Bottling *et al. Empirical Res Voc Ed Train* (2024) 16:7
https://doi.org/10.1186/s40461-024-00162-4

Empirical Research in
Vocational Education and Training

RESEARCH Open Access

Participation, motivation, and emotional states in the course of VET teacher training: results of an 18-months longitudinal study

Matthias Bottling[1*], Julia Katharina Weiß[1] and Tobias Kärner[1]

*Correspondence:
matthiaswilhelm.bottling@uni-hohenheim.de

[1] Chair of Economic and Business Education (560A), University of Hohenheim, Fruwirthstraße 47, 70599 Stuttgart, Germany

Abstract

Background: Our study aims to investigate inter- and intraindividual effects of trainee teachers' perceived opportunities of participation in vocational education and training teacher training on their emotional states. Additionally, it is examined whether the subjective reason for action as in intrinsic and extrinsic motivation affects the relationship between perceived participation and emotional states. In this respect, control-value theory constitutes the guiding conceptual framework in our study.

Methods: On the basis of a longitudinal design with a total of 75 trainee teachers in Germany and a maximum of 58 survey time points during 18-months of teacher training (in total 1790 individual measurements), we traced the perception of participatory opportunities, intrinsic and extrinsic motivation as well as weekly emotional states. Multilevel modeling allowed us to examine both between- as well as within-person effects of perceived participation.

Results: The results of our multilevel models indicate, among other findings, statistically significant within- and between-person effects of perceived participation opportunities on enjoyment, hope, pride, as well as anger, anxiety, shame, and hopelessness. Furthermore, the attributed subjective reason for action, i.e., the intrinsic or extrinsic motivation, moderates the relationship between perceived opportunities to participate and emotional states.

Discussion: The findings, which are consistent across different emotions of the same valence and for the two different types of motivation, indicate that those trainee teachers who report low values for intrinsic motivation (or high values for extrinsic motivation) in a given week react more responsively to changes with regard to opportunities for participatory influence.

Keywords: Participation, Motivation, Emotional states, Multilevel modeling, Intensive longitudinal data, Vocational education and training teacher training

Introduction

Self-determined participation holds exceptional significance, not only for individuals but also within social practices. It is particularly valued in the educational context as it supports the cultivation of autonomous judgment and action competence[1] (Heid et al. 2023; Kärner et al. 2023). Given the clear and largely predefined formal structures and procedures characterizing teacher training[2] (in Germany), it is crucial to grant trainee teachers sufficient freedom within this framework, emphasizing the importance of providing opportunities for their involvement and co-determination in educational decisions pertinent to their training. As postulated by relevant training regulations, teacher training is intended to enable prospective teachers to fulfill their educational and teaching responsibilities independently and responsibly (e.g., BSPO 2015). This includes, among other things, the expectation that teachers are encouraged to support their students in developing self-determined, reflective, and responsible judgment and actions (KMK 2022) and therefore facilitate active participation among their students (Bergmark and Westman 2018). Thus, the same educational goal is required and addressed in a dual manner. To achieve this goal, it is consequently necessary to promote the development of autonomous rational judgment and action competence among trainee teachers within the context of teacher training, as it is a prerequisite for being able to decide and act independently and autonomously in a certain system. This involves fostering the ability for self-determined participation and influence on decisions by implementing corresponding opportunities during their training. However, the demand for independence and personal responsibility only makes sense if it is not a question of instrumentalizing self-determination for externally determined purposes (Heid 1991a; 1991b; 2005).

To be able to participate in decisions, trainee teachers need to possess the capability to exert substantial influence on the external characteristics that constitute their learning and working environment. The degree of influence of trainee teachers therefore ranges between perceived heteronomy (trainee teachers believe that decisions relevant to their training are made by others) and autonomy (trainee teachers believe that decisions relevant to their training are made by themselves) (Heid et al. 2023). The differentiation between the categories "autonomy" and "heteronomy" is reflected in the internal perspective of learning and working in different types or qualities of *motivation*. Possible reasons for the initiation, execution and maintenance of intentional behavior can thus be located on a continuum between intrinsic and various forms of extrinsic regulation (Ryan and Deci 2020). Also, the development of motivation based on self-determination is particularly promoted through the experience of being able to freely choose one's own actions (Deci and Ryan 1993). In principle, learners find motivation when granted opportunities for participation, for instance through offering them considerable choice

[1] Following Heid (2001), we understand this to mean the competence not only to solve problems, but also to critically evaluate, define and rationally justify them. Since the solution of work-related problems, as particularly experienced daily by prospective teachers, is not merely a product of applied knowledge and skills, but also an outcome of emotional and motivational processes during the application of such knowledge and skills, so-called non-cognitive facets of competence (especially motivational and emotional dispositions and states) must be taken into account within the context of work-related action regulation (Sembill et al. 2013).

[2] With the term *teacher training* we refer to the second phase of teacher education, the practical in-service training (see Sect. 2.1).

in how they deal with the learning activities in regard to teaching and its organization, collaboration among colleagues, thematic focus, and performance assessment (Aelterman et al. 2018; Kärner et al. 2023; Weiß et al. 2023).

External conditions of learning and control over them as well as internal qualities of action regulation determine emotional responses (Sembill 2010). As emphasized by Pekrun and Perry (2014), a person's inclination towards future learning and engagement with tasks can be significantly shaped by their *emotional states*. Control-value theory (CVT) postulates that the occurrence of learning and performance emotions depends on whether a person feels that he or she has (or does not have) control over activities and outcomes (e.g., through participation), especially if these have an attributed value (extrinsic and/or intrinsic origin), i.e., are of personal significance (Pekrun et al. 2011; Warwas and Helm 2017). Pekrun (2021) points out that previous research on the processual interplay of emotional states and motivation in teachers has too often focused on interindividual differences (*between-person level*) in experience and behavior and calls for broadening the perspective to examine intraindividual processes (*within-person level*) in order to obtain more meaningful research findings. While recent studies in educational research have delved into various emotion-related within-person aspects such as teachers' appraisal-emotions (Frenzel et al. 2020), teachers' emotional experiences (Ruiter et al. 2020), the dynamic between student engagement and teacher emotions (Li et al. 2024) or student emotions (Mainhard et al. 2018), as far as we know, there has been no within-person study on the emotional experiences of trainee teachers within teacher training programs. Yet, within-person analyses, focusing on individual fluctuations of emotional states, offer a deeper understanding of how individual perceptions or responses vary across time.

The aim of this study is therefore to investigate to what extent perceived possibilities of influence on decisive aspects of teacher training cause changes in the emotional state of trainee teachers. In addition, the question arises whether internal regulatory conditions, such as the type of motivation and, in particular, the subjective reasons for initiating and maintaining actions, have an influence on the relationship between perceived opportunities of participation and the resulting emotional states. One focal point of our study involves exploring the differentiation between internal and external values of learning activities and results, an aspect that deserves further exploration within the current literature on CVT. A more nuanced examination of the value component, specifically delving into the distinctions between intrinsic and extrinsic motivation, has the potential to offer new perspectives in regard to the emotional experiences of individuals. We introduce CVT as the guiding conceptual framework in our study, considering *participation* as an external condition (in terms of CVT as control), while *motivation* constitutes an internal condition of learning actions (in terms of CVT as value) in teacher training, forming the basis for *emotional responses*. By examining the teacher training program over a full 18-month duration, our focus extends beyond just between-person analyses identifying distinctions among trainee teachers. Specifically, we are also interested in investigating effects within trainee teachers. The two different analytical perspectives allow us to provide a comprehensive evaluation of participation in teacher training by examining both individual differences and variations within trainee teachers across time in regard to emotional states. On the basis of a longitudinal design with a total of 75

trainee teachers in Germany and a maximum of 58 survey time points during teacher training (in total 1790 individual measurements), we traced the weekly perception of participatory opportunities, intrinsic and extrinsic motivation as well as emotional states. Through multilevel analyses, inter- as well as intraindividual effects of perceived participation will be examined.

The article is structured as follows: Following the description and contextualization of vocational education and training (VET) teacher training, we provide an overview of theoretical approaches and empirical findings on perceived participation opportunities, subjective motivational values and emotional states. Ultimately, corresponding hypotheses are derived. Subsequently, the methodological approach is presented, encompassing the study design, description of measures, the empirical model and data analysis. The next section presents our empirical findings, followed by a comprehensive discussion of the results.

Contextual and theoretical background

The context of VET teacher training in Germany and the tension between autonomy and heteronomy

According to the OECD (2021, p. 91), "initial teacher education and training (ITET) for the VET sector is highly variable", meaning that not only the entry requirements differ among countries, but also the provision regarding the formal organization (e.g., the institutions in charge). However, they all have in common to equip prospective teachers with sufficient pedagogical as well as subject-specific expertise to adequately prepare their students for professional practice. In Germany, where the present study was conducted, teacher education is divided into two parts: a more theoretical phase at a university or college of education (including several weeks of a teaching internship in a vocational school) and a practical in-service phase (lasting 1–2 years, depending on the federal state), often referred to as the "second phase" of teacher education or "preparatory service". This second phase is characterized by two learning sites, the *training school*[3] and the *college of didactics and teacher education* (see also Weiß et al. 2023). As part of the teacher training program, performance is assessed over the entire duration and with regard to various examinations, starting with numerous feedback sessions, oral examinations, a written paper on a comprehensive teaching unit held, principal evaluations and teaching demonstrations, assessed with grades by seminar teachers who observe these lessons. During this second phase, trainee teachers must frequently interact with their mentors (experienced teachers) in the training school as well as with their seminar teachers who are responsible for training in didactics and subject-related competencies at the college of didactics and teacher education. At this point, the question arises of how much prospective teachers can (and/or want to) participate in the decisions made by their training instructors. While many aspects of the training are externally predetermined (timetable, curriculum, assessments, etc.) it is precisely the situations and interactions with the training mentors and seminar teachers that inherently provide opportunities for participation and co-determination. It is important to emphasize that

[3] The training school is a regular vocational school. Each trainee teacher is assigned to a training school at which they complete their teacher training.

the key objective of teacher education and training is to prepare and empower prospective teachers to work and learn independently in their (future) profession (BSPO 2015; Messner and Reusser 2000). For this reason, the external conditions during training should be designed in such a way that individuals can act and make decisions (at least to some extent) independently. As pointed out by Valenčič and Vogrinc (2007) in this context, mentors in particular are often faced with the dilemma of when help and support becomes an interference in the trainee's work. The question therefore arises as to how autonomy can be realized within a training framework that is sometimes relatively rigidly structured. According to Helsper (2016) professional action is characterized by more or less clear asymmetries between instructors and their learners or trainees and thus by more or less unequal distribution of power. This structural power imbalance renders professional actions inherently vulnerable to various forms of power abuse. In this context, participation provides an opportunity for learners to actively engage in their own development process and enhance their autonomy, precisely in order to address and mitigate existing power imbalances or to counteract the prevailing structural inequity. Helsper (2016) describes the paradoxical relationship between autonomy and heteronomy in professional practice as follows: When professionals, such as seminar teachers or mentors, intervene in a supportive and facilitative manner to promote autonomy—for example, by providing ample opportunities for participation—the result may paradoxically be that dependency is increased, any autonomy that may already exist is decreased, and consequently heteronomy is promoted. For instance, extensively involving the trainee teacher in collaborative lesson planning could unintentionally foster dependency if the trainee teacher relies heavily on the mentor for guidance, leading to heteronomy.

Participation, motivation and emotional states within the framework of control-value theory

By incorporating CVT as the guiding conceptual framework in our study, we regard participation as an external condition (within the context of CVT referred to as control), while motivation is seen as an internal condition influencing learning actions (within the framework of CVT referred to as value) in teacher training. CVT suggests that emotions related to learning and performance are influenced by an individual's perception of control over activities and outcomes. This perception, particularly when activities hold personal significance due to the attributed value, can determine the occurrence of emotions (Pekrun et al. 2011). Against this background, the following sections will provide a closer examination of the three central concepts mentioned and their interplay.

Perceived participation opportunities in teacher training

If one considers possible fields according to which external learning opportunities in teacher training can be described in more detail in terms of content and process, then the learning objectives and learning content, aspects of social and didactic-methodical design, structuring and organization of the learning opportunities as well as applied forms of examination and assessment criteria can be identified as essential dimensions (e.g., Hauk and Gröschner 2022; Kärner et al. 2023). In determining the content of these very decision fields, trainee teachers in principle

have the possibility of influencing the corresponding decisions. In this context, we understand participation as the involvement of trainee teachers in "decision-making and will-forming processes" (Reichenbach 2007, p. 54), which includes a dialogue between the learners and other decision-makers (e.g., seminar teachers or mentors) (Mager and Nowak 2012). In order to achieve participation, trainee teachers must be able to exert a significant influence on decisions relevant to their training, i.e., they must be able to choose actions from a defined set of options for action. This also includes the possibility to decide against something, which in turn presupposes corresponding freedom of action and decision-making with regard to the external conditions of their will and action (e.g., Habermas 1974; Heid 1991a; Oser and Biedermann 2007). At this point, it becomes clear that the learner's freedom of action and decision-making can be more or less pronounced in the training context (e.g., due to organizational and procedural restrictions or opportunities). The degrees of trainee teacher influence therefore range between perceived and/or actual external control (relevant decisions are made externally from the trainees' points of view) and autonomy (trainees make the relevant decisions independently) (summarized and described in more detail in Heid et al. 2023 and Kärner et al. 2023).

Depending on the specific context, perceived control in CVT can mean, for example, that there are opportunities to participate in shaping the (learning) environment and outcome. The perception of sufficient internal control over activities and their outcomes is the central prerequisite for the expectation that success can be achieved or failure prevented (Pekrun et al. 2007). Also, assuming that learner development is largely determined by complex interactions between the learner with his/her individual learning prerequisites and the characteristics of the learning environment (Kärner and Kögler 2016), it could be postulated that institutionalized educational processes should make it possible to do justice to the individual differences between learners in terms of their development opportunities. One possible way to ensure this is for learners themselves to influence the momentous decisions that underlie the design of such educational processes and thus to provide them with a certain degree of control over learning situations. Learners would therefore have to be given opportunities to constructively participate in determining the spectrum of assessment characteristics that require justification or ways of achieving goals (Heid 1992; Heid et al. 2023; Kärner et al. 2023). The basis of justification aimed at the interaction between the person and the (learning) environment refers, in the sense of self-organization processes, to the assumption of a self-determined emergence of order, which represents an action-regulated process within the person, but also between persons and in the person-environment interaction (Sembill 1999).

