Teachers' enthusiasm and humor and its' lagged relationships with students' enjoyment and boredom - A latent trait-state-approach

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A B S T R A C T

Following Pekrun's (2006) control-value theory of achievement emotions, we investigated carry-over effects and cross-lagged relationships between student-perceived teacher enthusiasm and humor and students' enjoyment and boredom both within and between university lectures. We used a latent state-trait approach to acknowledge the role of situational factors in this relationship. Data were collected from 559 university students (76% female, mean age 21.6 years) from seven different lecture courses. We assessed students' self-reported emotions and student-perceived teacher enthusiasm and content-related humor over a period of four lectures at three random points during each lecture course. The analyses revealed that all variables were influenced by previous measures within lectures; however, between lectures, only previous enjoyment and humor influenced the subsequent measure. When students experienced boredom, they perceived less teacher enthusiasm and humor. On the other hand, perceived teacher humor positively affected enjoyment within lectures.

1. Introduction

According to the control-value theory (CVT) of achievement emotions (Pekrun, 2006), achievement emotions in education are elicited by individual, environmental, and situational factors (Pekrun, 2006, 2017). During the last decade, there has been an increased research interest in the impact of the learning environment on students' achievement emotions, especially in regard to the impact of student-perceived teaching dimensions on students' achievement emotions in secondary schools (e.g., M. Bieg et al., 2017; Bieg, Grassinger, & Dresel, 2019; Goetz, Keller, Lüdtke, Nett, & Lipnevich, 2020). However, these findings are restricted to secondary schools based on the age of the adolescent students and their teachers in that setting. School students typically join their teachers' lessons a few times a week over the duration of at least one school year; thus, strong social relationships can be formed, and teachers and students get to know each other well. However, it remains an open question whether these findings also apply to university students in a lecture course. The lecture is still one of the most traditional and common teaching formats used in higher education. This teaching format typically entails a strong social distance between the university teacher and students. Students typically join a lecture course once a week over a period of one semester in a rather anonymous setting with almost no private contact with the teacher. Thus, the question arises whether student-perceived teaching dimensions have an impact on higher education students' achievement emotions (e.g., Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011; Pekrun, Muis, Frenzel, & Goetz, 2018)?

Some recent studies of secondary schools have focused on student-perceived teacher enthusiasm (Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009; Frenzel, Becker-Kurz, Pekrun, Goetz, & Lüdtke, 2018; Keller, Goetz, Becker, Morger, & Hensley, 2014) and humor (S. Bieg, Grassinger, & Dresel, 2017, 2019) as important affectively toned facets of teaching, with the assumption of being more directly linked to students' emotions (S. Bieg et al., 2017, 2019; Frenzel, Goetz, Lüdtke, et al., 2009; Goetz, Lüdtke, Nett, Keller, & Lipnevich, 2013; Hatfield, Cacioppo, & Rapson, 1993; Keller et al., 2014). However, these studies have not investigated perceived teacher enthusiasm and teacher humor simultaneously as two distinguishable aspects of teaching (M. Bieg et al., 2017).

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Thus, a necessary next step in research on teaching characteristics and their relations to students' emotions is to examine the relevance of various teaching characteristics in university lecture courses for students' emotions to expand the available evidence (a) on higher education students and (b) on a different learning environment than that of secondary schools. This evidence is of theoretical relevance for our understanding of instructional and learning processes and has practical implications, for example, for designing academic teaching training programs.

