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ORIGINAL PAPER

Factors mitigating the decline of motivation during the first academic year: a latent change score analysis

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Abstract

Research shows that in university education programs, students' motivation decreases over time, which is associated with indicators of reduced academic success, such as student dropout rate. Consequently, researchers have analyzed motivation change and explored the options available to universities to maintain a high level of motivation among students. Using Person-environment fit theory, our research suggests that perceived support offered by lecturers and instructional quality influence students' subject interest. We conducted a longitudinal design of 823 participants from Baden-Wuerttemberg Cooperative State University and estimated a latent change score model using data collected between the participants' first and second academic years. Our findings suggest that perceived support from lecturers mitigated the decrease in subject interest. Moreover, our results support the hypothesis that universities can attenuate the decreasing change of subject interest from students. Our findings are contextualized with reference to contemporary research in the field and we offer practical suggestions for maintaining high motivation among students.

Keywords Motivation change · Lecturer support · Instructional quality · Higher education · Freshmen

The beginning of a study program at university leads to many new situations and challenges for students in their first academic year. This kind of transition means, first of all, a new learning environment (Briggs et al., 2012), sometimes revealing learning strategies ill-suited for rigorous scientific study program (Endres et al., 2021). Often this transition is also marked by disappointment due to high expectations (Grassinger, 2018). In the same way this transition could also lead to significant changes in life, for example "the first time of living away from home for an extended period" (Alsubaie et al., 2019, p. 484). In this process, social and academic requirements have to be adapted to the new environment, which could affect motivational aspects (Noyens et al., 2019). Researchers studying this period have found evidence of decreasing motivation, which is associated with the intention to drop out (Benden & Lauermann, 2022; Chen, 2012; Schnettler et al., 2020). In contrast, high motivation is associated with higher achievement in higher education (Schneider & Preckel, 2017) or continuing to master's level study (Harackiewicz et al., 2002). From universities` point of view, this is very important because their reputation and revenue suffer as a result of high dropout rates (Beer & Lawson, 2016; Klein & Stocké, 2016).

For this reason, the question of how universities can maintain high motivation to ensure academic success is important to answer. For example, offering self-regulated learning programs motivation is a central linked to performance (Perels et al., 2022; Schmitz & Perels, 2011; Theobald, 2021). Researchers stated that other predictors of achievement (e.g., cognitive abilities or socioeconomic background) are hardly modifiable as opposed to motivational components (van Maurice et al., 2014). Using

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Person-environment fit theory (PEF; Rubach et al., 2022), our research aims to identify factors in the university context that influence motivation change, like instructional quality or perceived support of lecturers. In other words, we aim to analyse why some students experience a more significant motivational change than others. We focus on the first academic year.

Xu et al. (2021) emphasize that longitudinal research in higher education is needed for motivation analysis, despite challenges in data collection. It has been argued that administrative (or institutional) data should be used to support research concerning university students (Fredricks et al., 2019; Jansen et al., 2022), because most research is undertaken within the field of school research (Frenzel et al., 2010; Lazarides et al., 2019; Schwarzenthal et al., 2023; Wentzel, & Miele, 2016). To test the robustness of theories, researching subpopulations such as cooperative universities, which have doubled their enrollments in Germany to 120,000 in the last decade (Hofmann, 2023), provides welcome support. In cooperative education students rotate between academic learning at university (the theory phase) and work experience in a workplace of a company (the work phase). These students therefore have an employment contract with a company (Coll & Zegwaard, 2011; Wild & Neef, 2019). Kramer and colleagues (2011) demonstrate that cooperative students are more motivated in certain aspects compared to students at a traditional or applied sciences university. Our research intends to meet the research desiderata presented here.

Theoretical framework

The pioneering work of Lewin emphasised that human behaviour is a function of a person in their environment and contrasted with Freud and other contemporaries who focused almost exclusively on the role of the individual in explaining behaviour (Bowman, & Denson, 2014). The further development of this framework into the person-environment fit state (PEF), in line with the conclusions of Rubach et al. (2022), stated that the interaction between a person (P) and the environment (E) influences the individual's behaviour ($B = f(P, E)$; summarised in Holland, 1997; Eccles et al., 1993). De Clercq et al. (2021a) identify a research gap in analysing the impact of the university environment on student behaviour, e.g. in the transition from school to university, and present initial results from recent years.

Using PEB framework, Phillips (2017) reported that educational learning settings are influenced by social conditions and social context; in other words, this framework can be described as socioculturally based. Good fits are thought to promote positive outcomes, in terms of students' satisfaction with their university experience, psychological well-being (Gilbreath et al., 2011) and family relationships (Gutman & Eccles, 2007), while poor fits promote negative outcomes. Jansen and Kristof-Brown (2006) point out that not only one, but several dimensions of fit contribute simultaneously to an individual's attitudes and behaviour. A poor fit with one or more environmental dimensions may be compensated by a good fit with another environmental dimension. Furthermore, the PEF focuses on longer-term developments and outcome (Jansen & Kristof-Brown, 2006).