Intrinsic and extrinsic motivation of trainee teachers

The differentiation between the categories of autonomy and heteronomy is reflected in the internal perspective of learning in different types or qualities of motivation, which are described in more detail in the context of the self-determination theory (SDT) of motivation (Ryan and Deci 2020). Possible reasons for initiating, executing, and maintaining intentional behavior can thus be located on a continuum of relative self-determination whereby the perceived location of action execution shifts between intrinsic

and extrinsic motivation: In the case of *intrinsic motivation* learning actions are initiated, executed and maintained due to their own will and out of pure object-related interest, without a need for consequences that can be separated from the action to maintain the learning action; in the case of *extrinsic motivation*, an action is carried out due to its factual or anticipated external consequences and not of one's own volition, which can be expressed, for example, in carrying out an activity in order to meet the specified requirements. The learning and working environment plays a special role in the genesis of the above-mentioned motivational qualities by supporting or thwarting the satisfaction of basic psychological needs, e.g., for autonomy (see Weiß et al. 2023) in the sense of the above-mentioned freedom of action and decision-making, since, for example, the satisfaction of the need for autonomy promotes the development of intrinsic motivation (Ryan and Deci 2020; Scheja 2009; Sembill and Scheja 2008; Kärner et al. 2023).

The *subjective value* attributed to activities and outcomes within CVT can be intrinsic or extrinsic in origin, i.e., they are of personal significance (Pekrun et al. 2011; Warwas and Helm 2017). Intrinsic values are defined as activities that are valued per se or are enjoyable and do not necessarily produce an outcome (Pekrun et al. 2007). In contrast, extrinsic values encompass the instrumental use of activities in generating desired outcomes and the ability of these outcomes to potentially trigger further consequences (Heckhausen 1991). In our theoretical model, we refer to intrinsic and extrinsic importance of activities in teacher training and distinguish between intrinsic and extrinsic motivation, as motivated behavior ultimately affects emotional states (Seifried and Sembill 2005). Several studies utilize a single dimension approach of value. Yet, we differentiate between intrinsic and extrinsic value appraisals, following Simonton and Garn (2020) and recommendations from Pekrun and Perry (2013), who advocate for this due to their conceptual differences. Additionally, Frenzel et al. (2007) underscore the importance of considering the dual dimensions of value appraisals. Götz et al. (2010) have derived from appraisal theories that a higher degree of personal relevance or attributed value with regard to an activity or outcome is associated with higher levels of positive emotional experiences. Specifically, CVT implies that subjective values influence both the type of emotion experienced and its intensity. The intensity of the experienced emotion is suggested to depend on the degree of subjective value, including one's interest level or motivation in specific learning material or the perceived significance of success and failure in an exam (Pekrun et al. 2007).

Emotional states of trainee teachers

The conception of emotional states is understood as an emotionally motivationally characterized, subjective and situation-specific experience of a mental state. In contrast to stable, person-related emotional traits, these emotional states can take on different as well as continuously varying characteristics within and between individuals during the course of the teacher training program (Sembill 1992; 2010). They can occur as a trigger, concomitant and/or consequence of cognitive (i.e., information-processing) processes and represents an essential component of action regulation processes (Achtenhagen et al. 1988; Schumacher 2002; Sembill 1992). Sembill (1992) emphasizes the need

to constructively include the emotional states and needs of learners in didactic efforts and to understand them as a constitutive element for the acquisition and change of knowledge.

In the context of the CVT, Pekrun et al. (2007) describe achievement emotions as emotions that are directly related to achievement activities or outcomes. In the context of teacher training, emotional states affecting learning and performance can be considered as achievement emotions, as trainee teachers in particular are subject to continuous assessments. On the one hand, they engage in self-evaluation and reflection of their own performance and practice. This assessment encompasses various dimensions, such as the overall effectiveness and success of the lesson they have conducted, the extent to which students have acquired knowledge during class, an evaluation of their pedagogical competencies beyond the scope of subject expertise, and their ability to integrate and execute recommendations provided by their instructors. On the other hand, they are implicitly evaluated by students (e.g., through facial expressions, gestures and body language as well as expressed satisfaction), whereas they are explicitly evaluated for their performance by colleagues, mentors, seminar teachers, or the school principal via feedback and grades.

Emotional states play a particularly important role in the teaching profession, as teaching is associated with high demands and low control, which often results in emotional exhaustion and increased teacher turnover (Shackleton et al. 2019). In this context, Aprea et al. (2023), for example, report from a broad-based longitudinal study that teachers at vocational schools work noticeably longer hours than the specified weekly working hours. In turn, weekly working hours correlate positively with the perception of stress and the risk of burnout and negatively with well-being and job satisfaction. Especially against the background of the shortage of teachers in many countries (e.g., UNESCO 2023), an adequate understanding of the underlying processes linked to emotional states seems to be indispensable in teacher training (Sembill and Kärner 2020). Accordingly, it has been acknowledged by, for example, Schutz et al. (2007) and Sutton and Wheatley (2003) that gaining a deeper insight into the emotions and emotional processes of (trainee) teachers holds promise for enhancing pre-service teacher education programs.

Interdependencies between participation opportunities and motivation with regard to emotional states

A crucial aspect of CVT lies not solely in assuming a direct effect between control or subjective value and resultant emotional states. Rather, it posits that both assessments of control and value appraisals impact achievement emotions in a multiplicative manner (Pekrun 2006). Emotions with positive valence (e.g. enjoyment, hope, or pride) arise when control and subjective value are high, while emotions with negative valence (e.g. anger, anxiety, shame, hopelessness, or boredom) occur when both factors are low. In this context, Pekrun et al. (2007) argue that the impact of perceived control on achievement emotions is moderated by the subjective value (of intrinsic or extrinsic nature). CVT emphasizes the mutual *reinforcement* of control and value: if both factors are present to a sufficient degree, they reinforce each other in their effect and the emotional

reaction becomes more intense (Götz et al. 2010; Pekrun 2006; Pekrun et al. 2007; for an application of CVT in the VET context, see Kögler and Göllner 2018). From a statistical point of view, the sign of the regression weight of the interaction between control and value would be positive in this case. In addition to the assumption of mutual reinforcement, as postulated by the CVT, the assumption of mutual *compensation* is also conceivable and plausible. In terms of content, this would mean that a lack of perceived control could be compensated for by a higher subjective value. From a statistical point of view, the sign of the regression weight of the interaction between control and value would be negative in this case.

Hypotheses

Against the background of the theoretical assumptions and relationships between perceived participation opportunities, motivation in the sense of subjective reasons for action, and emotional states described above, we formulate the following hypotheses, which are tested in our empirical study.

- *H1:* Greater perceived participation, in the sense of being able to influence the (learning) environment, corresponds positively with the emotional states of enjoyment, hope, and pride, and negatively with the emotional states of anger, anxiety, shame, hopelessness, and boredom.
- *H2:* The attributed subjective reason for action, i.e., the intrinsic or extrinsic motivation, is positively associated with the emotional states of enjoyment, hope, and pride, and negatively with the emotional states of anger, anxiety, shame, hopelessness, and boredom.
- *H3:* The attributed subjective reason for action, i.e., the intrinsic or extrinsic motivation, moderates the relationship between perceived opportunities to participate and emotional states.

Method

Study design

Based on a longitudinal design, weekly short questionnaires were conducted at a total of 58 data collection points (weeks) over the 18-month period of teacher training, resulting in 1790 individual measurements from 75 trainee teachers.[4] We chose the experience sampling method in a weekly diary format as the survey method. In view of the total duration of teacher training (18 months), the weekly survey frequency enabled us to achieve a relatively high measurement density and an interval-contingent survey plan. A major advantage of such a survey method is that diary data is generally more valid (e.g., ecological validity) than data obtained from retrospective measurements (for an overview of the experience sampling and diary method see Rausch et al. 2022 and Seifried and Rausch 2022). As not all trainee teachers provided information for every week in the questionnaire, the average response rate was around 24 surveys per person with

[4] The data stem from a research project involving the voluntary survey of 86 trainee teachers across the entirety of their teacher training at a single educational institution. Due to incomplete data availability concerning the variables of interest, the sample size has been diminished.

a standard deviation of around 21 surveys. In order to keep the effort for participants as low as possible, no data was collected during school vacations. Our data collection began in January 2022 and ended in July 2023. Participants were invited to take part in the questionnaire by email at the end of the working week (Friday), for which they had time to complete it over the weekend.

The sample is a full census conducted at one of four teacher training institutions for vocational schools in the federal state of Baden-Württemberg (BW), Germany. This sample is representative for the training cohort in terms of socio-demographic characteristics that began their training in the same year in the aforementioned federal state. Our sample includes 54 females (62.79%), which closely mirrors the gender distribution of female trainee teachers in BW (60.05%). A chi-square analysis revealed that the ratio of males to females in our sample did not show a statistically significant deviation from the other VET training institutions in BW with respect to the observed gender distribution [$\chi^2(1,\ n=388)=0.346,\ p=0.557$]. Additionally, the average age of participants in our sample is 29.63 years, which matches the average age of the population at 29.70 years. A t-test further indicated that there is no significant difference in the average age of our participants compared to other VET training institutions in BW [$t(380)=0.140,\ p=0.889$].

The study received approval from the relevant government authority, and all trainee teachers willingly consented to their involvement in the study and the use of their data. As an incentive for regular study participation, a total of €1000 was raffled off among all participants. In order to take part in the prize draw, at least 50% (29) of all 58 questionnaires had to be completed. A higher participation rate increased the chances of receiving a higher expense allowance.[5]

Measures

Perceived participation opportunities

The subjective experience of being able to influence one's environment can sometimes deviate from the actual (objective) situationally given opportunities for influence or autonomy (cf. e.g., Meyer-Ahrens et al. 2010). In the course of operationalizing perceived participation opportunities, we deliberately decided to ask study participants about their subjective experience as a phenomenally-conscious and articulable state, i.e., their sense of opportunities to exert influence. The reason for this is that the trainees are our only source of information and we therefore assumed that they would be able to provide more valid information about their subjective experience of participation opportunities than about the factual objective conditions. When examining external learning opportunities, various dimensions can be identified that allow for considerable learner influence (summarizing Kärner et al. 2023): the consideration of aspects of social interaction, the structuring and organization of learning opportunities, the definition of learning objectives and content as well as aspects related to the forms of examination or assessment criteria used (e.g., Hauk and Gröschner 2022; Reisenauer 2020; Weinert 1982). Our self-developed items for assessing

[5] Depending on the draw, the amounts to be disbursed were €25, €50, and €100. Thus, altogether a maximum of €175 could be won.

Table 1 Items for assessing perceived participation opportunities

Participation in VET teacher training regarding…	Item
… collaboration	… I felt like I could influence who I worked with. *(original: … hatte ich das Gefühl, Einfluss darauf nehmen zu können, mit wem ich zusammenarbeitete.)*
… organization of work	… I felt like I could influence the way I handled my tasks (e.g., preparing classes and teaching). *(original: … hatte ich das Gefühl, Einfluss darauf nehmen zu können, auf welche Art und Weise ich meine Aufgaben (z. B. Unterrichtsvorbereitung und -durchführung) erledigte.)*
… content definition	… I felt like I could influence which topics and content I dealt with. *(original: … hatte ich das Gefühl, Einfluss darauf nehmen zu können, mit welchen Themen und Inhalten ich mich beschäftigte.)*
… performance evaluation	… I felt like I could influence how my performance was evaluated. *(original: … hatte ich das Gefühl, Einfluss auf die Beurteilung meiner Leistungen nehmen zu können.)*

Introductory question and text: "How strongly do you agree with each of these statements regarding this week of your teacher training? This week in teacher training,…"

perceived participation opportunities are based on these theoretical considerations on possible dimensions of participation as well as on the empirical work by Kärner and Jüttler (2024) capturing perceived participation in educational settings in terms of collaboration, organization of work, content definition, and performance evaluation. Participants were asked how strongly they agreed with each of the four items for the respective week, measured on a six-point Likert-type scale ranging from (1) *do not agree* to (6) *totally agree*. The exact wording of the items can be found in Table 1.

A two-level confirmatory factor analysis (CFA; Chou et al. 2000) was conducted to test whether our four perceived participation items reliably measure the facets of a joint perceived participation construct in teacher training and thus load on one common factor, both within and across individuals. For the evaluation of model fit in structural equation modeling, we followed recommended cut-off values for the fit indices (see Homburg and Baumgartner 1995; Marsh et al. 2004; Homburg et al. 2008). With respect to reliability, we refer to McDonald's coefficient omega (hierarchical; ω_h) as an estimate of the general factor saturation of a test. ω_h offers a quantitative estimation indicating the extent to which the scale measures its overarching factor (Zinbarg et al. 2006). The multilevel confirmatory factor analysis provides sufficient evidence to adopt a common factor (χ^2 (4) = 15.592, $p = 0.004$; CFI = 0.986; RMSEA = 0.040; $SRMR_{within} = 0.021$; $SRMR_{between} = 0.020$) with reliabilities $\omega_{within} = 0.611$ and $\omega_{between} = 0.907$. All model fit indices are within the recommended cut-off values, indicating that the model fit can be considered as good. Whereas reliability on the within-person level was acceptable (Yang et al. 2022), it was excellent on the between-person level. With regard to the factor loadings, these were moderate at the within-person level and moderate to high at the between-person level (see Fig. 1). As all factor loadings were statistically significant, it underscored the presence of systematic common variance among the items and, as a result, provided sufficient support for the calculation of one participation scale across all items.

