020).

Overall, we found an increase in enthusiasm for the subject, a decrease in enthusiasm for teaching and self-efficacy for classroom management (factor disruptive behavior in the classroom). No significant changes were found for general self-efficacy and self-efficacy for classroom management (factor procedure of the lesson). This inconsistent pattern emphasizes investigating specific motivational aspects when dis-

cussing the change in teacher motivation across phases. While Bandura (1997), as well as theories of intrinsic motivation (e.g., Csikszentmihalyi 1996; Krapp 2002) argue for the stability of constructs, once established, we see that for beginning teachers' self-efficacy and enthusiasm are not fully established but rather malleable depending on the (mastery) experiences in school.

Discussing our results in more detail; Regarding the increase in enthusiasm for the subject it would be necessary to clarify whether student motivation or performance might in turn affect a teacher's enthusiasm. For example, it is possible that subject-specific student questions further stimulate a teacher's enthusiasm.

Our findings further indicate that classroom disruptions are particularly important for beginning teachers. This is in line with results that effective classroom management is especially important for beginning teachers because it influences teaching quality (Lazarides et al. 2020) and well-being (Aloe et al. 2014). Unsuccessful classroom management can lead to frustration and stress and it can be assumed that this also affects the satisfaction a teacher experiences in the classroom. Taken together, this can contribute to the reality shock (e.g., Dicke et al. 2015) that especially occurs at the beginning of a professional career.

There is no evidence for the change of general self-efficacy, but descriptive results of the latent means show that general self-efficacy varies with respect to different factors. Factor 1, competence in dealing with problematic students and parents (t1: $M = 2.611$, t2: $M = 2.662$), is rated lower than factor 2, innovative teaching ($M = 3.172$, t2: $M = 3.161$). Dealing with problematic students and parents is challenging, and one would expect that concrete situations would arise, especially at the beginning of a career, in which these situations can be practiced. That no change takes place is maybe attributed to the special nature of teacher education in Germany, which combines two obligatory phases. First, predominantly theoretical training at university (König et al. 2017), which includes, e.g., subject knowledge as well as didactic knowledge. Second, building on this, the pre-service teacher education is practice-oriented and takes place at training school to impart practical experience but is complemented by theoretical courses in teacher education institutes (Kleickmann and Anders 2013). Actual entry into the profession takes place only when both phases have been successfully completed. Nevertheless, the means for both time points show only a medium score. Situations involving problems can be very complex, and this may lead to teachers feeling less competent in this area. A later investigation several years into the teaching career would be interesting because teachers would have presumably mastered difficult situations by then. Factor 2 (innovative teaching methods) can also be attributed to the teacher education system. Means of the scale are rather high, which indicates that beginning teachers are well prepared with innovative teaching methods when they enter the profession.

Overall, our results show significant results in the variance of all motivational scales, which indicates that there are individual differences. The smallest differences in variance were found for enthusiasm for the subject, while individuals differed especially in self-efficacy for classroom management. To sum up, significant variances of the latent change score variables suggest that the average change in motivational scales does not apply equally to all participants.

5.4 Social support's influence on motivational variables

We emphasize that resources, especially for a challenging transition phase, should be identified in order to counteract the high dropout that is taking place nationally and internationally at this occupational stage and to keep teachers in the profession. Our results showed that social support is not related to the change of teaching motivation variables. This somewhat contradicts our expectations, as the internal network (e.g., from mentors or colleagues) has been shown to be helpful, as it is related closely to the professional situation and can provide more concrete advice (e.g., Kassis et al. 2019). However, our study participants report that they are already highly supported which indicates the level of social support but does not allow any conclusions about the quality of the network of individual participants. Thus, we recommend future (also qualitative) studies to gain more information about the role of social support for beginning teachers' motivation and to learn more about their environments. Finally, entering the teaching profession can be described as a complex situation and other factors, such as subject knowledge or subject didactics, may also play an important role.

5.5 Limitations and future research directions

Despite the study's methodological strengths, it has some limitations. Our study was restricted to specific aspects of teacher motivation. We divided self-efficacy into general self-efficacy and self-efficacy for classroom management. It should be reiterated that teacher self-efficacy is multidimensional and encompasses more than two dimensions (Tschannen-Moran and Woolfolk Hoy 2001), and we have not covered all of them. Also teacher enthusiasm can be further distinguished between the experienced and displayed component of teacher enthusiasm (Keller et al. 2018) that do not necessarily coincide. Moreover, in terms of expectancy-value theory, our study focuses on intrinsic task value only. By definition, subjective task value is a person's assessment of the quality of a task and is divided into four components (attainment value, intrinsic value, utility value, and cost) (e.g., Eccles and Wigfield 2002). Consequently, no statements can be made about attainment value, utility value, and cost. In our study, where we examine the transition phase from the end of pre-service teacher education into the professional life at school, we would presume that teachers at the end of pre-service will pursue the goal of successfully entering the teaching profession (attainment and utility value).