An example of this is Holland's (1997) framework, where PEF has also received recent attention (Bowman, & Denson, 2014). In his research, Holland proposes six categories of interest, the so-called RIASEC model (R: Realistic; I: Investigative; A: Artistic; S: Social; E: Enterprising; C: Conventional) and suggests that people who fit or match their interests with their actions and choices in an academic field of study are generally more satisfied, more productive and more likely to persist than those who mismatch. Research on Holland's typology generally supports this prediction in both undergraduate majors and professional settings (Fonteyne et al., 2017; Putz, 2011). Further research into person-environment fit and academic success in higher education underlined the relevance of this framework and showed that study grades, perceived performance and study satisfaction were more strongly related to subjective fit than to subjective abilities (Bohndick et al., 2018). However, to our knowledge there is no longitudinal research into mitigating the decline of motivation against the background of person-environment fit in higher education and cooperative education.

Kahu and Nelson's (2018) suggest a theoretical framework of structural influences from the university environment that affect the educational interface between the higher education institutions and the student, as well as impact student engagement and finally social and academic outcomes. Empirical findings support this framework and assumptions. De Clercq et al. (2021b) present findings that class size contributes to academic achievement. Further analysis by Bohndick et al. (2021) shows the influence of type of higher education as well as academic disciplines on students' self-efficacy, goal commitment and volition. Schaeper (2019) also provides evidence of the importance of the influence of the university environment on student behaviour, as she finds that a cognitively activating learning environment significantly increases academic integration.

The advantage of utilizing the PEF lies in its ability to elucidate how environmental factors, such as the university institution, influences individual interest development. This impact can be attributed to factors like perceived instructional quality or lecturer support. Our study aims to investigate this research query.

Theoretical framework of interest development and predictors

In line with Hidi and Renninger (2006, p. 112), we understand interest as a motivational variable in terms of psychological state, where individuals, over a given time, engage or are predisposed to reengage, with particular classes of objects, events, or ideas. Krapp (2007) divides interest into situational interests, which exist for a limited period of time and are triggered by external incentives (situational interests), and individual interests, which refer to a characteristic of a person conceived as a stable disposition. The further theoretical assumptions of the Four-Phase Model of Interest development by Hidi and Renninger (2006) postulate a number of phases. Phase one is "Triggered Situational Interest" and phase two is "Maintained Situational Interest" (developing of situational interests). Phase three is "Emerging Individual Interest" and finally phase four is "Well-Developed Individual Interest" (the creation of individual interest). Our research focuses on subject interest as a type of individual interest, which falls within a late phase of this model.

Declining interest in programs both at schools (Gaspard et al., 2020) and at universities (Wild, 2022) is well-documented. In the following paragraphs, we discuss existing research in school and university contexts, using cross-sectional and longitudinal study designs that consider account the association of interest with gender, academic field, social background and performance. This is done because of the PEF framework, in which there are multiple dimensions of fit contribution, and one or more environmental dimensions may compensate for another, less developed environmental dimension (Jansen & Kristof-Brown, 2006). Unfortunately, results from higher education research are scarce, so we are forced to present results from additional educational institutions. In addition, results are available from many different areas, resulting in a relatively blurred picture of results.

Existing research on the influence of gender on interest has thus far been inconclusive. Research from schools is presented first, as it is better developed compared to higher education. The academic domain of mathematics is well represented in research. A study in Norway demonstrated lower interest for girls in middle school (Høgheim & Reber, 2019). Frenzel et al. (2010) reported similar findings in Bavarian schools, showing that although boys are more interested in mathematics than girls, both groups are characterized by declining trajectories. Krapp (2002) noted a trend towards a more rapid decline in interest in science-related subjects among girls than boys. In contrast, however, Dotterer et al. (2009) reported a more rapid decline in academic interest among boys. Different findings on gender trajectories in academic fields indicate the influence of the respective academic field on students' interest. Renninger and Hidi (2017) studied the variable 'decline of interest' in one working-class school among grade 6 students in 12 subjects: Arts, English, Mathematics, Music, Physical Education, Science, and Social Studies. They concluded that classroom experiences (including instructional practices) influenced these results. Correlatively, Renninger and Su (2019) emphasize that disciplinary approach, content, activities, events or ideas influence the development of interest in a subject. Studies predicting the development of motivational values in relation to gender in higher education can be summarized as inconsistent. Studies, particularly in STEM education, had not found gender differences (Robinson et al., 2019; Kosovich et al., 2017), while other studies have demonstrated gender differences (Benden & Lauermann, 2022; Watt et al., 2012).

Research concerning interest and its development over time has demonstrated that social background is an influence factor. Frenzel et al. (2010), for example, show in their study of students' interest in mathematics between grade 5 and grade 9, that higher values of family interest in mathematics correlate with higher values among students' interest in mathematics. Similarly, Dotterer et al. (2009) report in school research that for the development of academic interests, students' mothers' educational expectations were positively related to students' interests. Notably, students' interest declined to a less significant extent when their fathers had greater educational attainment. Moreover, decline in student interest was slower when students' mothers' level of academic interest was higher. In a study of first-year university mathematics students Benden and Lauermann (2022) found that between the midpoint and the end of the semester the interest of students from wealthier families declined less than that of their peers.