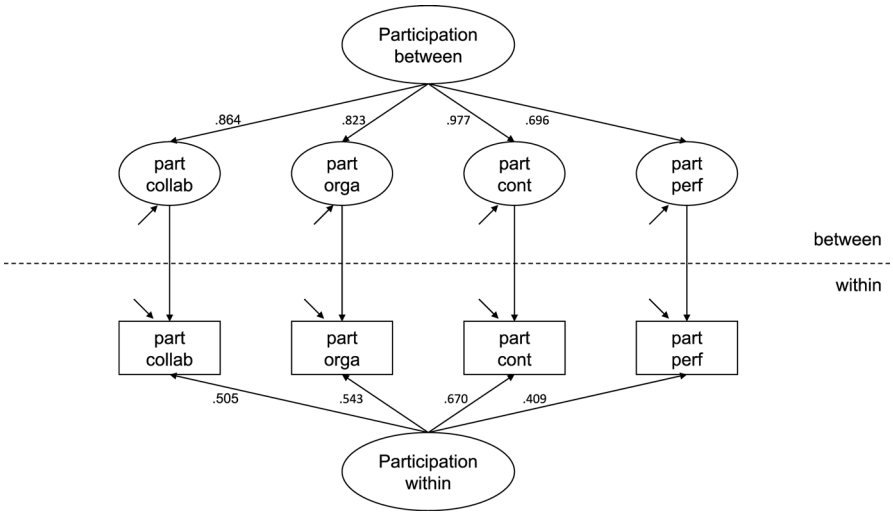

Fig. 1 CFA for assessing the structure of the perceived participation opportunities scale. *part collab* participation regarding collaboration, *part orga* participation regarding the organization of work, *part cont* participation regarding contents, *part perf* participation regarding performance evaluation

Intrinsic and extrinsic motivation

To assess the extrinsic and intrinsic subjective reason for action attributed to the activities during teacher training, one single item for each type of motivation was used, aiming to reflect extrinsic and intrinsic motivation. In this context, we deliberately opted for the utilization of single items due to our sort of weekly experience sampling method, which involved the administration of brief, user-friendly surveys. This decision is grounded in a thorough consideration of scientific recommendations regarding the use of single items (e.g., Allen et al. 2022; Matthews et al. 2022).

The items were self-constructed, but in accordance with SDT and inspired by existing instruments such as the Academic Motivation Scale (AMS-C 28) College Version (Vallerand et al. 1993) or the scales of Prenzel et al. (1996). Both items were measured on a six-point Likert-type scale ranging from (1) *never* to (6) *always.* Again, the exact wording of the items is listed in Table 2.

Table 2 Items for assessing the subjective reason for action in terms of motivation

Subjective reason for action	Item
Intrinsic motivation	… I completed my tasks because of my inner drive to accomplish them. *(original: … habe ich meine Tätigkeiten ausgeführt, weil ich es aus mir heraus wollte.)*
Extrinsic motivation	… I completed my tasks to meet the specified requirements. *(original: … habe ich meine Tätigkeiten ausgeführt, um den vorgegebenen Anforderungen gerecht zu werden.)*

Introductory text: "The following statements refer to learning and working during this week of your teacher training. Please give your personal rating for each statement. This week while learning and working in teacher training …"

Emotional states

In order to evaluate the emotional responses in each week of teacher training we implemented in total eight items, which are intended to capture the emotional states of trainee teachers. According to Keller et al. (2014, p. 69), who refers to Lazarus (1991) in his explanations, almost all emotion theories assume that emotions are extremely variable and have subtle differences, and many emotion researchers believe "that broad dimensions such as positive vs. negative affect are not sufficient to accurately describe the occurrence of emotions". As we share this view, we consider our individual emotional states in a very differentiated way and refrain from creating a common scale for emotional states with positive vs. negative valence. One distinct item was assigned to each emotional state, encompassing enjoyment, hope, pride, anger, anxiety, shame, hopelessness, and boredom. The formulation of the items was conducted based on the Achievement Emotion Questionnaire (AEQ) (Short) and adapted to our survey context (Bieleke et al. 2021; Pekrun et al. 2011). All items were assessed utilizing a six-point Likert-type scale, spanning from (1) *never* to (6) *always*. Table 3 sets forth the precise wording of these items.

Statistical modeling and data analysis

As outlined in the previous sections, the aim of our empirical study is to investigate the relationship between perceived opportunities to influence aspects relevant to training and changes in the emotional state of trainee teachers. In addition, the question arises whether internal regulatory conditions, such as the type of motivation and in particular the subjective reasons to initiate and maintain actions, affect the emotional states directly as well as the aforementioned relationship between perceived participation opportunities and the resulting emotional states. In the following, we transfer the ideas of underlying

Table 3 Items for assessing emotional states

Emotional states	Item
Enjoyment	… I enjoyed my tasks. *(original: … hatte ich Spaß an meinen Tätigkeiten.)*
Hope	… I was confident because I was doing well. *(original: … war ich zuversichtlich, weil ich gut zurechtkam.)*
Pride	… I was proud of myself. *(original: … war ich stolz auf mich.)*
Anger	… I was upset. *(original: … war ich verärgert.)*
Anxiety	… I was worried and tense. *(original: … machte ich mir Sorgen und war angespannt.)*
Shame	… I felt like I had embarrassed myself. *(original: … hatte ich das Gefühl, mich blamiert zu haben.)*
Hopelessness	… I was so resigned that I felt quite powerless. *(original: … war ich so resigniert, dass ich mich ganz kraftlos fühlte.)*
Boredom	… I was bored. *(original: … war ich gelangweilt.)*

Introductory text: "Your everyday life as a trainee teacher can trigger various feelings. Please indicate how you felt this week in your role as a trainee teacher. This week in teacher training, …"

psychological mechanisms regarding the effect of weekly[6] perceived participation opportunities and weekly motivation on weekly emotional states of trainee teachers to our empirical model and describe the applied empirical approach accordingly.

The emotional state of trainee teacher *j* during week *w* (emot_states_{wj}) is predicted (a) based on the trainee's weekly perceived participation (perc_part_{wj}) and the trainee's weekly motivation (mot_{wj}), which were centered on trainee *j*'s person-mean of perceived participation opportunities and trainee *j*'s person-mean of motivation, respectively, thus isolating a solely within-person effect (e.g., Kramer et al. 2021; Raudenbush and Bryk 2002) and (b) based on trainee *j*'s mean of all perceived participation (perc_part_pmean_j) and motivation reports (mot_pmean_j), centered on their respective grand-means, representing the between-person effect. The model also incorporated random effects for both the intercept and the slope of perceived participation opportunities as well as motivation. The following equations describe our model.

Level 1 (within trainee teachers):

$$\text{Emot\_states}_{wj} = \beta_{0j} + \beta_{1j} \times \text{perc\_part}_{wj} + \beta_{2j} \times \text{mot}_{wj} + \varepsilon_{wj} \tag{1}$$

Level 2 (between trainee teachers):

$$\beta_{0j} = \gamma_{00} + \gamma_{01} \times \text{perc\_part\_pmean}_j + \gamma_{02} \times \text{mot\_pmean}_j + \upsilon_{0j} \tag{2}$$

$$\beta_{1j} = \gamma_{10} + \upsilon_{1j} \tag{3}$$

$$\beta_{2j} = \gamma_{20} + \upsilon_{2j} \tag{4}$$

Moreover, for the assessment of intraindividual differences in intraindividual effects, we carried out a *within-level* (level 1 × level 1) moderation analysis, which tends to be rarely used in scientific studies due to the fact that experience sampling or extensive longitudinal data is required, and many studies are still conducted cross-sectionally. In this way, more detailed information can be derived at the person level, which improves the understanding of processes that take place within individuals. This was implemented by adding the interaction term ($\text{perc\_part}_{wj} \times \text{mot}_{wj}$) to our model, constituting a fixed effect.[7] The equation on level 1 is therefore extended as follows.

Level 1 (within trainee teachers):

$$\begin{aligned}\text{Emot\_states}_{wj} = {} & \beta_{0j} + \beta_{1j} \times \text{perc\_part}_{wj} + \beta_{2j} \times \text{mot}_{wj} \\ & + \beta_3 \times (\text{perc\_part}_{wj} \times \text{mot}_{wj}) + \varepsilon_{wj}\end{aligned} \tag{5}$$

In Eqs. (1) to (5):

- β_{0j} is the mean of the emotional state of trainee teacher *j*;
- β_{1j} represents the randomly varying slope parameter for perceived participation;
- β_{2j} represents the randomly varying slope parameter for motivation;

[6] The data was collected on a weekly basis over a total period of 18 months (see Sect. 3.1) at a single teacher training institution for vocational schools.

[7] The effect was not randomly estimated in order to avoid convergence problems.

- β_3 represents the fixed slope parameter for the interaction term;
- γ_{00} is the average emotional state across all trainee teachers and measurement times (weeks), i.e., the grand mean;
- γ_{10} represents the average slope parameter for perceived participation;
- γ_{20} represents the average slope parameter for motivation;
- $\gamma_{01,}$ γ_{02} and γ_{11} are the parameters to be estimated;
- υ_{0j}, υ_{2j} are the deviations of the mean value of trainee teacher *j* from the mean value across all trainee teachers and measurements (weeks), i.e., the level 2 random effect (level 2 residual variance); and
- ε_{wj} is the deviation of the measurement at week *w* from the average emotional state of trainee teacher *j* (level 1 residual variance).

The following Fig. 2 graphically illustrates the analysis model on both levels.

In order to test the empirical model described above on the basis of the collected data, we estimated in total 16 two-level models. Multilevel models split the residual variance of the dependent variable, i.e., the emotional states, into two (statistically orthogonal, i.e., independent) variance components:

- Variance within level 2 units (intra-individual variability): $\text{Var}(\varepsilon_{wj})$
- Variance between level 2 units (inter-individual variability): $\text{Var}(\upsilon_{0j})$

The ratio of the level 2 variance to the total variance is the intraclass correlation coefficient (ICC), which is reported in Table 4. The respective ICC across all variables falls within the range of 0.30–0.57, indicating that there is both variance within trainee teachers (observations of an individual vary) and variance between trainee teachers (there are differences between individuals), which justifies the analysis of both levels. Multilevel models were employed to address the nested hierarchical structure within the data. Likelihood ratio tests were employed to assess the significance of random effects by comparing the model's fit with and without the corresponding random variance. If

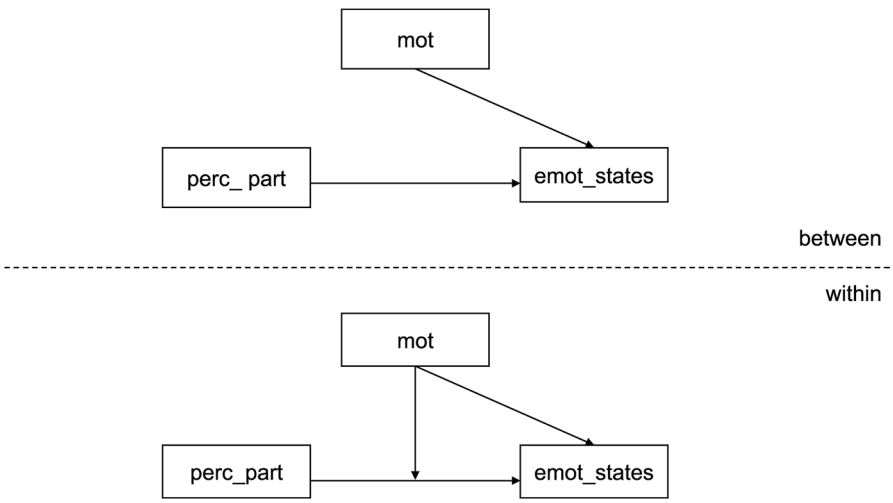

Fig. 2 Hypothetical models for analysis. *perc_part* perceived participation opportunities, *mot* motivation, *emot_states* emotional states

random variances are not estimated, despite the presence of random variances in the parameters, "Type I error rates can be badly inflated" (Baird and Maxwell 2016, p. 187). Starting with a null model to estimate the variability of trainee teachers' reports of their experienced emotional states, we subsequently included predictors as in perceived participation opportunities and intrinsic or extrinsic motivation to test main effects at each level. Following this, we analyzed interactions while controlling for the direct effects. In order to determine both inter- and intraindividual differences in intraindividual effects, we conducted cross-level (level 1 × level 2) and within-level (level 1 × level 1) moderation analyses. However, for the former, we did not find significant differences with respect to *gender* and *age* in the intraindividual effect of perceived weekly participation on emotional states of a trainee teacher. For the latter, we first conducted eight models incorporating perceived participation and intrinsic motivation as the potential moderator, each utilizing one of the following weekly emotional states as a dependent variable: enjoyment, hope, pride, anger, anxiety, hopelessness, shame, and boredom. Similarly, we have added eight additional models that consider the potential moderator of extrinsic motivation.[8] All statistical analyses were performed in R (version 4.2.1 using the nlme package from Pinheiro et al. (2018) for estimating the multilevel models; the model parameters are based on restricted maximum likelihood estimations). In each of our analyses, we applied the standard α-level of 0.05 (two-tailed).

Results

Descriptive data and correlations

Table 4 contains descriptive data (mean, standard deviation and ICC) as well as Pearson correlation coefficients on the within-person level (below the diagonal) and on the between-person level (above the diagonal).

With regard to the descriptive values, it can be seen that, on average, an above-average number of opportunities for participatory influence are reported ($M = 4.21$; 4 = often and 5 = very often). Extrinsically motivated reasons for action ($M = 4.23$) tend to reach higher approval ratings than intrinsic ones ($M = 3.75$; 3 = sometimes and 4 = often). Emotions with positive valence (enjoyment: $M = 4.17$, hope: $M = 3.91$, pride: $M = 3.45$) each achieve higher approval ratings on average than emotions with negative valence (shame: $M = 1.72$ to anxiety: $M = 3.13$; 1 = never, 2 = rarely, and 3 = sometimes).