1.1. Academic emotions

CVT offers an integrative framework for investigating the antecedents and effects of emotions experienced in academic contexts (Pekrun, 2006). Academic emotions are defined as emotions experienced by students that directly relate to learning behaviors, in-class activities, and achievement outcomes (Pekrun, Goetz, Titz, & Perry, 2002). Academic emotions arise when a person interprets an academic situation through two kinds of appraisals: subjective control of the situation and subjective value. Subjective control relates to a person's expectation that she/he can influence and control an activity and its outcome. Subjective value refers to the appraisal that the result of studying is personally important (Pekrun, 2006). These appraisals are mainly elicited by appraisal antecedents, whereby the learning environment represents a distal antecedent of students' emotions (Goetz et al., 2020). Given that student-perceived enthusiasm and humor are an important part of the learning environment according to CVT, these factors have an effect on students' academic emotions, especially when teachers' behavior provides direct or indirect information about the controllability or value of the learning setting or topic (Pekrun, 2006). Beyond the theoretical support of the link between the learning environment and students' achievement emotions by Pekrun's CVT (2006), empirical support for this link has been provided by studies at secondary schools, thereby demonstrating that enthusiasm and humor are relevant to the formation of students' control and value appraisals and, consequently, to their academic emotions (e.g., M. Bieg et al., 2017; S. Bieg et al., 2019; Frenzel, Goetz, Lüdtke, et al., 2009, b; Goetz et al., 2020; Lazarides & Buchholz, 2019).

In the present study, we examined two emotions, following two criteria. We focused on very frequently and intensively experienced emotions in learning settings, namely, enjoyment and boredom (criterion 1). Enjoyment and boredom are prototypical emotions that students experience in class and are also frequently experienced among university students (Pekrun et al., 2002; Respondek, Seufert, & Nett, 2019). Enjoyment is a pleasant emotion and is predictive of a number of positive achievement outcomes at university and school (Pekrun et al., 2002; Pekrun et al., 2011; Pekrun, Lichtenfeld, Marsh, Murayama, & Goetz, 2017). For example, enjoyment is positively related to students' interest and intrinsic motivation (Pekrun et al., 2002), focuses attention on the task, and promotes relational memory processing and the use of flexible learning strategies and self-regulation (Pekrun et al., 2018). Boredom is one of the most prevalent emotions experienced among higher education students, is reported very frequently (Goetz & Nett, 2012; Larson & Richards, 1991) and has mainly negative effects on several achievement outcomes; that is, boredom promotes task-irrelevant thinking, reduces cognitive resources and weakens attention (Goetz et al., 2014; Nett, Goetz, & Hall, 2011; Pekrun, Hall, Goetz, & Perry, 2014; Pekrun et al., 2010; Pekrun et al., 2018). When boredom is experienced in the academic domain, it fulfills the characteristics of an academic emotion (Goetz & Hall, 2014). Additionally, we aimed to examine both positive and negative emotions, as well as both activating and deactivating emotions (criterion 2; see Pekrun et al., 2018). With enjoyment, we investigated a positively valenced activating emotion, and with boredom, we investigated a negatively valenced deactivating emotion.

An experimental study conducted at a university by Frenzel, Taxer, Schwab, and Kuhbandner (2019) showed that teacher enthusiasm positively affected students' emotions (enjoyment and boredom) during a lecture, with students' ratings of their emotions being higher in the condition with a high display of teacher enthusiasm than in the condition with a low display of teacher enthusiasm. Nett et al. (2011) found that the learning environment in grade 11 is a critical determinant of adolescent students' boredom. Goetz, et al. (2020) found a negative direct effect of teacher enthusiasm on students' boredom in a study at secondary school. Referring to teacher humor, the findings of a longitudinal study of secondary school students showed that the more students perceived teachers' content-related humor, the greater they reported enjoyment and the less they reported boredom and anger (S. Bieg et al., 2019). Based on these previous findings, we expect positive relations of teacher enthusiasm and humor with higher education students' experience of enjoyment and negative relations with boredom.

CVT further assumes that the social and learning environment shape emotions and that the emotions displayed by students can influence the social and learning environment in class. The theory supposes that "emotions, their individual and social antecedents, and their effects are linked by reciprocal causation over time" (Pekrun, 2006, p. 327). Thus, a reciprocal causation of students' emotions and their perceptions of teaching dimensions (e.g., teacher enthusiasm and teacher humor) is theoretically sound. This means that, for example, a student who experiences more enjoyment likely perceives more teacher enthusiasm and humor and vice versa; thus, her/his strong perceptions of teachers' enthusiasm and/or humor should lead to more pronounced enjoyment on her/his behalf.