Researchers have found an association between performance and interest, with one meta-analysis reporting an effect of $r = .30$ (Schiefele et al., 1993). However, Schiefele (2009) emphasized that the causal relation between interest and achievement has not yet been established. Van Maurice et al. (2014) conducted a longitudinal study in a primary school and found that grades influence interest but not vice versa. In their research on a secondary school, Scherrer et al. (2020) found that the associations between interest and achievement were reciprocal rather than unidirectional. Schiefele (2009) emphasizes, in line with findings from Dotterer et al. (2009), that for the lower secondary school level interest is either a nonsignificant or weak antecedent of achievement, while for post-secondary education, Rotgans and Schmidt (2011) conclude that situational interest impacts achievement. Meta-analysis in higher education shows that intrinsic motivation, which is included in the construct of interest, is associated with performance (Schneider

& Preckel, 2017). In the following sections, interest and its association with perceived instructor support and perceived instructional quality will be discussed.

Interrelation between the development of interest and perceived lecturer support

We conceptualize lecturer support, in line with Lazarides et al. (2019) and Leenknecht et al. (2020), as the degree to which lecturers provide adaptive explanations, respond constructively to errors, adequately pace students' learning and have a respectful and caring attitude to lecturer-student interactions both in the course environment and the educational institute. Given our use of PEF as a theoretical context, we assume that lecturer support is an important component that affects students' behaviour. This is because we understand lecturer support as a social condition of the environment that influences individuals' behaviour. Consequently, better perceived lecturer support is in line with good fits between individuals and their environments, leading to positive outcomes, such as increasing interest. Lazarides et al. (2019) note that only a few studies exist in this field, especially regarding perceived teacher support on a class-level and its effects on students' academic outcomes.

Empirical results indicate the importance of perceived support in educational settings and confirm its effect on students' academic outcomes. More specifically, research shows associations between perceived teacher support and student interest (Dietrich et al., 2015; Hettinger et al., 2022) as well as an indirect impact of teacher support on academic performance via motivation, as revealed by longitudinal studies (Affuso et al., 2022). Lazarides et al. (2019) present similar results, showing that teacher support mitigated the decline in students' interest. Moreover, research has explored an association between perceived support and fewer instances of anti-immigrant attitudes (Miklikowska et al., 2019) as well as perceived support and decreased intention to quit (Tvedt et al., 2021a; Van Houtte & Demanet, 2016). Grew et al. (2022) underline the importance of teacher support on account of its reported association with higher engagement and achievement, based on their meta-analysis of approximately 200 studies (Roorda et al., 2017). Lei et al. (2018) found an association between teacher support and emotions in a meta-analysis. Nonetheless, the question of change of perceived support over time in education programs remains open. Wit et al. (2010) and Lazarides et al. (2019) report a decline, but Tvedt et al. (2021b) found no change in perceived support over time in their study. Research in higher education shows further effects of lecturer support on students' engagement (Chan & Lee, 2023).

Interrelation between the development of interest and perceived instructional quality

In line with the approach taken by Holzberger et al. (2013), we characterized instructional quality as interaction between the three theoretical dimensions of cognitive activation, effective classroom management, and individual learning support. Meta-analyses, such as conducted by Schneider and Preckel (2017) for higher education and Seidel and Shavelson (2007) for school, show the effects of instructional quality on educational outcomes. As it is clear from the theoretical approach framework of PEF shown above, instructional quality is possibly a condition creating a good fit for the environment, in terms of influence on students' behaviour. Consequently, positive outcomes follow, such as increasing interest.

Empirical research underlines these theoretical assumptions. Results show instructional quality is associated with interest in higher education (Schiefele & Jacob-Ebbinghaus, 2006) and school (Dorfner et al., 2018). Moreover, studies in school research by Yang and Kaiser (2022) and Klusmann et al. (2022) demonstrate the importance of instructional quality for academic outcome factors, such as performance (Atlay et al., 2019; Capin et al., 2022). A further aspect is the relationship between perceived instructional quality and perceived lecturer support. Initial empirical research into this relationship has been carried out by Blömeke and Klein (2013) for school and Hagenauer et al. (2022) for higher education.

Overall, regarding the state of contemporary research in this field, it should be noted that many studies refer to schools. As a result, there are still research gaps regarding the decline of motivation and the relevance of lecturer support, as well as instructional quality, for higher education. We respond to these desiderata with our study.

Objective

The aim of our research is to understand which institutional factors mitigate the decline of motivation in a higher education context. Using the theoretical framework of PEF, we assume that a higher scoring of education environments, as an indicator of better fit, influences students' behaviour positively. In addition, we anticipate, based on this theoretical framework, that personal characteristics also affects students' behaviour. Consequently, we integrate control variables into our model. More specifically, we postulate the following two hypotheses in our research.

Hypothesis 1 the decline of subject interest is associated with perceived lecturer support.

Hypothesis 2 the decline of subject interest is associated with perceived instructional quality.

A visualized summary of our theoretical considerations, the empirical findings reported above, and our hypotheses are presented in Fig. 1. Furthermore, we control some personal characteristics that affect the cognitive variable of university entrance qualification grades in our research. Studies have found that gender (Voyer & Voyer, 2014; Baye & Monseur, 2016), academic field (Westrick et al., 2021) and social background (Sirin, 2005; Rodríguez-Hernández et al., 2020) influence student performance in various ways. Lastly, we explore the effects of demographic group differences (gender, academic field, social background and University entrance qualification grade), perceived lecturer support and perceived instructional quality on subject interest in a cross-sectional perspective.