Pearson correlations at the within-person level show positive correlations of medium strength[9] of perceived participation with the emotional states of enjoyment, hope, and pride, and negative correlations of medium strength with the emotional states of anger, anxiety, shame, and hopelessness. In addition, perceived participation corresponds positively with intrinsic motivation. Pearson correlations at the between-person level show strong positive correlations of perceived participation with the emotional states of enjoyment and hope, and negative correlations of medium strength with the emotional states of anger, anxiety, shame, hopelessness, and boredom. Moreover, perceived participation corresponds positively with intrinsic (strong effect) and extrinsic (small effect) motivation.

[8] Due to convergence issues in some models, it was not possible to include both intrinsic and extrinsic motivation simultaneously in one model as incorporating random effects rendered the models excessively complex.

[9] Following Cohen (1988), |r| = .10 can be referred to as a small correlation, |r| = .30 as a moderate correlation and |r| = .50 as a strong correlation.

Table 4 Descriptive data and Pearson correlations

Variables		M	SD	ICC	Correlations											
					(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Sociodemographics																
(1)	Age	29.67	4.98	–	**0.398**	–0.011	–0.014	0.096	–0.082	–.178	–0.180	–0.085	–0.016	0.104	0.075	–0.135
(2)	Gender[a]	34.67% male		–	–	–0.060	–0.022	0.044	–0.137	–.029	**–0.258**	–0.139	**–0.255**	0.139	0.013	–0.167
Perceived opportunities for participation																
(3)	Part. scale	4.21	0.82	0.55	–	–	**0.518**	**0.572**	0.139	**–0.395**	**–0.336**	**–0.456**	**–0.400**	**–0.384**	**0.508**	**0.276**
Emotional sates																
(4)	Enjoyment	4.17	0.99	0.42	–	**0.416**	–	**0.690**	**0.395**	**–0.628**	**–0.498**	**–0.657**	**–0.402**	**–0.602**	**0.508**	**0.385**
(5)	Hope	3.91	1.06	0.34	–	**0.424**	**0.579**	–	**0.577**	**–0.610**	**–0.718**	**–0.652**	**–0.576**	**–0.394**	**0.508**	**0.333**
(6)	Pride	3.45	1.20	0.41	–	**0.358**	**0.516**	**0.535**	–	–0.140	**–0.311**	–0.204	–0.036	**–0.235**	**0.434**	**0.413**
(7)	Anger	2.14	1.04	0.30	–	**–0.295**	**–0.340**	**–0.395**	**–0.307**	–	**0.672**	**0.796**	**0.637**	**0.560**	**–0.430**	–0.194
(8)	Anxiety	3.13	1.27	0.37	–	**–0.286**	**–0.374**	**–0.505**	**–0.301**	**0.388**	–	**0.650**	**0.737**	**0.272**	**–0.354**	–0.084
(9)	Shame	1.72	0.96	0.55	–	**–0.223**	**–0.256**	**–0.290**	**–0.232**	**0.328**	**0.267**	–	**0.691**	**0.643**	**–0.390**	**–0.295**
(10)	Hopelessness	2.16	1.25	0.42	–	**–0.324**	**–0.437**	**–0.493**	**–0.340**	**0.432**	**0.500**	**0.346**	–	**0.428**	**–0.363**	–0.139
(11)	Boredom	1.78	0.92	0.57	–	–0.013	**–0.060**	0.002	–0.040	0.029	**–0.062**	**0.086**	0.020	–	**–0.442**	**–0.467**
Motivation																
(12)	Intrinsic Mot	3.75	1.21	0.45	–	**0.385**	**0.514**	**0.463**	**0.404**	**–0.256**	**–0.316**	**–0.164**	**–0.404**	–0.012	–	**0.482**
(13)	Extrinsic Mot	4.23	1.11	0.40	–	0.015	0.006	**–0.067**	**0.083**	0.013	**0.176**	0.004	**0.066**	**–0.125**	0.021	–

Coefficients marked in bold are significant at least at the ≤ .05 level; [a]1 = female, 2 = male; *Participation*: six-point Likert-type scale (1 = do not agree—6 = totally agree); *Emotional states* and *Motivation*: six-point Likert-type scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often, 6 = always); Correlations on the between-person level are depicted above the diagonal; correlations on the within-person level are shown below the diagonal; Number of observations = 1699–1790; Number of trainee teachers = 75; *ICC* Intraclass Correlation Coefficient, *Part.* Perceived participation opportunities, *Mot.* Motivation

Intrinsic motivation at the within-person level shows medium to strong positive correlations with all emotional states having a positive valence as well as negative small to medium correlations with all emotional states having a negative valence except for boredom (not statistically significant). At the between-person level intrinsic motivation is significantly correlated with all emotional states—again showing medium to strong positive (negative) associations with the emotional states that have a positive (negative) valence. Extrinsic motivation at the within-person level is negatively correlated with hope and boredom as well as positively correlated with pride, anxiety, and hopelessness. All these Pearson correlations are small in effect size. Also, we found that extrinsic motivation corresponds positively with enjoyment, hope and pride (medium effects) and negatively with shame and boredom (medium effects) at the between-person level.

To assess the development of the analyzed variables over time, we have depicted the development of all variables on a weekly average in Fig. 5 in the Appendix section. It is particularly noticeable that there is no clearly recognizable monotonic trend in the data,[10] intrinsic motivation reached permanently lower average values than extrinsic motivation, and positive emotions have permanently higher average values over time than negative emotions, with the exception of anxiety. Moreover, it can be seen that the mean value curves for intrinsic motivation and participation develop quite similarly, whereas extrinsic motivation tends to move in the opposite direction. Finally, when emotions with positive valence rise, those emotions with negative valence tend to fall. The graph also contains some central occurrences during teacher training.

Likelihood ratio tests: fixed vs. random slope models

As we assume that the effects of perceived participation opportunities on emotional states vary across individuals, we compared our random slope models to the less complex fixed slope models and conducted likelihood ratio tests to test whether the integration of random effects improves the model fit.

It turns out that all random effects models are significantly better than the fixed effects models, except for the model with *boredom* (χ^2 (2) = 5.252, $p = 0.072$) as the dependent variable, i.e., there is no statistically significant difference in the (within-person) effect of participation on boredom between trainee teachers. However, the other models indicate that there are differences in the (within-person) effect between individuals (time-varying predictor perceived participation and predicted variables enjoyment (χ^2 (2) = 21.142, $p < 0.001$), hope (χ^2 (2) = 11.566, $p = 0.003$), pride (χ^2 (2) = 19.934, $p < 0.001$), anger (χ^2 (2) = 7.917, $p = 0.019$), anxiety (χ^2 (2) = 38.536, $p < 0.001$), shame (χ^2 (2) = 55.647, $p < 0.001$), and hopelessness (χ^2 (2) = 51.193, $p < 0.001$)). The random slope models are graphically illustrated in Fig. 3. It becomes apparent that the lines only run parallel for the random slope model with boredom. By following the suggestion of Barr et al. (2013) that all fixed effects should also be included as random effects, we nevertheless continue our analysis for all variables with the random slope models.

[10] We applied the Mann–Kendall trend test to all variables, which confirmed the assumption that there was no monotonic trend in the data over time.

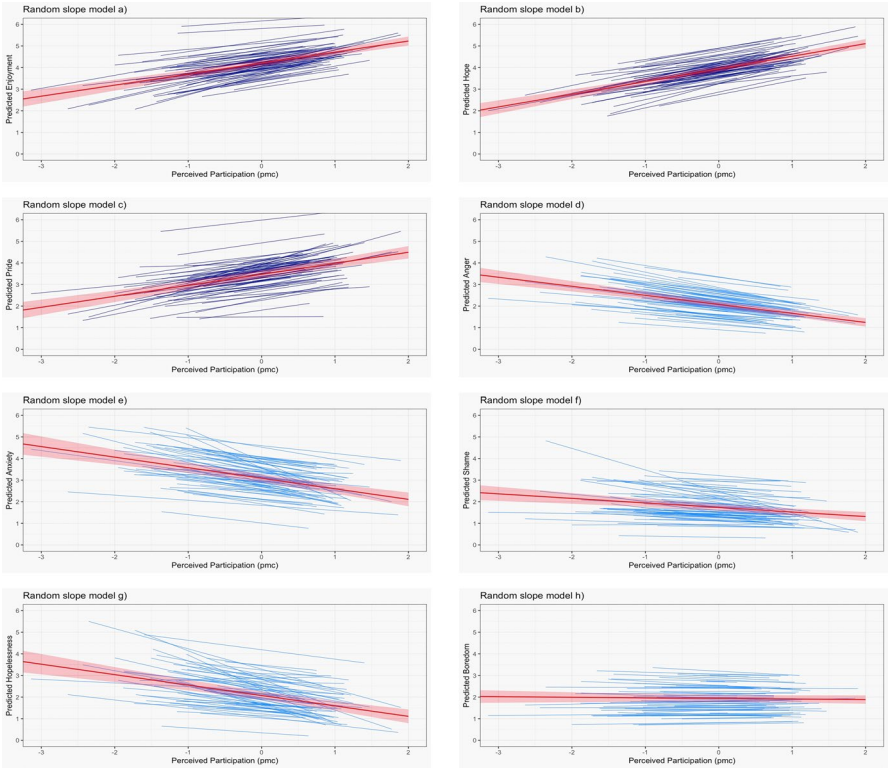

Fig. 3 Illustration of the random slope models a to h. *pmc* person-mean centered

Multilevel models

Effects of perceived participation opportunities on emotional states

First, we refer to the intra- as well as interindividual effects of perceived participation opportunities on emotional states of trainee teachers (see Tables 5, 6, 7 and 8). The results of our multilevel models indicate statistically significant within-person effects of perceived participation opportunities on

- enjoyment (Model 1a: $b = 0.313$, $p < 0.001$; Model 2a: $b = 0.511$, $p < 0.001$),
- hope (Model 1b: $b = 0.384$, $p < 0.001$; Model 2b: $b = 0.568$, $p < 0.001$),
- pride (Model 1c: $b = 0.332$, $p < 0.001$; Model 2c: $b = 0.496$, $p < 0.001$),
- anger (Model 1d: $b = -0.313$, $p < 0.001$; Model 2d: $b = -0.414$, $p < 0.001$),
- anxiety (Model 1e: $b = -0.326$, $p < 0.001$; Model 2e: $b = -0.490$, $p < 0.001$),
- shame (Model 1f: $b = -0.171$, $p < 0.001$; Model 2f: $b = -0.207$, $p < 0.001$),
- and hopelessness (Model 1g: $b = -0.270$, $p < 0.001$; Model 2g: $b = -0.470$, $p < 0.001$).

As expected, this can be seen both in the model that simultaneously considers intrinsic motivation (Models 1a–g) and in the model that at the same time includes extrinsic motivation (Models 2a–g). The findings indicate that trainee teachers report more enjoyment, hope, and pride as well as less anger, anxiety, shame, and hopelessness in weeks in which they perceive more opportunities to influence decisions

Table 5 Results of multilevel models predicting emotional states (Models 1a, 1b, 1c, and 1d)

Variable	Model 1a): predicted weekly mean of "Enjoyment"			Model 1b): predicted weekly mean of "Hope"			Model 1c): predicted weekly mean of "Pride"			Model 1d): predicted weekly mean of "Anger"		
	Est	**95% CI**	***p***	**Est**	**95% CI**	***p***	**Est**	**95% CI**	***p***	**Est**	**95% CI**	***p***
Fixed effects												
Intercept	4.193	[4.063; 4.323]	< 0.001	3.943	[3.822; 4.063]	< 0.001	3.452	[3.287; 3.617]	< 0.001	2.083	[1.943; 2.223]	< 0.001
Within												
Participation	0.313	[0.242; 0.385]	< 0.001	−0.384	[0.308; 0.460]	< 0.001	−0.332	[0.251; 0.412]	< 0.001	−0.313	[−0.394; −0.232]	< 0.001
Intrinsic Mot	0.331	[0.212; 0.401]	< 0.001	0.297	[0.229; 0.364]	< 0.001	0.273	[0.193; 0.353]	< 0.001	−0.136	[−0.213; −0.059]	< 0.001
Between												
Participation	0.262	[0.037; 0.487]	0.023	0.480	[0.266; 0.695]	< 0.001	0.084	[−0.208; 0.377]	0.567	−0.050	[−0.295; 0.196]	0.689
Intrinsic Mot	0.421	[.251; .592]	< 0.001	0.234	[0.072; 0.395]	0.005	0.482	[0.261; 0.703]	< 0.001	−0.213	[−00.398; −0.028]	0.025
Within												
Participation × Intrinsic Mot	−0.050	[−0.098; −0.002]	0.043	−0.068	[−0.122; −0.014]	0.014	−0.007	[−0.066; 0.052]	0.817	0.055	[−0.005; 0.115]	0.074
Random effects (variances)												
Intercept	0.268			0.215			0.435			0.293		
Participation (within)	0.020			0.018			0.016			0.015		
Intrinsic Mot. (within)	0.042			0.032			0.050			0.043		
Residual	0.394			0.495			0.590			0.627		
Explained variance												
Pseudo-R^2 (within)	0.375			0.336			0.281			0.157		
Pseudo-R^2 (between)	0.416			0.439			0.249			0.098		

Est. Estimate, *CI* Confidence Interval; number of participants for all models = 75; number of observations across all models ranged from 1721 to 1731; Computation of Pseudo-R2 based on Xu (2003)

Table 6 Results of multilevel models predicting emotional states (Models 1e, 1f, 1g, and 1h)