Only a few studies have investigated reciprocal relations postulated within CVT at school (Pekrun, 2006; Pekrun et al., 2007). Frenzel, Goetz, Lüdtke, et al. (2009) proposed reciprocal causal relationships among self-reported school-teacher enjoyment, student-perceived teacher enthusiasm, and student enjoyment. This study was recently "revisited" and extended (Frenzel et al., 2018). However, there is a lack of quantitative evidence about the reciprocal relationship of student-perceived teacher enthusiasm and humor in university lectures and their reciprocal relations to students' experienced emotions in short-term reciprocal cycles based on the examination of the interactive relations of these constructs within several consecutive study lessons. Considering these reciprocal relations helps to understand the dynamics of instruction over time, informs about direct influences and provides empirical evidence for the theoretical assumptions made in CVT. To close this research gap, we investigated student-perceived teacher enthusiasm and teachers' content-related humor and their cross-lagged relations with students' experienced enjoyment and boredom at university (Fig. 1), i.e., the impact of student-perceived teacher enthusiasm and the content-related humor of the teacher in one course session on students' experienced enjoyment and boredom in a consecutive course session and vice versa. We additionally considered that students' achievement emotions are simultaneously influenced by person-specific (trait) and situation-specific (state) components (Respondek et al., 2019).

1.2. Student-perceived teacher enthusiasm

Many educational research studies, especially those examining teaching effectiveness (e.g., Feldman, 1988; Marsh, 1984), have considered teacher enthusiasm as instructional behavior (Brophy & Good, 1986; Keller et al., 2014) that is expressed in a motivating, dynamic and energetic teaching style enriched with gestures, varied intonation and the use of humor, eye contact, facial and verbal expressions and movement (Marsh, 1994; Patrick, Hisley, & Kempler, 2000; Pekrun et al., 2018). A recent definition of teacher enthusiasm goes beyond this unilateral conceptualization and describes teacher enthusiasm as the "conjoined occurrence of positive affective experiences, that is teaching-related enjoyment, and the behavioral expression of these experiences, that is (mostly nonverbal) behaviors of expressiveness" (Keller, Woolfolk Hoy, Goetz, & Frenzel, 2016, p. 751). In this

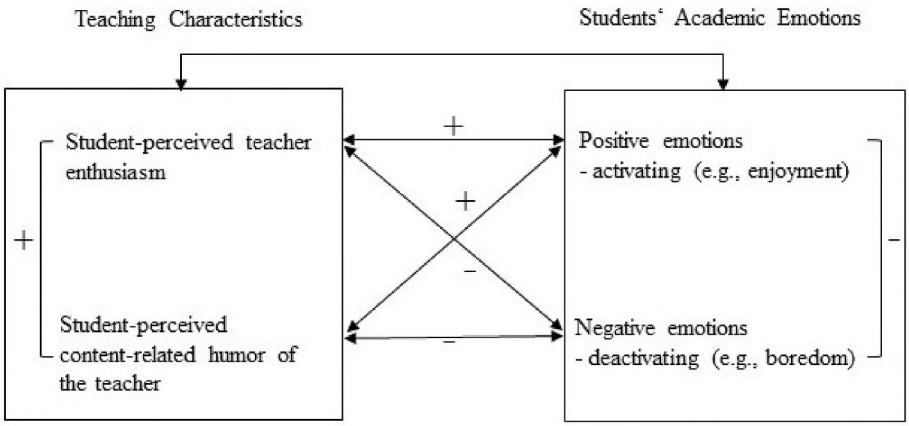

Fig. 1. *Model of expected reciprocal relations. Note.* Reciprocal relations based on Pekrun's (2006) control-value theory on achievement emotions.

sense, teacher enthusiasm encloses displayed teaching behavior as a visible behavior, and teachers' affective experiences are included as hidden forces of this behavior (Keller et al., 2016). This latter dispositional teacher enthusiasm manifests itself in observable teaching behavior for students (Keller et al., 2014). Consequently, teachers' enjoyment will be translated into an enthusiastic teaching style (Frenzel, Goetz, Lüdtke, et al., 2009). However, enthusiastic teaching must be separated from teachers' enjoyment, which is the experience behind their enthusiastic behavior (Pekrun et al., 2018). An important longitudinal school study by Frenzel et al. (2018) showed that student-perceived teacher enthusiasm mediates the effect of teachers' enjoyment on students' enjoyment. Cross-sectional results for ninth graders revealed that student-perceived teacher enthusiasm acts as a mediator between dispositional teacher enthusiasm and students' interest (Keller et al., 2014).