Methods

Participants and design

Our longitudinal analysis is based on data from cooperative students in their first (July 2016) and second academic years (March 2017), from the cohort starting in 2015 of the panel study titled "Study Process – Crossroads, Determinants of Success and Barriers during a Study at the DHBW" (Deuer & Meyer, 2020). These timepoints were chosen, so that students would have completed a theory phase and a work integrated phase in each academic year. In this study, we invited all 34,000 enrolled students at Baden-Wuerttemberg Cooperative State University (DHBW) every year by email to participate in an online survey. The research group sent an email twice in an interval of two weeks to all students with a link to a questionnaire, inviting them to participate in the survey. Participation was voluntary and a privacy policy was adhered to. Every 50th student who answered more than one question received a coupon worth 10€. At the end of the project (September 30th, 2019), we matched the survey data with demographic data from the university's administrative department.

In the annual survey in 2016 and 2017 all enrolled students of DHBW, approximately 34,000, were invited. In wave 1 there were 5,838 participations and in wave 2 there were 5,697 participations (Deuer & Meyer, 2020). Only 823 participated twice. The 823 participants had an average age of $M = 21.12$ years ($SD = 2.69$) in their first academic year. Regarding gender, the distribution was 455 female (55.3%) to 368 male (44.7%) students. 57.6% of the students were enrolled in business administration, 31.0% in engineering, and 11.4% in social work. We have chosen these academic disciplines for our research, because the aim of the panel study was to analyse the cooperative education system with these three faculties (Deuer & Meyer, 2020). However, the relevance of research on these fields of study can be justified in furtherways. On the one hand, economics, engineering and social work are among the most popular, i.e., most highly frequented, fields of study in Germany (Federal Statistical Office of Germany, 2022, p. 31). On the other hand, there is also a high demand for skilled workers in these fields. For example, a current and future shortage of skilled workers is diagnosed for social work

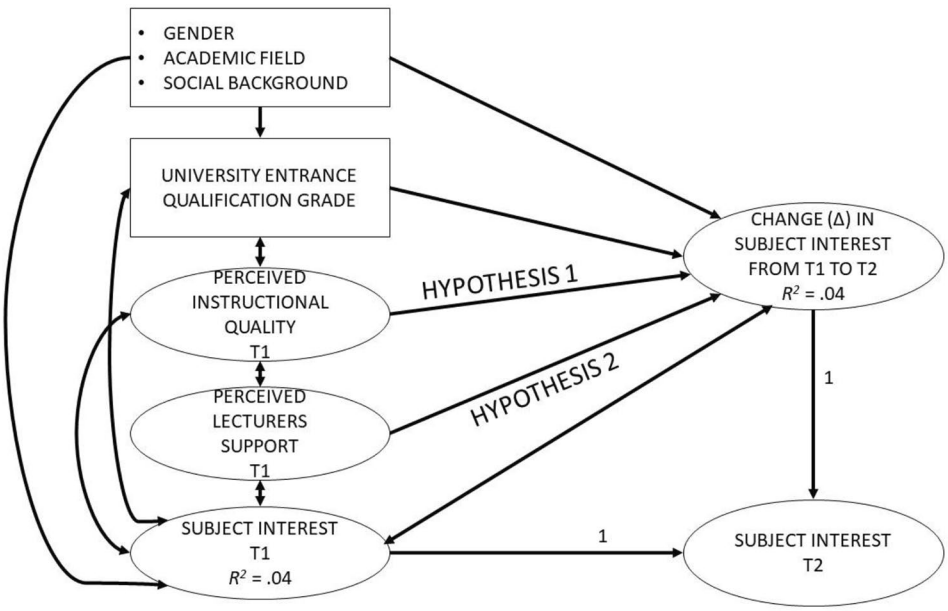

Fig. 1 Hypothesized model and assumption of the associations in the statistical model. Academic year 1 is T1 and academic year 2 is T2

(Vogler-Ludwig et al., 2016; Hickmann & Koneberg, 2022). Our data shows that more male students (z = 6.8; 73.3%) were enrolled in engineering, whereas more female students were studying business administration (z = 2.4; 63.5%) and social work (z = 4.7; 91.5%) with a significant effect size (χ^2 (2) = 147.27, $p < .001$, *Cramérs V* = 0.42). In total, 39.1% of the participants had at least one parent with a university degree (≙ high social background).

The participating students in the sample were enrolled in three-year bachelor's programs. This program is worth 210 credit points, measured according to the European Credit Transfer System. There is a precondition for this program, that students must have a university entrance qualification as well as a three year contract with their partner companies. Consequently, they earn a monthly salary in this program (including during the theoretical semesters) with a status as regular employees and were thereby entitled to vacation and insurance protection. This curriculum is highly standardized and so most of the students reach a degree in regular study time. There are few dropouts in this program and the dropout rate is below universities of applied science as well as universities. After graduation about 83% of cooperative students in this program are offered a permanent contract of employment, normally by their corporate partner (Nickel et al., 2022; Statistisches Landesamt Baden-Württemberg, 2016; Wild & Neef, 2019). Some people see this study program as a method for "selection of the best" by companies (Weich et al., 2017).

Measures

Subject interest

We measured subject interest as self-report using an adjusted instrument originally used by Fellenberg and Hannover (2006). All items of psychometric scales used in this research are listed in Table 1. The three items (sample item: My field of study matches my interests.) ranged from 1 (= strongly disagree) to 5 (= strongly agree). Reliability in academic year one (ω = 0.83) and academic year two (ω = 0.85) were recorded as good. Furthermore, we conducted a longitudinal invariance analysis for this instrument using cutoff criteria designed by Chen (2007), which indicated a change of Δ CFI ≤ 0.010 or RMSEA Δ CFI ≤ 0.015 in the models of configural, metric, scalar and strict invariance (Putnick & Bornstein, 2016; Widaman et al., 2010). The results confirm strict measurement invariance for time (see Table 2), which is a precondition for latent change analysis (McArdle, 2009).