Variable	Model 1e): predicted weekly mean of "Anxiety"			Model 1f): predicted weekly mean of "Shame"			Model 1g): predicted weekly mean of "Hopelessness"			Model 1h): predicted weekly mean of "Boredom"		
	Est	95% CI	*p*	Est	95% CI	*p*	Est	95% CI	*p*	Est	95% CI	*p*
Fixed effects												
Intercept	3.073	[2.887; 3.259]	< 0.001	1.744	[1.591; 1.897]	< 0.001	2.049	[1.862; 2.237]	< 0.001	1.959	[1.793; 2.124]	< 0.001
Within												
Participation	−0.326	[−0.446; −0.205]	< 0.001	−0.171	[−0.261; −0.082]	< 0.001	−0.270	[−0.376; −0.163]	< 0.001	−0.006	[−0.079; 0.066]	0.865
Intrinsic Mot	−0.262	[−0.341; −0.183]	< 0.001	−0.050	[−0.113; 0.012]	0.111	−0.285	[−0.367; −0.203]	< 0.001	−0.016	[−0.094; 0.061]	0.683
Between												
Participation	−0.496	[−0.814; −0.177]	0.003	−0.360	[−0.622; −0.098]	0.008	−0.481	[−0.811; −0.150]	0.005	−0.180	[−0.465; 0.103]	0.208
Intrinsic Mot	−0.084	[−0.325; 0.156]	0.487	−0.167	[−0.365; 0.031]	0.097	−0.131	[−0.380; 0.118]	0.298	−0.313	[−0.528; −0.098]	0.005
Within												
Participation × Intrinsic Mot	0.084	[0.011; 0.156]	0.023	0.009	[−0.038; 0.056]	0.704	0.123	[0.059; 0.188]	< 0.001	0.007	[−0.041; 0.056]	0.767
Random effects (variances)												
Intercept	0.540			0.389			0.566			0.458		
Participation (within)	0.088			0.062			0.065			0.022		
Intrinsic Mot. (within)	0.036			0.030			0.050			0.057		
Residual	0.878			0.358			0.695			0.400		
Explained variance												
Pseudo-R^2 (within)	0.205			0.152			0.289			0.074		
Pseudo-R^2 (between)	0.174			0.258			0.186			0.210		

Est. Estimate, *CI* Confidence Interval; number of participants for all models = 75; number of observations across all models ranged from 1730 to 1731; Computation of Pseudo-R2 based on Xu (2003)

Table 7 Results of multilevel models predicting emotional states (Models 2a, 2b, 2c, and 2d)

	Model 2a): predicted weekly mean of "Enjoyment"			Model 2b): predicted weekly mean of "Hope"			Model 2c): predicted weekly mean of "Pride"			Model 2d): predicted weekly mean of "Anger"		
Variable	**Est**	**95% CI**	***p***	**Est**	**95% CI**	***p***	**Est**	**95% CI**	***p***	**Est**	**95% CI**	***p***
Fixed effects												
Intercept	4.202	[4.064; 4.341]	< 0.001	3.935	[3.810; 4.060]	< 0.001	3.473	[3.301; 3.646]	< 0.001	2.085	[1.941; 2.228]	< 0.001
Within												
Participation	0.511	[0.422; 0.600]	< 0.001	−0.568	[0.480; 0.657]	< 0.001	−0.496	[0.395; 0.597]	< 0.001	−0.414	[−0.495; −0.333]	< 0.001
Extrinsic Mot	0.018	[−0.032; 0.069]	0.472	−0.058	[−0.126; 0.010]	0.093	0.090	[0.020; 0.161]	0.012	−0.023	[−0.037; 0.084]	0.450
Between												
Participation	0.431	[0.218; 0.644]	< 0.001	0.611	[0.413; 0.809]	< 0.001	0.320	[0.051; 0.589]	0.021	−0.194	[−0.419; 0.032]	0.092
Extrinsic Mot	0.344	[0.155; 0.533]	< 0.001	0.115	[−0.060; 0.291]	0.195	0.375	[0.136; 0.614]	0.003	−0.120	[−0.320; 0.080]	0.237
Within												
Participation × Extrinsic Mot	−0.019	[−0.081; 0.042]	0.540	0.015	[−0.051; 0.082]	0.652	0.025	[−0.047; 0.098]	0.494	−0.076	[−0.147; −0.005]	0.036
Random effects (variances)												
Intercept	0.302			0.231			0.474			0.313		
Participation (within)	0.054			0.045			0.064			0.023		
Extrinsic Mot. (within)	0.008			0.028			0.029			0.015		
Residual	0.488			0.563			0.659			0.656		
Explained variance												
Pseudo-R^2 (within)	0.225			0.244			0.197			0.118		
Pseudo-R^2 (between)	0.342			0.397			0.181			0.037		

*Est.*Estimate, *CI* Confidence Interval; number of participants for all models = 75; number of observations across all models ranged from 1719 to 1759; Computation of Pseudo-R2 based on Xu (2003)

Table 8 Results of multilevel models predicting emotional states (Models 2e, 2f, 2g, and 2h)

Variable	Model 2e): predicted weekly mean of "Anxiety"			Model 2f): predicted weekly mean of "Shame"			Model 2g): predicted weekly mean of "Hopelessness"			Model 2h): predicted weekly mean of "Boredom"		
	Est	95% CI	*p*	Est	95% CI	*p*	Est	95% CI	*p*	Est	95% CI	*p*
Fixed effects												
Intercept	3.089	[2.902; 3.277]	< 0.001	1.735	[1.580; 1.889]	< 0.001	2.078	[1.887; 2.269]	< 0.001	1.943	[1.778; 2.109]	< 0.001
Within												
Participation	−0.490	[−0.619; −0.362]	< 0.001	−0.207	[−0.293; −0.121]	< 0.001	−0.470	[−0.607; −0.332]	< 0.001	−0.021	[−0.088; 0.046]	0.538
Extrinsic Mot	0.228	[0.153; 0.303]	< 0.001	−0.004	[−0.063; 0.056]	0.912	−0.078	[−0.002; 0.159]	0.056	−0.104	[−0.166; −0.042]	0.001
Between												
Participation	−0.608	[−0.902; −0.314]	< 0.001	−0.474	[−0.711; −0.237]	< 0.001	−0.551	[−0.851; −0.251]	< 0.001	−0.318	[−0.572; −0.063]	0.015
Extrinsic Mot	0.037	[−0.225; 0.298]	0.780	−0.122	[−0.333; 0.088]	0.250	−0.059	[−0.326; 0.207]	0.660	−0.305	[−0.531; −0.079]	0.009
Within												
Participation × Extrinsic Mot	−0.037	[−0.121; 0.048]	0.396	0.003	[−0.051; 0.057]	0.904	−0.111	[−0.190; −0.033]	0.006	0.024	[−0.033; 0.081]	0.406
Random effects (variances)												
Intercept	0.551			0.400			0.590			0.463		
Participation (within)	0.125			0.060			0.170			0.019		
Extrinsic Mot. (within)	0.026			0.026			0.040			0.028		
Residual	0.900			0.358			0.758			0.404		
Explained variance												
Pseudo-R^2 (within)	0.185			0.152			0.224			0.065		
Pseudo-R^2 (between)	0.157			0.237			0.151			0.202		

Est. Estimate, *CI* Confidence Interval; number of participants for all models = 75; number of observations across all models ranged from 1757 to 1759; Computation of Pseudo-R2 based on Xu (2003)

concerning their training and education. As for the between-person effects our two-level models imply that trainee teachers who on average report more perceived opportunities to participate also experience generally more

- enjoyment (Model 1a: $b = 0.262$, $p = 0.023$; Model 2a: $b = 0.431$, $p < 0.001$),
- hope (Model 1b: $b = 0.480$, $p < 0.001$; Model 2b: $b = 0.611$, $p < 0.001$), and
- pride (Model 2c: $b = 0.320$, $p = 0.021$).

Also, trainee teachers report less

- anxiety (Model 1e: $b = -0.496$, $p = 0.003$; Model 2e: $b = -0.608$, $p < 0.001$),
- shame (Model 1f: $b = -0.360$, $p = 0.008$; Model 2f: $b = -0.474$, $p < 0.001$),
- hopelessness (Model 1g: $b = -0.481$, $p = 0.005$; Model 2g: $b = -0.551$, $p < 0.001$),
- and boredom (Model 2h: $b = -0.318$, $p = 0.015$).

For pride and boredom, however, the effect is only statistically significant in the model that incorporates extrinsic motivation (Model 2c and 2h).

Effects of motivation on emotional states

Next, we address the direct intra- and interindividual effects of the subjective reason for action, i.e., motivation, again on emotional states of trainee teachers. In regard to the *within-person effects* of intrinsic motivation, the multilevel models reveal statistically significant effects on all emotional states except for shame and boredom, meaning that trainee teachers experience emotions with positive valence stronger (Model 1a: $b = 0.331$, $p < 0.001$; Model 1b: $b = 0.297$, $p < 0.001$; Model 1c: $b = 0.273$, $p < 0.001$) and emotions with negative valence weaker (Model 1d: $b = -0.136$, $p < 0.001$; Model 1e: $b = -0.262$, $p < 0.001$; Model 1g: $b = -0.285$, $p < 0.001$) in weeks where they report higher levels of intrinsic motivation. With respect to the *between-person* effect, we found five statistically significant effects of intrinsic motivation. Trainee teachers who reported more intrinsic motivation on average felt more enjoyment (Model 1a: $b = 0.421$, $p < 0.001$), hope (Model 1b: $b = 0.234$, $p = 0.005$), and pride (Model 1c: $b = 0.482$, $p < 0.001$) as well as less anger (Model 1d: $b = -0.213$, $p = 0.025$) and boredom (Model 1h: $b = -0.313$, $p = 0.005$).

For extrinsic motivation we found fewer statistically significant direct effects compared to intrinsic motivation. On the *within-person* level extrinsic motivation has a positive effect on pride (Model 2c: $b = 0.090$, $p = 0.012$) as well as on anxiety (Model 2e: $b = 0.228$, $p < 0.001$) and a negative effect on boredom (Model 2h: $b = -0.104$, $p = 0.001$). This means that trainee teachers experience more pride but also more anxiety and less boredom in weeks in which they are more extrinsically motivated. Finally, and on the *between-person* level our models show statistically significant effects of extrinsic motivation on enjoyment (Model 2a: $b = 0.344$, $p < 0.001$), pride (Model 2c: $b = 0.375$, $p = 0.003$), and boredom (Model 2h: $b = -0.305$, $p = 0.009$). Thus, trainee teachers who are more extrinsically motivated on average, feel generally more enjoyment and pride and less boredom.

Effects of the interaction between perceived participation opportunities and motivation on emotional states

Overall, we found six significant interaction effects on the within-person level in our 16 models, with intrinsic motivation serving as a moderator in a total of four cases and extrinsic motivation in two cases. On the one hand, intrinsic motivation moderates the relationship of perceived participation and four emotional states, namely enjoyment (Model 1a: $b = -0.050$, $p = 0.043$), hope (Model 1b: $b = -0.068$, $p = 0.014$), anxiety (Model 1e: $b = 0.084$, $p = 0.023$) and hopelessness (Model 1g: $b = 0.123$, $p < 0.001$). In regard to the former two emotional states, representing positive emotional experiences, the effect is negative. Whereas for the latter two (negative) emotional states the effects are positive. On the other hand, extrinsic motivation represents a moderator on the within-person level in the relationship of perceived participation and anger (Model 2d: $b = -0.076$, $p = 0.036$) as well as perceived participation and hopelessness (Model 2g: $b = -0.111$, $p = 0.006$). Both effects are negative.

All significant interaction effects identified are depicted in Fig. 4. The linear growth trajectories of weekly intrinsic motivation, which were person-mean centered (refer to Fig. 4, models 1a, 1b, 1e and 1g) and their respective deviations of plus/minus one (scale) unit, as well as the person-mean centered weekly extrinsic motivation (refer to Fig. 4, models 2d and 2g) with corresponding deviations of plus/minus one (scale) unit, are illustrated in the graphical representations.

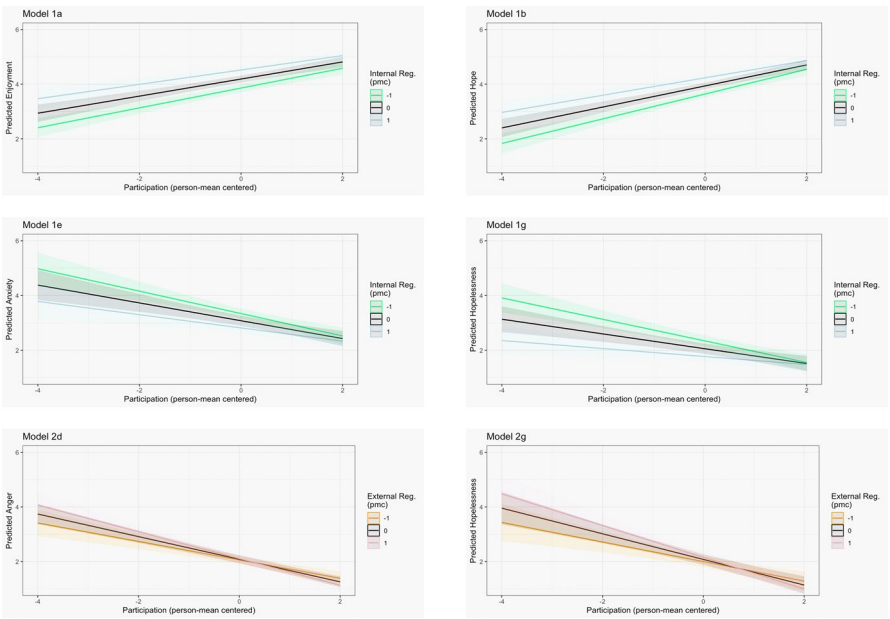

Fig. 4 Within-person differences of intrinsic regulation in intra-individual effects: Illustration of the interaction effects. *pmc* person-mean centered; Plus / minus one scale unit; The model numbering refers to the models in Tables 5, 6, 7, and 8

Discussion

Summary of findings in the light of our hypotheses

In this concluding section, we will discuss our results against the background of our presented in Hypotheses section. In support of hypothesis *H1*, on the *within-person level* our results reveal a significant positive effect of perceived participation opportunities, characterized by the weekly capacity to influence the learning and working environment, on the weekly experienced emotional states of enjoyment, hope, and pride. Conversely, a notable inverse (negative) effect is observed on the emotional states of anger, anxiety, shame, and hopelessness. Overall, this corroborates the notion that during weeks of increased sense of agency and influence within the learning and working context more positive emotional experiences are induced, while diminished perceived participation opportunities correspond with negative emotional states. As for the emotional state of boredom, there is insufficient evidence to substantiate *H1*. The results on the *between-person level* also provide evidence supporting the validity of *H1*. Trainee teachers who, on average, indicate a higher frequency of perceived participation tend to experience increased levels of enjoyment, hope, and pride. This aligns with the study of Götz et al. (2010), who obtained similar results regarding *H1* and the emotions of enjoyment and pride for university students. The authors, in this context, define "control" as the subjective perception that, according to individual assessment, the situation is under one's own management or influence. Similarly, Jenßen et al. (2021) found that control appraisals of pre-service teachers have a large effect on their enjoyment. Additionally, we found that trainee teachers reported lower levels of anxiety, shame, hopelessness, and boredom. Notably, no significant effect was observed for the emotional state of anger on this between-person level.