Moreover, Stenlund (1995) found in qualitative studies that teachers reported more enthusiasm in motivated, well-behaved and highly performing classes and felt enthusiastic when students were motivated, which was confirmed through a quantitative study by Kunter, Frenzel, Nagy, Baumert, and Pekrun (2011). In line with the reciprocal assumptions made in CVT, the opposite relation is even more reasonable, as teachers' enthusiasm is an important factor that predicts students' emotions (Keller et al., 2014) and is related to students' enjoyment at secondary schools and in university lectures (Frenzel et al., 2009a, 2018, 2019). A learning environment enriched with an enthusiastic teaching style promotes school students' enjoyment and reduces their negative emotions (Frenzel, Pekrun, & Goetz, 2007; Kunter et al., 2013). In summary, research has shown that teachers' enthusiasm has an impact on students' emotions in educational settings and can be itself dependent on them. Although teacher enthusiasm can be measured via teacher self-reports or from the perspective of an external observer, it is very often assessed by student perceptions (e.g., Frenzel, Goetz, Lüdtke, et al., 2009; Keller et al., 2014; Praetorius, Lenske, & Helmke, 2012), and various studies have documented the value of student reports for assessing teaching dimensions (Aleamoni, 1999; Feldmann, 1988; Trautwein, Lüdtke, Schnyder, & Niggli, 2006). In an examination of the impact of perceived teachers' enthusiasm on students' emotions, it seems quite evident that students' perception of teachers' behavior rather than teachers' actual behavior might have an impact on students' emotions (Keller et al., 2014). In line with this assumption, especially when teachers' enthusiasm has been measured as perceived by students, teachers' enthusiasm has been empirically found to impact students' control and value appraisals and, eventually, their achievement emotions (Goetz et al., 2020; Frenzel, Goetz, Lüdtke, et al., 2009b).

1.3. Student-perceived content-related humor of the teacher

Teachers' humor, especially humor related to the specific course content, is important for perceived teaching quality at secondary schools, as well as in higher education (S. Bieg & Dresel, 2018; Wanzer, Frymier, & Irwin, 2010). One characteristic of teacher humor is an incongruence in the presentation that students have to resolve to understand the humor and laugh at it (Wanzer et al., 2010). Martin and Ford (2018) offered a detailed definition of humor as a "broad multifaceted term that represents anything that people say or do that others perceive as funny and tends to make them laugh, as well as the mental processes that go into both creating and perceiving, such an amusing stimulus, and the emotional response of mirth involved in the enjoyment of it" (p. 16). This definition of humor as a multidimensional concept has also been shown effective in the consideration of teachers' humor at schools and in higher education (S. Bieg & Dresel, 2016; Frymier, Wanzer, & Wojtaszczyk, 2008; Martin, Puhlik-Doris, Larsen, Gray, & Weir, 2003; Wanzer, Frymier, Wojtaszczyk, & Smith, 2006).

Teacher humor that pertains to the currently focused content in a classroom or in a lecture has been indicated to be of particular relevance. Teachers' content-related humor integrates both verbal and nonverbal elements and includes the use of funny examples, word play, exaggerated descriptions and representations, funny spontaneous anecdotes related to the topic and content-related cartoons or memes (Booth-Butterfield & Wanzer, 2016). Through the use of content-related humor, teachers in school and higher education can help students focus their attention, can offer easy-to-remember illustrations and clarifications, and can provide cues for elaboration (S. Bieg & Dresel, 2018; Wanzer et al., 2010). College students have previously evaluated this type of humor as appropriate (Wanzer et al., 2006). In addition to this humor type, teachers can use unrelated humor, self-disparaging and aggressive humor (S. Bieg & Dresel, 2016; Frymier et al., 2008).