Perceived lecturer support

In our study, perceived lecturer support was measured as self-report by an instrument adapted from Thiel et al. (2008) with four items. Reliability in our sample was seen as adequate (ω = 0.74; sample item: Are you satisfied with the support and supervision provided by the lecturers in terms of

Table 1 Used items, in translation and in their original German language

Item in English	Item in German
Subject interest	*Fachinteresse* (adapted from Fellenberg & Hannover, 2006)
I have doubts about whether my field of study really fits my interests.	Ich habe Zweifel, ob mein Studienfach auch wirklich meinen Interessen entspricht.
My field of study matches my interests.	Mein Studienfach deckt sich mit meinen Interessen.
My field of study is exactly right for me.	Mein Studienfach ist genau das Richtige für mich.
Perceived lecturer support	*Wahrgenommene Unterstützung durch Lehrende* (adapted from Thiel et al., 2008)
Are you satisfied with the support and supervision provided by the lecturers with regard to learning techniques and strategies?	Sind Sie mit der Unterstützung und Betreuung durch die Lehrenden hinsichtlich von Lerntechniken und -strategien zufrieden?
Are you satisfied with the support and supervision provided by the lecturers with regard to basic skills in academic work (e.g. research)?	Sind Sie mit der Unterstützung und Betreuung durch die Lehrenden hinsichtlich von Grundkompetenzen wissenschaftlichen Arbeitens (z.B. Recherche) zufrieden?
Are you satisfied with the support and supervision provided by the lecturers with regard to assistance with learning and work difficulties?	Sind Sie mit der Unterstützung und Betreuung durch die Lehrenden hinsichtlich von Unterstützung bei Lern- und Arbeitsschwierigkeiten zufrieden?
Are you satisfied with the support and supervision provided by the lecturers with regard to support in preparing for examinations (papers, presentations, homework, transfer tasks, etc.)?	Sind Sie mit der Unterstützung und Betreuung durch die Lehrenden hinsichtlich von Unterstützung bei Prüfungsvorbereitungen (Referate, Präsentationen, Hausarbeiten, Transferaufgaben etc.) zufrieden?
Perceived instructional quality	*Wahrgenommene Lehrqualität* (adapted from Thiel et al., 2008)
The lecturers are well prepared.	Die Lehrenden sind gut vorbereitet.
The courses are well structured.	Die Lehrveranstaltungen sind gut strukturiert.
The courses are varied.	Die Lehrveranstaltungen sind abwechslungsreich gestaltet.
The lecturers are dedicated.	Die Lehrenden sind engagiert.

Table 2 Results of measurement invariance testing for subject interest over time ($N = 823$)

	df	χ^2	χ^2 / *df*	*CFI*	*RMSEA*	Δ *CFI*	Δ *RMSEA*
Configural invariance	5	22.054	4.41	0.994	0.064		
Metric invariance	7	24.880	3.55	0.993	0.056	0.001	0.009
Scalar invariance	9	27.357	3.04	0.993	0.050	0.000	0.006
Strict invariance	12	29.322	2.44	0.994	0.042	0.001	0.008

assistance with learning and work difficulties?). The scale ranged from 1 (= very dissatisfied) to 5 (= very satisfied).

Perceived instructional quality

The scale for perceived instructional quality was adapted from Thiel et al. (2008) and measured as self-report. The four items had tolerable reliability (ω = 0.75; sample item: The courses are well structured.). Measurement varied between 1 (strongly disagree) and 5 (strongly agree).

University entrance qualification grades

In the German education system, university entrance qualification grades range from 1 (the highest score, equivalent to a grade A in Great Britain and the United States) to 4 (the lowest passing score, equivalent to a grade E in Great Britain or a grade D in the United States). The university administration gave us access to this data. For a better interpretation of this variable, we have recoded this variable for our analyses in this study so that higher values mean better scores.

Data analyses and missing values

In our preliminary analysis through SPSS 29, using descriptive statistics we interpreted kurtosis and skewness outside the range of −1 to +1 as problematic for the assumption of normal distribution (e.g. Hair et al., 2014). Following Cohen (1988), we interpreted the effect size for Pearson's correlation *r* (small is *r* = .10–29; medium is *r* = .30–49, and large is *r* ≥ .50), Cohen's *d* for *t*-tests (small is *d* = 0.20–49; medium is *d* = 0.50–79, and large is *d* ≥ 0.80) and Cohen's *f* for analyses of variance (small is *f* = 0.10–22; medium is *f* = 0.23–39, and large is *f* ≥ 0.40). In our research, a *p*-value of less than 0.05 (two-tailed) was deemed statistically significant.