In regard to hypothesis *H2,* which posits hat the subjectively attributed value, encompassing both intrinsic and extrinsic aspects of an activity, has a positive effect on the emotional states of enjoyment, hope, and pride, which can be confirmed for intrinsic motivation on the within person-level as well as on the between-person level. These findings collectively underscore the robustness of the association between perceived value and positive emotional outcomes, contributing valuable insights to our understanding of the motivational dynamics involved in emotional experiences of trainee teachers. For extrinsic motivation, however, the assumption can only be partially supported, as on the within-person level we only find a positive effect on pride and on the between-person level our models reveal positive effects again on pride and also on enjoyment. For the emotional states with negative valence, we found that in weeks with higher levels of intrinsic motivation, anger, anxiety, and hopelessness are less pronounced (within-person level) while more intrinsically motivated trainee teachers also experience less anger and boredom on average (between-person level). Only for intraindividual reported shame and boredom as well as interindividual experienced anxiety, hopelessness and shame we did not find evidence to support *H2*. Other research correspondingly discovered that the attributed value is positively linked to enjoyment and pride (Götz et al. 2010; Jenßen et al. 2021) and negatively associated with boredom (Kögler and Göller 2018).

Moreover, it is particularly interesting that the only within-person effect that changes its direction with respect to the two predictors, intrinsic vs. extrinsic motivation, is

related to the emotional state of anxiety. While intrinsic motivation leads to trainee teachers being less anxious, extrinsic motivation is associated with a higher level of anxiety. This can be justified by considering that intrinsic motivation, emanating from within the individual based on their own will and/or genuine interest, fosters a positive emotional state that acts as a protective factor against anxiety. Conversely, extrinsic motivation, driven by external rewards or pressure, can introduce stressors that contribute to an elevated emotional state of anxiety among trainee teachers. These findings are consistent with previous research (e.g., Ahmetović et al. 2020; Gkonou 2013).

Our analysis also revealed intraindividual differences in intraindividual effects, i.e., significant interaction effects between perceived opportunities of participation and the types of motivation. Hypothesis *H3*, suggesting a multiplicative influence of the interaction between perceived participation opportunities and subjective intrinsic value (i.e., intrinsic motivation) on the emotional states of trainee teachers, is supported by our empirical findings. For trainee teachers who report above-average intrinsic motivation in a given week, the influence of participation on enjoyment as well as hope is diminished. In essence, for trainee teachers experiencing increased intrinsic motivation in specific weeks, perceived participation no longer exerts as pronounced an impact on these two emotional states with positive valence. In summary, the actually positive correlation between perceived participation and emotional states becomes weaker. Conversely, this also applies to the emotions with negative valence, as the actually negative relationship is also weakened. In other words, it can be stated that in weeks in which trainee teachers perceive fewer opportunities for participation, above-average intrinsic motivation compensates for the perception of anxiety and hopelessness. For the emotional state of anger this is also true yet only for a significance level of 10% (Model 1d: $b = 0.055$, $p = 0.074$). Thus, our findings show, that the joint impact of perceived participation opportunities and intrinsic motivation contributes significantly to influencing the emotional states, highlighting the combined effect on trainee teachers.

Ultimately, we also found evidence for *H3* with respect to extrinsic motivation: In contrast to the aforementioned results, for trainee teachers who report above-average extrinsic motivation in a given week, the negative effect of perceived participation on anger as well as hopelessness is greater and thus amplified, meaning that trainee teachers are less angry or hopeless. Therefore, the empirical evidence affirms the hypothesized multiplicative impact of the interaction between perceived participation opportunities and the subjective extrinsic value (i.e., extrinsic motivation) on the emotional states of trainee teachers, namely anger and hopelessness. In this respect, Weiß et al. (2023) found that a participation-friendly or autonomy-promoting environment can already contribute to a positive experience among trainee teachers during teacher training.

Overall, our analyses indicate that within the framework of CVT, it is pertinent to view the subjective value as a dual dimension. This is evident because models considering intrinsic motivation differ from those focusing on extrinsic motivation. For instance, a significant within-level effect of intrinsic motivation on enjoyment and anger is observed, whereas such an effect is absent in relation to extrinsic motivation. The findings in this case are consistent with the assumptions of CVT, which suggests that intrinsic values correspond with emotions linked to learning and activity (this category also encompasses enjoyment and anger), whereas extrinsic values are likely to align with

emotions associated with outcomes and achievements, such as pride or anxiety (Pekrun et al. 2007). The significant interaction effects of the within-level moderations also differ depending on the type of motivation (extrinsic vs. intrinsic) and call for a differentiated consideration. These results are in line with Simonton and Garn (2020), who also identified an effect of (only) intrinsic value on enjoyment and argued for a separate treatment of subjective value.

Apart from our hypotheses, another intriguing observation arises from the data: trainee teachers exhibit notably higher levels of extrinsic motivation on average over time compared to intrinsic motivation, a trend clearly depicted in Fig. 5 (in the Appendix section), where, in certain instances, a difference of more than one scale unit between the two motivational types is evident. Possible explanations for this phenomenon include the fact that trainee teachers' performance is evaluated through "external reinforcers" (Morris et al. 2022, p. 1802) such as grades, which, according to research, tends to promote extrinsic motivation (Lin et al. 2003; Morris et al. 2022). Given that performance assessments are conducted by individuals within the training environment (seminar teachers, principals, etc.), trainee teachers naturally strive to meet their expectations and fulfill their requirements. Moreover, the potential for earlier civil servant status, contingent upon performance during teacher training, presents an added incentive for securing a more stable job position.

Limitations of the study

Despite the valuable insights gained from this study, there are several limitations that must be taken into account when evaluating our results. Firstly, due to organizational constraints, we were only able to collect data from one of the four VET teacher training locations in the state of BW. However, the sample is representative for the training cohort in terms of the socio-demographic characteristics *gender* and *age* that began their training in the same year in the aforementioned federal state. In addition, our sample is comparable to trainee teachers in other federal states in terms of age and gender. In Bavaria, for example, roughly two-thirds of all trainee teachers at vocational schools were between 27 and 32 years old in 2022, with a proportion of men in this group being below 40% (Bavarian State Office for Statistics 2022). In Hamburg, for example, the average age of trainee teachers at all school types in 2024 was 29.8 years with a male proportion of 29.5% (Zeller 2024). While a larger sample would have been desirable and the results may only be transferable to other contexts with restrictions in this respect, our chosen study design made it possible to collect a total of 1790 individual measurements, which provided remarkable insights, particularly on the within-person level.

Secondly, we asked about the subjectively perceived opportunities for participation in teacher training, which may of course differ from the opportunities for influence actually granted. Future studies could, for example, also include the perspective of other people involved in teacher training, such as mentors or instructors. This would at least provide the opportunity to incorporate another perspective and triangulate situational perceptions. Valid information about what actually takes place in teacher training would probably require observational methods, which, however, given the length and complexity of the training (e.g., various training locations), is rather unrealistic in research practice.

Thirdly, it is important to address the reliability values of the CFA for perceived participation opportunities at the within-person level. While the reliability coefficient omega ($\omega_{within} = 0.61$) may not reach optimal levels, literature provides support for the acceptability of moderate reliability. For example, Yang et al. (2022) suggest that reliability values ranging from 0.50 to 0.70 may be acceptable in specific contexts, such as scales with fewer items or studies focusing on within- and between-person variations (e.g., Fisher et al. 2016; Fleeson 2001), which reflects our specific study context. Similarly, Shrout (1998) proposed a range of 0.61–0.80 to indicate moderate reliability. The author implies that moderately reliable measures may introduce some bias when used as explanatory variables in regression analyses; however, the adverse effects are relatively limited. To assess the robustness of the results in the face of this alteration of the models, we conducted additional analyses by using the four individual items of perceived participation separately, resulting in a total of 64 models. Overall, there are *no* major changes compared to the original 16 models that include the aggregated participation scale. With respect to intraindividual differences in intraindividual effects (within-level moderation) the same applies as significant interaction effects are observed predominantly for the same emotions, with only minor deviations in two specific effects: (1) In weeks in which trainee teachers perceive fewer opportunities for participation in regard to *organization of work*, above-average intrinsic motivation compensates for the perception of anger and (2) trainee teachers who report above-average extrinsic motivation in a given week, the positive effect of perceived participation in regard to *content definition* on pride is weaker, meaning that trainee teachers are less proud. However, as the overall representation remained largely consistent and the reliability coefficient omega at the between-person level was good ($\omega_{between} = 0.91$), we sticked to our perceived participation scale.

Finally, it must be acknowledged that the sample might be selective due to the voluntary nature of the survey. It cannot be ruled out that, for instance, trainee teachers might feel particularly positive during a specific week or may wish to express frustrations. Challenges associated with potential sample selection biases (person-related confounders) and potential context-related confounders, however, are more or less normal and acceptable in field studies like ours when prioritizing realistic field conditions. Another approach would involve conducting controlled experimental studies, which, although they may help mitigate person-related and context-related confounders under specific conditions, often sacrifice external validity.

Conclusions

Even though our study has some limitations as described, empirical evidence emerges supporting our formulated hypotheses. Our models have shown that the within-person perspective plays a central and non-negligible role in finding empirical evidence for CVT. We therefore also encourage future researchers to extend their analyses beyond the between-person perspective and include the within-person level in order to achieve more meaningful results with regard to emotional-motivational aspects (see also Pekrun 2021). Summing up and given the assumption that emotional states can be interpreted as an essential parameter for assessing the fit between the person and the environment (Sembill et al. 2007), the interaction effects found can be

interpreted as follows: The findings, which are consistent across different emotions of the same valence and for the two different types of motivation, indicate that those trainee teachers who report low values for intrinsic motivation (or high values for extrinsic motivation) in a given week react more responsively to changes with regard to opportunities for participatory influence. And this responsiveness is expressed in changes in the emotions experienced. In statistical terms, the greater responsiveness is reflected in the stronger associations between participation and emotions for low values of intrinsic motivation and high values of extrinsic motivation. Following Sembill (2003), the findings can be read as follows: "Emotions have seismographic functions […]: They evaluate and report the success/failure of motive or need satisfaction. They thus control attention and give structure to the constant stream of perceived events. Since negative emotional experience urges change and positive emotional experience urges maintenance of the current situation […] it becomes clear that emotion and motivation are inseparable in the momentary experience of an individual" (Sembill 2003, p. 184, translated by the authors). Referring back to the introduction of our article and the postulate for self-determined participation articulated there in the second phase of teacher education, Sembill's (2003) assumption regarding the seismographic functions of emotions for the individual's perspective may imply recognizing and considering one's feelings as sensors for internal and external circumstances as well as attending to one's own needs. From the institutional perspective of education, it may mean recognizing their feelings as a sensorium for evaluating training conditions. This, in turn, could imply, as a consequence for the design of teacher education, taking seriously the postulates of self-determination and personal responsibility as educational goals formulated in relevant training regulations – those who want to promote self-determination must also consistently grant it.

Appendix

Study variables over time

See Fig. 5.