Despite our selection of indicators for teacher self-efficacy and enthusiasm, one benefit of the study is that it combines these two constructs as one component of expectations of success and one value component. The profile analyses were in favor of similar values on both components (quantitative profiles) so that the interaction (i.e., having high levels of expectancy and low levels of values [or the other way around]) is rather unlikely. This finding further suggests that a variable-centered approach may not offer a large distribution compared to person-centered approaches. Our study also examined the change of motivational variables during a highly stressful phase: transition into the teaching profession. No statements can be made about the prior change of teacher self-efficacy and enthusiasm, e.g., in the context of uni-

versity teacher education. A longitudinal investigation of the variables with a longer time frame would be desirable. Also, determining early changes measured against a starting point at the beginning of the study would be particularly interesting.

The study shows a considerable dropout from t1 to t2 in the longitudinal section. The data originates from a large German research program in which the participants had already been interviewed twice before. On the one hand, it can be assumed that there is a certain inertia against participating in the survey again. On the other hand, other factors may also play a role, such as a high level of stress associated with the entry into professional life. Dropout analyses, however, suggest random dropout. It must be pointed out that the data are important for teacher education in Germany, indicating generally highly motivated beginning teachers.

Finally, while an advantage of the study is the large sample size, encompassing different subjects and school tracks, the results cannot be generalized easily to teacher education in other countries with different teacher education systems.

5.6 Practical implications

In our sample, we had predominantly highly motivated teachers, both in pre-service teacher education and later with in-service teachers. However, considering that previous research indicates that negative motivational prerequisites can lead to burnout (Fernet et al. 2012; Kunter et al. 2011), the focus should be on those with low motivation levels during teacher education at an early stage or at the beginning of in-service teachers' work experience. Several intervention studies have aimed to increase teacher self-efficacy, and a meta-analysis on this topic is currently in the preparatory stages (Täschner et al. unpublished manuscript). It is important to know the underlying mechanisms, particularly for the development of training programs, but to date, little is known about the predictors that influence teacher enthusiasm (Burić and Moè 2020).

Social support, a variable viewed as a resource, is a multifaceted construct, and future research should examine different facets to consider not only the professional network, but also the private one.

There is a consensus that motivational characteristics are malleable (Kunter et al. 2013; Locke and Latham 2004) and can be influenced by, e.g., teacher education. Therefore, learning opportunities should be offered during teaching students' university training to stimulate their motivation. These situations should be designed as close to practice as possible to avoid reality shock later. Practical teaching situations or feedback can be mentioned as examples. Programs that promote motivation would be desirable for future training.

6 Conclusion

Overall, in the present study we examined the interplay between different motivational variables among teachers. Our results indicate that, at the end of pre-service teacher education, teachers have similar levels on aspects of self-efficacy and enthusiasm but that subgroups of teachers can be identified that differ significantly in

their level on these variables (showing a low, medium, and high profile). Two years into the teaching profession, there is no evidence that these three distinct subgroups have persisted, indicating that teachers become more homogeneous with regard to their motivational level. While the results of the profile analysis may be interpreted in a way that it may not be relevant to distinguish between the different aspects of motivation, the results of our longitudinal analysis are contrary to this interpretation.

Focusing on the significant transition between end of teacher education and entering the teaching profession, results from the latent change score analyses showed no consistent picture with regard to the change in motivational variables. The different patterns of change (e.g., increase for enthusiasm for the subject, decrease for enthusiasm for teaching, no change for general self-efficacy) emphasize the importance to address specific motivational constructs. Finally, the intraindividual differences in how beginning teachers changed in their motivational aspects emphasize the need to further examine underlying processes that cause individual changes in self-efficacy and enthusiasm.

Supplementary Information The online version of this article (https://doi.org/10.1007/s11618-022-01093-0) contains supplementary material, which is available to authorized users.

Funding The research was funded by the Federal Ministry of Education and Research (BMBF) and the Standing Conference of the Ministers of Education and Cultural Affairs of the Federal Republic of Germany (KMK) (ZIB, 2022). The data come from the BilWiss research program (project phase BilWiss-Beruf: 01PK11007) which was also funded by the Federal Ministry of Education and Research (BMBF).

Funding Open Access funding enabled and organized by Projekt DEAL.

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Conflict of interest A. Hartl and D. Holzberger declare that the research was conducted in the absence of any commercial of financial relationships that could be construed as a potential conflict of interest. The authors claim responsibility for the contents of this article.

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