Latent Change Score Models were used to test our hypothesis by MPUS Version 8.8 (Muthén & Muthén, 1998–2017). Testing preconditions by longitudinal measurement invariance are reported in the chapter 'measures' and was performed using the R software package 'semTools' (Jorgensen et al., 2022). We used a latent change score model because such models are largely free from measurement error and, consequently, inter-individual differences in intra-individual change can be estimated more precisely relative to models working with manifest scores (Lazarides et al., 2019; McArdle, 2009; Steyer et al., 1997). In line with McArdle (2009, p. 583), we fixed values (= 1) between the values of T1 and T2 to estimate the latent change score (Δ) (Rupprecht et al., 2019). Moreover, we set the parameter between their latent change score and their level at Time 2 to 1 for identifying the model (McArdle, 2009; Rupprecht et al., 2019). See Fig. 1 for details. In our analysis, we used the criteria of Hu and Bentler (1999) with *RMSEA* ≤ 0.06 and *CFI* and *TLI* ≥ 0.95, as well as *SRMR* ≤ 0.08 judged a good model fit.

Some values in our 1,646 measurements (two measurements for each participant) were missing. Variables had missing values between 0% and 8.3% ($M = 4.85$; $SD = 2.72$). In 1,418 cases (86.15% of the sample) and in 23,493 (95.15% of the sample) of 24,690 values, no values were missing. When the measurement of a single item or demographic variable was missing in a measurement point, we replaced the missing data using multiple imputations by chained equations of the software R package "mice" with 20 imputations (van Buuren & Groothuis-Oudshoorn, 2011), taking into account the time variable using the multilevel structure of the data (Grund et al., 2018).

Results

Preliminary analysis

Descriptive analyses of the study variables are presented in Table 3, as well as the correlations between them. Perceived instructional quality is particularly striking because of Kurtosis = 1.74, which indicates a problem for normal distribution. The correlation between the two measurement points of interest is *r* = .71. Medium effects were recorded for the correlation between perceived lecturer support and perceived instructional quality (*r* = .46). All other correlations are *r* < .30. Further bivariate analysis of the manifest change score of interest that is based on the two measurement points indicates association with perceived lecturers support (*r* = –.07), perceived instructional quality (*r* = .01) and university entrance qualification grade (*r* = –.04).

An analysis based on *t*-tests showed no significant differences in university entrance qualification grades and gender

Table 3 Descriptive statistics and manifest correlations (*r*)

	M	*SD*	*Skew*	*Kurtosis*	1.	2.	3.	4.	5.	6.
1. Subject interest (T1)	3.90	0.80	−0.89	0.65	–					
2. Subject interest (T2)	3.82	0.83	−0.91	0.65	0.71	–				
3. Change in subject interest (Δ = T2 – T1)	−0.08	0.62	−0.40	1.70	−0.34	0.43	–			
4. Perceived lecturers support (T1)	2.98	0.72	−0.19	0.15	0.18	0.12	−0.07	–		
5. Perceived instructional quality (T1)	3.55	0.61	−0.90	1.74	0.26	0.25	0.01	0.46	–	
6. University entrance qualification grade	3.87	0.58	−0.13	−0.67	−0.02	−0.05	−0.04	0.01	−0.08	–

Note. $N = 823$. Variables ranging from 1 (= strongly disagree) to 5 (= strongly agree). University entrance qualification grade ranges from 2 (= lowest performance) to 5 (= best performance)

Table 4 Standardized coefficients from the latent change modeling

	Subject interest T1			Change in Subject interest T2–T1 (Δ)		
	β	*SE*	*p*	β	*SE*	*p*
Perceived lecturers support (T1)	0.15	0.04	0.001	0.18	0.08	0.018
Perceived instructional quality (T1)	0.31	0.04	< 0.001	–0.14	0.08	0.072
University entrance qualification grade	–0.05	0.04	0.170	0.08	0.05	0.121
Gender (male = 0; female = 1)	–0.04	0.04	0.308	–0.02	0.05	0.722
Social Background (low = 0; high = 1)	–0.03	0.04	0.344	0.02	0.05	0.750
Academic field engineering (Ref. social work = 0)	–0.06	0.06	0.333	–0.13	0.09	0.140
Academic field business administration (Ref. social work = 0)	–0.22	0.06	< 0.001	–0.03	0.08	0.687

Note. $N = 823$

($t(821) = 1.71$, $p = .087$, $d = 0.12$) or social background ($t(821) = 0.92$, $p = .357$, $d = 0.07$). However, significant differences were found, as estimated by analysis of variance, in academic fields for university entrance qualification grades with medium effect size ($F(2, 820) = 39.33$, $p < .001$, $f = 0.31$), with the highest performance score for engineering ($M = 4.06$; $SD = 0.54$), followed by business administration ($M = 3.85$; $SD = 0.58$), with social work having the lowest performance ($M = 3.48$; $SD = 0.46$) (significant post hoc tests were conducted according to Scheffé for all three fields). Analysis of variance for repeated measurements showed a significant decline of subject interest from measurement one to measurement two with small effect size ($F(1, 822) = 14.04$, $p < .001$, $f = 0.13$).

Further preliminary analyses using analysis of variance as well as analysis of variance for repeated measures for the two measurement points tested the existence of interaction effects with different combination of factors gender, social background, university entrance qualification grade and academic field on subject interest, perceived lecturers support as well as perceived instructional quality. The presence of interaction terms should be excluded from latent change score models due to the assumption of consistent associations. However, there are no significant interaction terms with at least small effect size (Cohen's $f \geq 0.10$). See supplementary material for details. Consequently, the combination of analysed factors does not have a systematic impact on the way in which the teaching environment in higher education is experienced by students in our study.