In the present study, we focused on the student-perceived content-related humor of the teacher, as it is associated with positive student outcomes at higher education, such as students' enhanced ability to process humorous messages (Wanzer et al., 2010), increased motivation and interest (Goodboy, Booth-Butterfield, Bolkan, & Griffin, 2015), more enjoyment and less negative emotions, such as boredom and anxiety (Banas, Dunbar, Rodriguez, & Liu, 2011; Wanzer & Frymier, 1999). Additionally, studies of higher education students have shown that content-related humor helps students remember the learning material and promotes recall (Wanzer et al., 2010; Ziv, 1988) and control in learning tasks (Wanzer et al., 2010). Teachers' content-related humor is more related to achievement activities than other types of teacher humor and increases attention to the learning material, promotes the elaboration and understanding of a task and thus supports students' control appraisals. In this vein, Pekrun and Stephens (2012) stated that

the quality of examples a teacher provides can contribute to students' perceived control. This should also be true for funny examples or spontaneous anecdotes that are related to the lecture content. Because teachers' content-related humor is evaluated by students as appropriate, such humor further supports positive value appraisals (S. Bieg et al., 2017; 2019; Wanzer et al., 2010). Consequently, student-perceived teachers' content-related humor can also function as a distal antecedent of students' emotions.

Considering that teacher humor shows a conceptual proximity to teacher enthusiasm and constitutes its own category in the measurement of teacher enthusiasm (Marsh, 1982), it is assumed that teacher humor is also a teaching characteristic that is observable by students and provides information for them on control and value (S. Bieg & Dresel, 2016; S. Bieg et al., 2019). However, teachers' content-related humor must be distinguished from teachers' enthusiasm and be analyzed separately from it; in addition to the factorial separability of teacher enthusiasm and teacher humor, there are also theoretical reasons to analyze these two constructs simultaneously but as separate constructs. For example, enthusiasm and humor show different relations to teacher motivation; the production of content-related teacher humor is associated with cognitive efforts by the teacher and includes the components of knowledge and skill (Booth-Butterfield & Wanzer, 2010; Spitzberg, 1983). While enthusiasm is based on teachers' emotions, the production of humor is based on individuals' humor orientation. Therefore, we look for various relations between teacher enthusiasm and humor and students' emotions and thus examine teaching characteristics in short-term reciprocal cycles.

Although some findings on teachers' enthusiasm and humor and their relation to students' emotions have been reported in previous studies at universities (Frenzel et al., 2019; Wanzer et al., 2010), these studies have not concurrently examined the two variables. Notably, most previous studies investigating student-perceived teacher humor and students' emotions in higher education have employed cross-sectional designs and thus could not draw conclusions concerning the causality of these relationships (Frymier et al., 2008; Wanzer et al., 2006, 2010). It has been mentioned before that teachers' enthusiasm and humor have an effect on school students' experienced emotions (M. Bieg et al., 2017; S. Bieg et al., 2019; Frenzel, Goetz, Lüdtke, et al., 2009; Goetz et al., 2020; Goetz et al., 2013; Lazarides & Buchholz, 2019; Pekrun, 2006). An important question is whether this effect is also valid for the learning environment at higher education, which is particularly characterized by less close relationships between teachers and students. Do the students carry their emotions and their perceptions of teaching characteristics from one lecture to the other? Or can we find these effects only during one lecture? There is a lack of empirical research on the immediate influence of teachers' enthusiasm and humor on students' experienced emotions using real-time assessments of emotions in university lectures. Because of the highly dynamic and context-dependent nature of emotions (Nett et al., 2017) and the variability of teaching characteristics during a lecture, we conducted state assessments within university lectures.