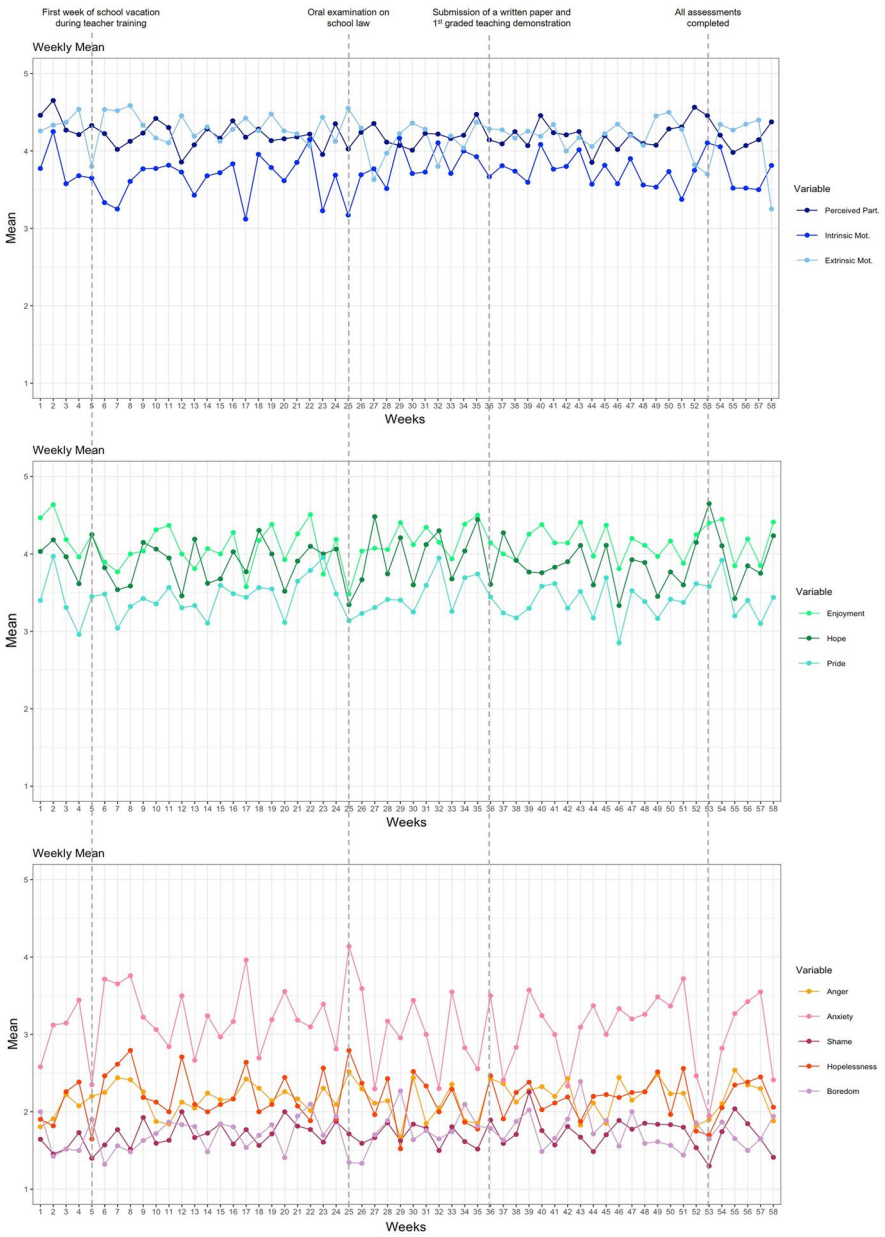

Fig. 5 Illustration of the weekly mean values of all variables. *Part.* Participation, *Mot.* Motivation

Abbreviations

AEQ	Achievement Emotion Questionnaire
AMS-C	Academic Motivation Scale College Version
BW	Baden-Württemberg
CFA	Confirmatory factor analysis
CVT	Control-value theory
ICC	Intraclass correlation coefficient
SDT	Self-determination theory
VET	Vocational education and training

Acknowledgements

We would like to thank all participants of the study. The authors would also like to thank the anonymous reviewers for their critical, but very constructive comments and suggestions that helped to improve the paper. Furthermore, we would like to thank Prof. Dr. Andreas Neubauer for some helpful comments regarding the statistical analyses.

Author contributions
MB: conceptualization, methodology, software, formal analysis, data curation, writing—original draft, editing, visualization, writing — review and project administration. JKW: conceptualization, methodology, software, formal analysis, data curation, writing—original draft, editing, visualization and writing — review. TK: conceptualization, writing—original draft, editing. All authors contributed to the article and approved the submitted version.

Availability of data and materials
The datasets presented in this article are not readily accessible, as the study was approved by the responsible government authority under the condition that the disclosure of data is not permitted.

Declarations

Ethics approval and consent to participate
The study was conducted in accordance with the Declaration of Helsinki.

Competing interests
The authors declare that they have no competing interests.

Received: 29 November 2023 Accepted: 23 April 2024
Published online: 16 May 2024

References

Achtenhagen F, Lüdecke S, Sembill D (1988) Zur Rolle und Bedeutung„Emotionaler Befindlichkeit" für das Lernen, Denken, Handeln in komplexen ökonomischen Situationen [The role and significance of "emotional states" for learning, thinking and acting in complex economic situations]. Z Berufs-Wirtsch.Pädag 84(1):50–68

Aelterman N, Vansteenkiste M, Haerens L, Soenens B, Fontaine JRJ, Reeve J (2018) Toward an integrative and fine-grained insight in motivating and demotivating teaching styles: the merits of a circumplex approach. j Educ Psychol 111(3):497–521. https://doi.org/10.1037/edu0000293

Ahmetović E, Bećirović S, Dubravac V (2020) Motivation, anxiety and students' performance. Eur J Contemp Educ 9(2):271–289. https://doi.org/10.13187/ejced.2020.2.271

Allen MS, Iliescu D, Greiff S (2022) Single item measures in psychological science. Eur J Psychol Assess 38(1):1–5. https://doi.org/10.1027/10155759/a000699

Aprea C, Böhm M, Rausch A, Sarochan N (2023) Arbeitszeit von Lehrkräften an beruflichen Schulen im Fokus Erste Expertise zu ausgewählten Ergebnissen des Projekts „Arbeitszeit, Arbeitsbelastung und Resilienz von Lehrkräften an beruflichen Schulen in Baden-Württemberg (AARL-BS)" [Focus on the working time of teachers at vocational schools. First expertise on selected results of the project "Working hours, workload and resilience of teachers at vocational schools in Baden-Württemberg (AARL-BS)"]. https://www.bwl.uni-mannheim.de/aprea/aarl-bs/. Accessed 17 Nov 2023

Baird R, Maxwell SE (2016) Performance of time-varying predictors in multilevel models under an assumption of fixed or random effects. Psychol Methods 21(2):175–188. https://doi.org/10.1037/met0000070

Barr DJ, Levy R, Scheepers C, Tily HJ (2013) Random effects structure for confirmatory hypothesis testing: keep it maximal. J Mem Lang 68(3):255–278. https://doi.org/10.1016/j.jml.2012.11.001

Bavarian State Office for Statistics (2022) Statistische Berichte. Lehrerausbildung in Bayern. Teil 1: Vorbereitungsdienst sowie Fach- und Förderlehrerausbildung 2021/22 [Statistical reports. Teacher training in Bavaria. Part 1: Preparatory service as well as subject and special needs teacher training 2021/22]. https://www.statistischebibliothek.de/mir/receive/BYHeft_mods_00013044. Accessed 12 Mar 2024

Bergmark U, Westman S (2018) Student participation within teacher education: emphasising democratic values, engagement and learning for a future profession. High Educ Res Dev 37(7):1352–1365. https://doi.org/10.1080/07294360.2018.1484708

Bieleke M, Gogol K, Götz T, Daniels L, Pekrun R (2021) The AEQ-S: a short version of the achievement emotions questionnaire. Contemp Educ Psychol 65:101940. https://doi.org/10.1016/j.cedpsych.2020.101940

BSPO (Prüfungsordnung berufliche Schulen) (2015) Verordnung des Kultusministeriums über den Vorbereitungsdienst und die den Vorbereitungsdienst abschließende Staatsprüfung für die Laufbahn des höheren Schuldienstes an beruflichen Schulen. Landesrecht Baden-Württemberg [Ordinance of the Ministry of Education and Cultural Affairs on the preparatory service and the state examination concluding the preparatory service for the career of the higher education service at vocational schools. Baden-Württemberg state law]. https://www.landesrecht-bw.de/bsbw/document/jlr-BerSchulhDAPVBW2016rahmen/part/X. Accessed 07 Nov 2023

Chou C-P, Bentler PM, Pentz MA (2000) A two-stage approach to multilevel structural equation models: application to longitudinal data. In: Little TD, Schnabel KU, Baumert J (eds) Modeling longitudinal and multilevel data: practical issues, applied approaches, and specific examples, 1st edn. Lawrence Erlbaum Associates Publishers, New York

Cohen J (1988) Statistical power analysis for the behavioral sciences. Erlbaum, New York

De Ruiter JA, Poorthuis AM, Aldrup K, Koomen HM (2020) Teachers' emotional experiences in response to daily events with individual students varying in perceived past disruptive behavior. J Sch Psychol 82:85–102. https://doi.org/10.1016/j.jsp.2020.08.005

Deci EL, Ryan RM (1993) Die Selbstbestimmungstheorie der Motivation und ihre Bedeutung für die Pädagogik [The self-determination theory of motivation and its significance for pedagogy]. Z Pädagog 39(2):223–238. https://doi.org/10.25656/01:11173

Fisher GG, Matthews RA, Gibbons AM (2016) Developing and investigating the use of single-item measures in organizational research. J Occup Health Psychol 21(1):3–23. https://doi.org/10.1037/a0039139
Fleeson W (2001) Toward a structure- and process-integrated view of personality: traits as density distributions of states. J Pers Soc Psychol 80(6):1011–1027. https://doi.org/10.1037/0022-3514.80.6.1011
Frenzel AC, Pekrun R, Goetz T (2007) Girls and mathematics—a "hopeless" issue? A control-value approach to gender differences in emotions towards mathematics. Eur J Psychol Educ 22(4):497–514
Frenzel AC, Fiedler D, Marx AK, Pekrun R (2020) Who enjoys teaching, and when? Between-and within-person evidence on teachers' appraisal-emotion links. Front Psychol 11:1092. https://doi.org/10.3389/fpsyg.2020.01092
Gkonou C (2013) A diary study on the causes of English language classroom anxiety. Int J Engl Stud 13(1):51–68
Götz T, Frenzel AC, Stoeger H, Hall NC (2010) Antecedents of everyday positive emotions: an experience sampling analysis. Motiv Emot 34(1):49–62. https://doi.org/10.1007/s11031-009-9152-2
Habermas J (1974) Politische Beteiligung – ein Wert „an sich"? [Political participation – a value "in itself"?]. In: Ackermann P (ed) Politische Sozialisation. Studienbücher zur Sozialwissenschaft. VS Verlag für Sozialwissenschaften, Wiesbaden, pp 138–142
Hauk D, Gröschner A (2022) How effective is learner-controlled instruction under classroom conditions? A systematic review. Learn Motiv 80:101850. https://doi.org/10.1016/j.lmot.2022.101850
Heckhausen H, Heckhausen J (1991) Motivation and action. Springer, New York
Heid H (1991a) Problematik einer Erziehung zur Verantwortungsbereitschaft [The problem of educating for responsibility]. Neue Sammlung 31(3):459–481. https://doi.org/10.5283/epub.25625
Heid H (1991) Erziehungsziel „Selbständigkeit" [Educational goal "Independence"]. Z Berufs-Wirtsch.pädag 87(4):267–269
Heid H (1992) Was „leistet" das Leistungsprinzip? [What does the performance principle "achieve"?]. Z Berufs-Wirtsch. pädag 88(2):91–108. https://doi.org/10.5283/epub.25627
Heid H (2001) Situation als Konstrukt. Zur Kritik objektivistischer Situationsdefinitionen [Situation as a construct. Criticising objectivist definitions of situations]. Schweiz Z Bildwiss 23(3):513–528. https://doi.org/10.25656/01:3778
Heid H (2005) Übertragung von Verantwortung – die Verwandlung fremdbestimmten Sollens in selbstbestimmtes Wollen [Transfer of responsibility - the transformation of externally-determined demands into self-determined volition]. In: Eigenstetter M, Hammerl M (eds) Wirtschafts- und Unternehmensethik – ein Widerspruch in sich? Kröning, Asanger, pp 163–182
Heid H, Jüttler M, Kärner T (2023) Participation in the classroom as a basis for democracy education? A conceptual analysis of the concept of student participation. Front Political Sci 5:1225620. https://doi.org/10.3389/fpos.2023.1225620
Helsper W (2016) Antinomien und Paradoxien im professionellen Handeln [Antinomies and paradoxes in professional action]. In: Dick M, Marotzki W, Mieg H (eds) Handbuch Professionsentwicklung. Bad Heilbrunn, Klinkhardt, pp 50–62
Homburg C, Baumgartner H (1995) Beurteilung von Kausalmodellen: Bestandsaufnahme und Anwendungsempfehlungen [Evaluation of causal models: inventory and application recommendations]. Marketing ZFP 17(3):162–176. https://doi.org/10.15358/0344-1369-1995-3-162
Homburg C, Klarmann M, Pflesser C (2008) Konfirmatorische Faktorenanalyse [Confirmatory factor analysis]. In: Hermann A, Homburg C, Klarmann M (eds) Handbuch Marktforschung. Gabler, Wiesbaden, pp 271–303
Jenßen L, Gierlinger F, Eilerts K (2021) Pre-service teachers' enjoyment and ICT teaching self-efficacy in mathematics—an application of control-value theory. J Digit Learn Teach Educ 37(3):183–195. https://doi.org/10.1080/21532974.2021.1929585
Kärner T, Kögler K (2016) Emotional states during learning situations and students' self-regulation: process-oriented analysis of person-situation interactions in the vocational classroom. Empir Res Vocat Educ Train 8:12. https://doi.org/10.1186/s40461-016-0038-8
Kärner T, Jüttler M, Fritzsche Y, Heid H (2023) Partizipation in Lehr-Lern-Arrangements: Literaturreview und kritische Würdigung des Partizipationskonzepts [Participation in teaching-learning arrangements: literature review and critical evaluation of the participation concept]. Z Erziehwiss 26:1053–1103. https://doi.org/10.1007/s11618-023-01171-x
Kärner T, Jüttler M (2024). Partizipation im Unterricht: Entwicklung eines Fragebogens zur Erfassung von lernerseitigen Partizipationsmöglichkeiten aus der Perspektive von Lernenden und Lehrenden [Participation in the classroom: Development of a questionnaire to assess learner participation opportunities from the perspective of both learners and teachers]. Z Erziehwiss. https://doi.org/10.1007/s11618-024-01235-6
Keller MM, Frenzel AC, Goetz T, Pekrun R, Hensley L (2014) Exploring teacher emotions: a literature review and an experience sampling study. In: Richardson PW (ed) Teacher motivation: theory and practice. Routledge, New York, pp 69–82
KMK (2022) Standards für die Lehrerbildung: Bildungswissenschaften (Beschluss der Kultusministerkonferenz vom 16.12.2004 i. d. F. vom 07.10.2022) [Standards for Teacher Training: Educational Sciences (Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of 16.12.2004 in the version of 07.10.2022)]. https://www.kmk.org/fileadmin/veroeffentlichungen_beschluesse/2004/2004_12_16-Standards-Lehrerbildung.pdf. Accessed 04 Dec 2023
Kögler K, Göllner R (2018) Control-value appraisals predicting students' boredom in accounting classes: a continuous-state-sampling approach. Empir Res Vocat Educ Train 10:4. https://doi.org/10.1186/s40461-018-0065-8
Kramer AC, Neubauer AB, Leonhardt A, Brose A, Dirk J, Schmiedek F (2021) Ambulatory assessment of rumination and worry. Capturing perseverative cognitions in children's daily life. Psychol Assess 33(9):827–842. https://doi.org/10.25656/01:24317
Lazarus RS (1991) Progress on a cognitive-motivational-relational theory of emotion. Am Psychol 46(8):819–834. https://doi.org/10.1037/0003-066x.46.8.819
Li PH, Mayer D, Malmberg LE (2024) Student engagement and teacher emotions in student-teacher dyads: the role of teacher involvement. Learn Instruc 91:101876. https://doi.org/10.1016/j.learninstruc.2024.101876
Lin YG, McKeachie WJ, Kim YC (2003) College student intrinsic and/or extrinsic motivation and learning. Learn Individ Differ 13(3):251–258. https://doi.org/10.1016/S1041-6080(02)00092-4