Testing the hypotheses

To test our hypotheses, we estimated the latent change score model. The achieved fit was found to be acceptable ($\chi^2 = 399.379$; $df = 134$; $\chi^2 / df = 2.980$; $p < .001$; $CFI = 0.944$; $TLI = 0.931$; $RMSEA = 0.049$; $SRMR = 0.044$). Table 4 shows the results of influence factors on subject interest in academic year one and of change in subject interest from academic year one to academic year two, according to the research question.

The first analysis in Table 4 shows the influence of perceived instructional quality ($\beta = 0.31$; $p < .001$) and perceived lecturer support ($\beta = 0.15$; $p = .001$) on subject interest in measurement one. Notably, social work students showed higher subject interest than students of business administration ($\beta = -0.22$; $p < .001$). However, the explained variance of approximately 4% indicated that there are further variables that affect subject interest.

Next, an analysis of change in subject interest from T1 to T2 was conducted. Our results indicate that only perceived lecturer support ($\beta = 0.18$; $p = .018$) had a positive effect. In other words, high perceived lecturer support mitigated the decline of subject interest from measurement one to measurement two. Again, the explained variance of approximately 4% was analysed. The direction of the algebraic effect sign for the change score has shifted from minus to plus comparing the bivariate and manifest analysis in Table 3 to this multivariate and latent analysis in Table 4.

Discussion

Given the numerous challenges which new students at universities face (Dresel & Grassinger, 2013; Pillay & Ngcobo, 2010), it is particularly important to understand why students' motivation decreases over time, especially in the first academic year (Benden & Lauermann, 2022; Wild, 2022). Determining the exact reasons for this is challenging is significant, because motivation is associated with many variables, such as student dropout (Schnettler et al., 2020; Wild et al., 2023a) and academic performance (Richardson et al., 2012; Schneider & Preckel, 2017). In this context, we analysed data with the aim of identifying variables that mitigated the decline of motivation, especially from an institutional perspective, with a focus on subject interest as a dependent variable. Most research in this context has been conducted in the context of schools, and a view from the higher education perspective is therefore needed.

Using the PEF framework, we assumed that personal characteristics as well as the characteristics of the environment – in this case, the university – interact to influence behaviour (Rubach et al., 2022). Our research centered on the university environment with a focus on the first academic year and subsequent development, up to the second academic year. In our initial explorative cross-sectional analysis, we identified associations between subject interest and the variables of perceived lecturers' support, perceived instructional quality as well as academic subject based on data for the first academic year. These findings are in line with those of Dorfner et al. (2018) and Schiefele and Jacob-Ebbinghaus (2006), who report an association between perceived instructional quality and interest. Moreover, our findings likewise support those of Dietrich et al. (2015) and Hettinger et al. (2022) regarding perceived lecturers' support and interest, respectively. The analysis of the latent change score from academic year one to academic year two shows a significant positive effect for perceived lecturers' support, which confirms Hypothesis 1 and demonstrates that perceived lecturer support mitigated the decline of students' subject interest from the first to the second academic year. Research from Lazarides et al. (2019) confirms this finding. In contrast, no significant influence on the change score could be found based on our analysis of perceived instructional quality. Consequently, Hypothesis 2 must be rejected.

Our study strengthens and contributes to the further development of PEF because our findings support its theoretical assumptions. This can be seen in the fact that we offer a contribution of analysing the importance of the environment in higher education as an influence factor and we do research on a subsample that has nearly doubled in Germany in the last decade from 2012 to approximately 120,000 cooperative students (Hofmann, 2023). Other empirical research based on person-environment-fit theories demonstrated similar findings in higher education on related topics, such as the conclusion of Buß (2019) that flexible study program structures improve the fit between students' needs and universities' offers. Further determinants are found in a high percentage of elective courses, a small number of teaching hours, and regularly distributed exams (Buß, 2019). Our research also shows that several environmental factors have an impact on interest, as shown in Table 4. Apparently, the assumption that multiple dimensions of fit contribute simultaneously to an individual's attitudes and behaviour as well as that one or more environmental dimensions could compensate for another less developed environmental dimension seems to hold (Jansen & Kristof-Brown, 2006). In addition, the theory-based assumption that longer-term developments are particularly relevant in the context of the PEF seems to hold, as evidenced by the effect of perceived lecturer support on the latent change score of changing interest when there is a time difference of almost one year as seen in our research (Jansen & Kristof-Brown, 2006). Furthermore, our study gives hints that PEF can also be used for higher education research (Bohndick et al., 2018).

The perspective on environmental factors in the transition phase to higher education is significant and therefore needs to be considered in more detail. A possible starting point for this is the qualitative research by Trautwein and Bosse (2017), which highlights four critical requirements for students in the transition to higher education with the (1) organisational dimension in addition to the (2) personal requirements, the (3) content dimension and the (4) social dimension. For the organisational dimension, this research highlights as examples coping with the quality of teaching (e.g. lack of support from their lecturers), coping with examination conditions (e.g. tight examination schedules and assessment mode), coping with formal regulations as administrative hurdles, and adjusting organisational requirement with the personal challenges of student life.