1.4. Traits and states of academic emotions and teachers' enthusiasm and humor

As emotions fluctuate based on specific situations, it seems plausible to also consider previous emotional experiences in the analysis of actual emotional experiences (Geiser, Hintz, Burns, & Servera, 2017; Respondek et al., 2019) and to investigate possible "carry-over effects" from previous situations (Eid, Holtmann, Santangelo, & Ebner-Priemer, 2017, p. 291). Such effects describe the impact that a previous situation has on the current situation; for example, when a student perceives the last lecture as boring, she/he is more likely to also perceive the current lecture as boring, independent of the current activities.

Constructs such as academic emotions and teaching characteristics are frequently conceptualized as relatively stable, trait-like constructs (e.g., Pekrun, et al., 2011; Frenzel et al., 2018; S. Bieg et al., 2017). This is surprising since most psychological constructs are also assumed to be situation specific to a considerable degree (Steyer, Ferring, & Schmitt, 1992). In particular, emotions are defined by their highly fluctuating and variable nature (Frijda, 2007). Furthermore, CVT explicitly describes the development of academic emotions as an intraindividual rather than an interindividual process (Pekrun, 2006). Hence, recent studies have accounted for the situation specificity of the experience of academic emotions (e.g., Becker, Goetz, Morger, & Ranelucci, 2014; Goetz et al., 2020) and instructional variables (Praetorius, Pauli, Reusser, Rakoczy, & Klieme, 2014).

A methodological approach that allows the disentangling of the stable and variable variance components of repeatedly assessed psychological constructs is the latent state-trait approach (for an overview, see Steyer, Schmitt, & Eid, 1999; Steyer, Mayer, Geiser, & Cole, 2015). Models following this approach can be used to address differential effects of stable traits and situation-specific states or interactions. Some advance types in this model family—particularly stable trait-autoregressive trait-state (STARTS) models (Kenny & Zautra, 2001; for an overview, see; Hamaker, Kuiper, & Grasmann, 2015)—further allow the analysis of carry-over effects, such as the impact of previous situations on current situational states.

Nett et al. (2017) applied a latent state-trait approach and found that academic emotions have both components, namely, a stable trait component and a situation-specific state component, and thus have a rather balanced impact on school students' emotions in classes. Respondek et al. (2019) further showed within a university setting that previous experiences in similar learning contexts contribute to the state component. Both studies indicated that a distinction of trait and state variance components is worthwhile as the structures and relationships of these components differ from each other. That is, the relationships between trait components of academic emotions can be different from relationships of state components of the same academic emotion; for example, enjoyment and anxiety in mathematics are not related as traits, but they are negatively related as states (Nett et al., 2017), which implies that the person-specific characteristics of being happy or anxious in general are unrelated, but one student cannot simultaneously experience enjoyment and anxiety. To the authors' knowledge, no empirical study has explicitly investigated the trait and state components of teaching characteristics, such as teachers' enthusiasm and humor. However, from a theoretical perspective, it is intuitive that both components, traits and states contribute to teachers' present enthusiasm and humor, similar to other instructional variables (Praetorius et al., 2014). Based on the findings by Nett et al. (2017), the assumption is that there might be relations within the trait and state components of student enjoyment and boredom with student-perceived teacher enthusiasm and humor, which are not necessarily equal. By addressing these interactive relations over time, we expect cross-lagged effects beyond the cross-sectional relation between the constructs.

1.5. The present study

The first aim of the present study was to expand the previous research by disentangling stable and variable components of students' enjoyment and boredom and student-perceived teacher enthusiasm and humor in university lectures. By doing so, we attempted to increase our understanding of the nature of the stability and variability of students' emotions as well as student-perceived teaching characteristics to position the results of the present study in the context of previous findings (Nett et al., 2017; Respondek et al., 2019). Thus, we applied latent structural equation models including latent trait and state components as well as autoregressive relations (STARTS models, Kenny & Zautra, 1995, 2001).