Mager U, Nowak P (2012) Effects of student participation in decision making at school. A systematic review and synthesis of empirical research. Educ Res Rev 7(1):38–61. https://doi.org/10.1016/j.edurev.2011.11.001
Mainhard T, Oudman S, Hornstra L, Bosker RJ, Goetz T (2018) Student emotions in class: the relative importance of teachers and their interpersonal relations with students. Learn Instruc 53:109–119. https://doi.org/10.1016/j.learninstruc.2017.07.011
Marsh HW, Hau K-T, Wen Z (2004) In search of golden rules: comment on hypothesis testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's findings. Struct Equ Modeling 11(3):320–341. https://doi.org/10.1207/s15328007sem1103_2
Matthews RA, Pineault L, Hong Y-H (2022) Normalizing the use of single-item measures: validation of the single-item compendium for organizational psychology. J Bus Psychol 37(4):639–673
Messner H, Reusser K (2000) Berufliches Lernen als lebenslanger Prozess [Vocational learning as a lifelong process]. Beiträge Zur Lehrerbildung 18(3):277–294. https://doi.org/10.25656/01:13433
Meyer-Ahrens I, Moshage M, Schäffer J, Wilde M (2010) Nützliche Elemente von Schülermitbestimmung im Biologieunterricht für die Verbesserung intrinsischer Motivation [Beneficial elements of pupils' choice on intrinsic motivation in biology lessons]. Z Didakt Nat Wiss 16:155–166
Morris LS, Grehl MM, Rutter SB, Mehta M, Westwater ML (2022) On what motivates us: a detailed review of intrinsic v. extrinsic motivation. Psychol Med 52(10):1801–1816. https://doi.org/10.1017/S0033291722001611
OECD (2021) Teachers and leaders in vocational education and training. OECD reviews of vocational education and training. OECD Publishing, Paris. https://doi.org/10.1787/59d4fbbl-en
Oser F, Biedermann H (2007) Partizipation – ein Begriff, der ein Meister der Verwirrung ist [Participation - a term that is a master of confusion]. In: Quesel C, Oser F (eds) Die Mühen der Freiheit – Probleme und Chancen der Partizipation von Kindern und Jugendlichen. Rüegger, Zürich and Chur, pp 17–37
Pekrun R (2006) The control-value theory of achievement emotions: assumptions, corollaries, and implications for educational research and practice. Educ Psychol Rev 18(4):315–341. https://doi.org/10.1007/s10648-006.9029-9
Pekrun R (2021) Teachers need more than knowledge: Why motivation, emotion, and self-regulation are indispensable. Educ Psychol 56(4):312–322. https://doi.org/10.1080/00461520.2021.1991356
Pekrun R, Perry RP (2013) Self-processes in achievement emotions: perspectives of the control-value theory. In: McInerney DM, Marsh HW, Craven R, Guay F (eds) Theory driving research: new wave perspectives on self-processes and human development. Information Age Publishing, Charlotte, pp 83–108
Pekrun R, Perry RP (2014) Control-value theory of achievement emotions. In: Pekrun R, Linnenbrink-Garcia L (eds) Educational psychology handbook series. International handbook of emotions in education. Routledge/Taylor & Francis Group, London, pp 120–141
Pekrun R, Frenzel AC, Goetz T, Perry RP (2007) The control-value theory of achievement emotions: An integrative approach to emotions in education. In: Schutz PA, Pekrun R (eds) Emotion in education. Elsevier Academic Press, Amsterdam, pp 13–36
Pekrun R, Goetz T, Frenzel AC, Barchfeld P, Perry RP (2011) Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). Contemp Educ Psychol 36(1):36–48. https://doi.org/10.1016/j.cedpsych.2010.10.002
Pinheiro J, Bates D, DebRoy S, Sarkar D, R Core Team (2018) Linear and nonlinear mixed effects models. R package nlme version 3.1–137. https://CRAN.R-project.org/package=nlme. Accessed 10 Sep 2023
Prenzel M, Kristen A, Dengler P, Ettle R, Beer T (1996) Selbstbestimmt motiviertes und interessiertes Lernen in der kaufmännischen Erstausbildung [Self-determined, motivated and interested learning in initial commercial training]. Z Berufs-Wirtsch.pädag 13:108–127
Raudenbush SW, Bryk AS (2002) Hierarchical linear models: applications and data analysis methods, 2nd edn. Sage Publications, Thousand Oaks
Rausch A, Goller M, Steffen B (2022) Uncovering informal workplace learning by using diaries. In: Goller M, Kyndt E, Paloniemi S, Damşa C (eds) Methods for researching professional learning and development. Professional and practice-based learning. Springer, Cham, pp 43–70
Reichenbach R (2007) Diskurse zwischen Ungleichen. Zur Ambivalenz einer partizipativen Pädagogik [Discourses between unequals. On the ambivalence of participatory pedagogy]. In: Quesel C, Oser F (eds) Die Mühen der Freiheit – Probleme und Chancen der Partizipation von Kindern und Jugendlichen. Rüegger, Zürich and Chur, pp 39–62
Reisenauer C (2020) Kinder- und Jugendpartizipation im schulischen Feld – 7 Facetten eines vielversprechenden Begriffs [Child and youth participation in schools – 7 facets of a promising term]. In: Gerhartz-Reiter S, Reisenauer C (eds) Partizipation und schule. Springer, Wiesbaden, pp 3–22
Ryan RM, Deci EL (2020) Intrinsic and extrinsic motivation from a self-determination theory perspective: definitions, theory, practices, and future directions. Contemp Educ Psychol 61:101860. https://doi.org/10.1016/j.cedpsych.2020.101860
Scheja S (2009) Motivation und Motivationsunterstützung. Eine Untersuchung in der gewerblich-technischen Ausbildung [Motivation and motivational support. A study in industrial-technical training]. Dr. Kovač, Hamburg
Schumacher L (2002) Emotionale Befindlichkeit und motive in Lerngruppen [Emotional state and motives in learning groups]. Dr. Kovač, Hamburg
Schutz PA, Cross DI, Hong HY, Osbon JN (2007) Teacher identities, beliefs, and goals related to emotions in the classroom. In: Schutz PA, Pekrun R (eds) Emotion in education. Elsevier, San Diego, pp 223–241
Seifried J, Rausch A (2022) Applying the experience sampling method to research on workplace learning. In: Goller M, Kyndt E, Paloniemi S, Damşa C (eds) Methods for researching professional learning and development. Professional and practice-based learning. Springer, Berlin, pp 19–41
Seifried J, Sembill D (2005) Emotionale Befindlichkeit in Lehr-Lern-Prozessen in der beruflichen Bildung [Emotional state in teaching-learning processes in vocational education and training]. Z Für Pädagogik 51(5):656–672. https://doi.org/10.25656/01:4774

Sembill D (1992) Problemlösefähigkeit, Handlungskompetenz und Emotionale Befindlichkeit: Zielgrößen Forschenden Lernens [Problem-solving ability, action competence and emotional state: Target variables of research-based learning]. Hogrefe, Göttingen
Sembill D (1999) Selbstorganisation als Modellierungs-, Gestaltungs- und Erforschungsidee beruflichen Lernens [Self-organization as a modeling, design and research idea for vocational learning]. In: Tramm T, Sembill D, Klauser F, John EG (eds) Professionalisierung kaufmännischer Berufsbildung. Festschrift zum 60. Geburtstag von Frank Achtenhagen. Peter Lang, Frankfurt a. M., pp 146–174
Sembill D (2003) Emotionale Befindlichkeit als bestimmende und sinngebende Voraussetzung von Lern- und Lebenswirklichkeit [Emotional states as a determining and meaningful prerequisite for the reality of learning and life]. In: van Buer J, Zlatkin-Troitschanskaia O (eds) Berufliche Bildung auf dem Prüfstand – Entwicklung zwischen systemischer Steuerung, transformation durch Modellversuche und unterrichtlicher innovation. Peter Lang, Frankfurt a. M., pp 181–205
Sembill D (2010) Emotionen – Auslöser, Begleiter und Ziele individuellen und sozialen Handelns [Emotions – triggers, companions and goals of individual and social action]. In: Nickolaus R, Pätzold G, Reinisch H, Tramm T (eds) Handbuch Berufs- und Wirtschaftspädagogik. Julius Klinkhardt, Bad Heilbrunn, pp 80–84
Sembill D, Scheja S (2008) Über die Motivationssituation der Auszubildenden eines Global Players [On the motivation situation of trainees at a global player]. Z Berufs-Wirtsch.pädag 104(2):178–200. https://doi.org/10.25162/zbw-2008-0011
Sembill D, Kärner T (2020) Emotionen sind Macht. Analoge und digitale Rhythmen in der Fortschrittsdebatte der beruflichen Lehrpersonenbildung [Emotions are power. Analog and digital rhythms in the debate on progress in vocational teacher training]. In: Heinrichs K, Kögler K, Siegfried C (eds) Berufliches Lehren und Lernen: Grundlagen, Schwerpunkte und Impulse wirtschaftspädagogischer Forschung. Digitale Festschrift für Eveline Wuttke zum 60. Geburtstag. bwp@ Profil 6, pp 1–49. https://www.bwpat.de/profil6_wuttke/sembill_kaerner_profil6.pdf. Accessed 15 Sep 2023
Sembill D, Rausch A, Kögler K (2013) Non-cognitive facets of competence. In: Beck K, Zlatkin-Troitschanskaia O (eds) From diagnostics to learning success. Proceedings in vocational education and training. SensePublishers, Rotterdam, pp 199–211
Sembill D, Wuttke E, Seifried J, Egloffstein M, Rausch A (2007) Selbstorganisiertes Lernen in der beruflichen Bildung – Abgrenzungen, Befunde und Konsequenzen [Self-organized learning in vocational education and training – Delimitations, findings and consequences]. bwp@ 13. https://www.bwpat.de/ausgabe13/sembill_etal_bwpat13.shtml. Accessed 15 Sep 2023
Shackleton N, Bonell C, Jamal F, Allen E, Mathiot A, Elbourne D, Viner R (2019) Teacher burnout and contextual and compositional elements of school environment. J Sch Health 89(12):977–993. https://doi.org/10.1111/josh.12839
Shrout PE (1998) Measurement reliability and agreement in psychiatry. Stat Methods Med Res 7(3):301–317. https://doi.org/10.1177/096228029800700306
Simonton KL, Garn AC (2020) Control–value theory of achievement emotions: a closer look at student value appraisals and enjoyment. Learn Individ Differ 81:101910. https://doi.org/10.1016/j.lindif.2020.101910
Sutton RE, Wheatley KF (2003) Teachers' emotions and teaching: a review of the literature and directions for future research. Educ Psychol Rev 15(4):327–358. https://doi.org/10.1023/A:1026131715856
UNESCO (2023) The teachers we need for the education we want: the global imperative to reverse the teacher shortage; factsheet. https://unesdoc.unesco.org/ark:/48223/pf0000387001. Accessed 07 Nov 2023
Valenčič M, Vogrinc J (2007) A mentor's aid in developing the competences of teacher trainees. Educ Stud 33(4):373–384. https://doi.org/10.1080/03055690701423473
Vallerand RJ, Pelletier LG, Blais MR, Brière NM, Senécal CB, Vallières ÉF (1993) Academic motivation scale (ams-c 28) college (cegep) version. Educ Psychol Meas vol. 52 and 53. https://lrcs.uqam.ca/wp-content/uploads/2017/08/emecegep_en.pdf. Accessed 10 Oct 2021
Warwas J, Helm C (2017) Enjoying working and learning in vocational education: a multilevel investigation of emotional crossover and contextual moderators. Empir Res Vocat Educ Train 9:11. https://doi.org/10.1186/s40461-017-0055-2
Weinert FE (1982) Selbstgesteuertes Lernen als Voraussetzung, Methode und Ziel des Unterrichts [Self-regulated learning as a prerequisite, method and goal of teaching]. Unterrichtswissenschaft 10(2):99–110
Weiß JK, Bottling M, Kärner T (2023) Professional identification in the beginning of a teacher's career: a longitudinal study on identity formation and the basic psychological need for autonomy in VET teacher training. Front Psychol 14:1196473. https://doi.org/10.3389/fpsyg.2023.1196473
Xu R (2003) Measuring explained variation in linear mixed effects models. Stat Med 22(22):3527–3541. https://doi.org/10.1002/sim.1572
Yang LQ, Wang W, Huang PH, Nguyen A (2022) Optimizing measurement reliability in within-person research: guidelines for research design and R shiny web application tools. J Bus Psychol 37:1141–1156. https://doi.org/10.1007/s10869-022-09803-5
Zeller M (2024) Start in den Vorbereitungsdienst zum Februar 2024. Stadtportal hamburg.de, Freie und Hansestadt Hamburg. https://www.hamburg.de/contentblob/355494/1349c1be7b7f824bce5f7466f9c18169/data/vorbereitungsdienst-bericht-einstellungen.pdf. Accessed 12 Mar 2024
Zinbarg RE, Yovel I, Revelle W, McDonald RP (2006) Estimating generalizability to a latent variable common to all of a scale's indicators: a comparison of estimators for ω_h. Appl Psychol Meas 30(2):121–144. https://doi.org/10.1177/0146621605278814

Publisher's Note