This raises the question of how to strengthen lecturer support in a university setting. According to Metheny et al. (2008), and adjusted for university, more cooperation between guidance counsellors and lecturers should be conducted to benefit students´ development. Other suggestions from school research are working in small groups and giving students positive feedback and praise, both of which are key strategies to foster teacher–student relationships (Joyce & Early, 2014). Coaching or mentoring programs, as well as online self-assessments, are also seen as enabling understanding of students' motivations from both an institutional perspective and from students' self-perspective (Ćukušić et al., 2014; Sneyers & de Witte, 2018; Unterbrink et al., 2012).

One strength of our research is its use of demographic data from university administration, specifically, university entrance qualification grade, gender and academic fields. This enables us to limit measurement error and social desirability bias. Another strength of our research is our use of latent change score models, which, relative to manifest scores, are more precise as measurement error is reduced. Furthermore, our data was not impacted by the COVID-19 pandemic, because they were collected in 2016 and 2017. The reliability of our study, according to McDonald's omega (McDonald, 1999), shows an acceptable value of $\omega \geq 0.70$ (Viladrich et al., 2017) and the model fit of latent change score analysis is adequate (Hu & Bentler, 1999).

Nonetheless, our research has limitations. The data used is from only one university, which has 12 campuses in one federal state of Germany. Consequently, our analysis can be seen as a kind of case study. The generalizability of our findings is also limited because the students are cooperative students chosen by companies, suggesting a possible selection bias (Kupfer, 2013). Our research explains nearly 4% of the variance of interest, which indicates that further indicators influence interest, such as the three basic psychological needs from self-determination theory, competence, autonomy and relatedness (Ryan & Deci, 2017). We measured interest with subject interest in a very general way and with only three items, and in further research, interest should be measured in a subject domain-specific focus, following the study of Jansen et al. (2016) conducted in a school context. Reliability for perceived instructor support and perceived instructional quality is $\omega \leq 0.75$. All the measurement instruments we use should be discussed and further developed in the academic discourse with regard to their quality (e.g. validity) in order to enable an even more precise measurement of teaching quality - although there are always limitations to measuring teaching practice through self-reporting (see comments below).

The response rate of 823 participants from 34,000 enrolled students at DHBW, that participate immediately two times successively in two surveys as a depend sample, was compared to the nearly 5,000 participants in these two surveys answering only one time (independent view) low and must be seen as a further limitation. This is due to the fact that the students could not be motivated to participate at two consecutive points in time. However, our results seem to be significant, because there exists, for example, a decrease in interest in our sample, as is known from previous research (Benden & Lauermann, 2022; Schnettler et al., 2020).

As already emphasized in the section 'measures', we use self-reports to measure subject interest, perceived lecturer support and perceived instructional quality in our research. According to Demetriou et al. (2015), there are limitations of using self-reporting. Individuals may provide invalid responses, as respondents may not answer truthfully or in a socially acceptable way, especially for sensitive questions. This is known as social desirability bias. Another problem is response bias, because participants may answer irrespective to the questions, such answering all questions with yes or no. Another challenge with self-reports is the clarity of the text in the items, which carries the risk of different interpretations of the questions. Being part of a research program is another factor influencing the response and a potential factor for invalid answers (Hawthorne effect). The lack of flexibility in scoring an answer is another limitation, as it limits the participants' ability to express themselves and their feelings. However, in medicine (Short et al., 2009) or in crime research (Jolliffe, & Farrington, 2014), it is argued that the use of self-reports creates robust results. Sticca et al. (2017) reported same findings for grades. Consequently, first practical implications can be derived using self-reports, that need to be closely observed and evaluated.

Another limitation of our design is the method of collecting annual data, as it does not allow for pinpointing critical moments of motivational change or development within the first year. This is particularly problematic since motivational changes are particularly likely to occur in the first year or immediately after the start of the study program (Benden & Lauermann, 2022). However, we conduct annual surveys only in the spring after the first semester for research and cost-effectiveness reasons, and also to ensure that new students have completed a theoretical and work integrated phase before participating in the survey for the first time.

Our study opens avenues for further research. It is important to analyse the development of different motivational aspects relative to the independent variable of perceived lecturer support, such as the motivational aspect of the cost (Flake et al., 2015) in the context of situated expectancy–value theory (Eccles & Wigfield, 2020). Theories and results should be tested for robustness in subgroups analysis to elaborate specific prevention and intervention options based on moderator analysis (e.g., Wang & Ware, 2013), in terms, for example, of the growing population of non-traditional students in higher education (Wild et al., 2023b). Although research on motivation at universities is of growing interest (Xu et al., 2021), this field is underdeveloped relative to school research.

Conclusion

Motivation in higher education study programs decreases over time (Benden & Lauermann, 2022; Wild, 2022). The first year at university is particularly important, as students are confronted with many new situations (Dresel & Grassinger, 2013; Pillay & Ngcobo, 2010; Wild & Grassinger,

2023) and the probability of students dropping out is highest in this phase (Chen, 2012). In our study, we were able to show that perceived support from lecturer slows down the decline in motivation from the first to the second year of study. Future research should verify our results for robustness and analyse further motivational aspects.

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Code availability Syntax is available. Please contact the corresponding author.

Data availability Data is available. Please contact the corresponding author.

Declarations

Informed consent Informed consent was obtained from all students who participated in the study prior to their completion of the research questionnaires.

Ethics approval All procedures of the conducted study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by Baden-Wuerttemberg Cooperative State University (July 8 2015). All the subjects gave their digital informed consent.

Conflict of interest The authors of this study declare that they have no biomedical or financial conflicts of interest to disclose.

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