We hypothesized that students' experiences of enjoyment and boredom within a university lecture would be due to stable, person-specific (trait) components, as well as variable, situation-specific

(state) components, and would additionally be influenced by previous experiences of enjoyment and boredom during the lecture (Nett et al., 2017; Respondek et al., 2019). This influence could be described as a carry-over effect (Eid et al., 2017). We expected strong carry-over effects of emotions within one lecture and weak but still existent carry-over effects from one lesson to the next, as suggested by the study of Respondek et al. (2019). Little is known about the stability and variability of student-perceived teacher enthusiasm and humor. However, as instructional variables show substantial differences in their stability and variability, we also hypothesized differences for the examined teaching characteristics (Praetorius et al., 2014).

The second aim was to provide insight into the dynamic nature and interactive processes of students' enjoyment and boredom and teachers' enthusiasm and humor as perceived by students. Hereby, we focused on short-term interactive processes both within and between lectures. Consequently, we expected reciprocal relations, and we hypothesized that student-perceived teacher enthusiasm and humor would be reciprocally related to students' enjoyment and boredom both within and between lectures. Accordingly, if a student perceives strong teacher enthusiasm or teacher humor, she/he should experience more enjoyment and less boredom; vice versa, if the student experiences enjoyment or boredom, she/he should perceive more or less teacher enthusiasm and humor. To our knowledge, this reciprocal relationship has not yet been empirically founded, and the current study can make an important contribution in this research field with an empirical investigation of theoretical assumptions.

2. Method

2.1. Sample and procedure

In total, 559 students from three different universities in southern Germany participated in the study. They were thoroughly informed about the procedure of the study and gave their written consent to participate. Participation in the study was voluntary, and students could withdraw their participation without any consequences at any time. Of the total sample, 79% of the students (439 students, 76% female) gave additional information; these students had a mean age of 21.6 years ($SD = 4.49$), and their ages ranged from 15 to 71 years (five students did not report their age). Most of the students were teacher students (69%), followed by psychology students (9%), literature students (8%) and social science students (6%). Six percent of the students were from other disciplines (natural sciences, environmental ethics, and educational science), and three percent did not report their areas of study. Most of the students had finished their first two semesters (62%). At the beginning of the data collection, students provided information on demographics and other variables.

Data were collected from seven different lecture courses taught by seven different university teachers (four female and three male). The measurements took place over a period of four consecutive course sessions (one session per week) and were collected three times within each 90-min lecture. This procedure resulted in a total of 12 state measurements for each student.

The measurements within sessions were prompted with an electronic device (iPod) that was programmed to randomly signal three times during the 90-min session. Whenever the device signaled, the lecturer stopped the lecture and invited all students to complete a short paper-pencil questionnaire. Then, the student participants completed assessments regarding the teaching dimensions (perceived teacher enthusiasm and perceived teacher humor) and their own emotional experiences (enjoyment and boredom).

2.2. Measures

To avoid overly long questionnaires and minimize disturbance during class, single items from well-established self-report scales were used for all measures. This procedure is common practice in experience-sampling studies in academic contexts (e.g., Ahmed, van der Werf, Minnaert, & Kuyper, 2010; M. Bieg et al., 2017; Respondek et al., 2019) and has been shown to be sufficiently reliable and valid (Gogol et al., 2014; Luhmann, Schimmack, & Eid, 2011).

2.2.1. Enjoyment and boredom

Students' state emotions were assessed with a single item each: "At the moment, I am experiencing [enjoyment/boredom]". These items were adapted from the Academic Emotions Questionnaire (AEQ; Pekrun et al., 2011) and were found to be sufficiently valid in previous studies (e.g., M. Bieg et al., 2017). They were rated on a 5-point Likert scale ranging from 1 *(not at all)* to 5 *(very strong)*.

2.2.2. Student-perceived teacher enthusiasm and humor

Teaching characteristics were assessed with a single item each measuring teachers' enthusiasm and teachers' content-related humor as perceived by the individual student. Previous studies in schools and universities have successfully used single-item measures of teacher enthusiasm and content-related humor (Frenzel et al., 2019; Goetz et al., 2020; Daumiller, Bieg, Dickhäuser, & Dresel, 2019). The item measuring students' perception of teachers' enthusiasm was based on Marsh and Bailey's scale (1993) and reads as follows: "At the moment, our instructor is teaching with enthusiasm". Content-related humor was measured with an adapted item based on the SEEQ (Marsh, 1982) as follows: "At the moment, our instructor is teaching the course content in a humorous manner". The items were rated on a 5-point Likert scale ranging from 1 *(strongly disagree)* to 5 *(strongly agree)*.

2.3. Rationale for the statistical analysis

To address the first research aim, we estimated univariate STARTS models (Kenny & Zautra, 2001), which are also known as trait-state error (TSE) models (Kenny & Zautra, 1995). A STARTS model allows the observed variance in a multiple-measured construct to be disentangled as three variance components: (1) a stable trait component, which is often interpreted as a stable person-specific component, (2) an autoregressive trait component, which can be interpreted as the component that changes over time but is still partly due to a previous state and (3) a state component, which can be interpreted as the current state (Kenny & Zautra, 2001). It is important to be aware that the latter state component is confounded by the measurement error. Thus, STARTS models do not allow for method effects or measurement invariance to be accounted for (Prenoveau, 2016). However, in a study applying latent state-trait models with autoregressive paths, Luhmann et al. (2011) found that single-item measures did not produce different results regarding relationships than two-item measures.

To achieve the suggested simplicity of a structural equation model, we made some assumptions and constraints when defining the univariate STARTS models, namely, all factor loadings were fixed to 1, and the state variance was set not to change over time. Thus, we assumed the total variance in the constructs to be equal at every measurement point. To meet the autoregressive structure assumption (Biesanz, 2012; Kenny & Zautra, 1995, 2001), we assumed the measures within a course session to be equally distant, even though they were assessed at random time points with intervals of more than 10 minutes and less than 30 minutes. Thus, we set all autoregressive paths within one course session to be equal. Furthermore, the three autoregressive paths between the lectures were set to be equal as well (Fig. 2).

To address the second research aim, pairs of univariate STARTS models were combined into one bivariate STARTS model as described by Kenny and Zautra (1995; Fig. 3).

The models were analyzed with Mplus 8 (Muthén & Muthén, 1998 – 2017). The full information maximum likelihood estimator was applied to account for missing data, and the robust full information maximum likelihood estimator was also applied. Thus, possible nonnormality in

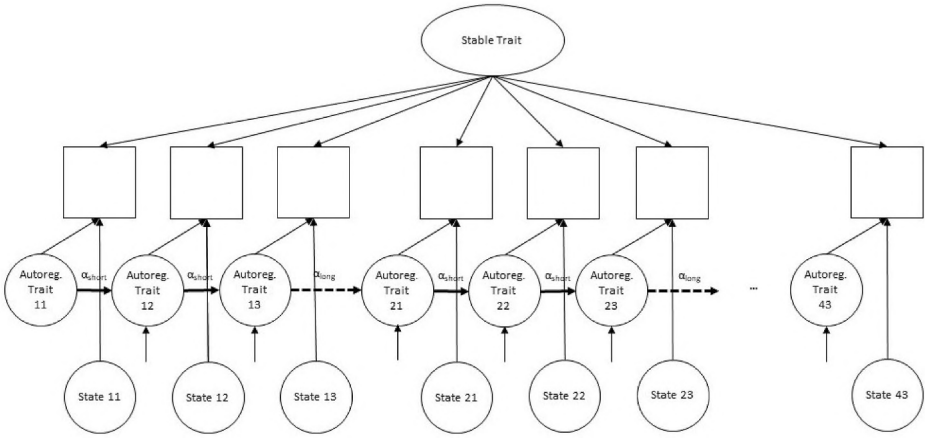

Fig. 2. Univariate STARTS Model. *Note*. For all four constructs (i.e., students' enjoyment and boredom and student-perceived teacher enthusiasm and humor), the univariate STARTS models were calculated to be identical. Squares represent the single-item measures at each measurement point. ST represents the latent trait, AT represents the autoregressive trait, and S represents the state that was confounded by the measurement error. All factor loadings were fixed to 1. The autoregressive paths within one lecture as well as the autoregressive paths between the lectures were fixed to be equal.

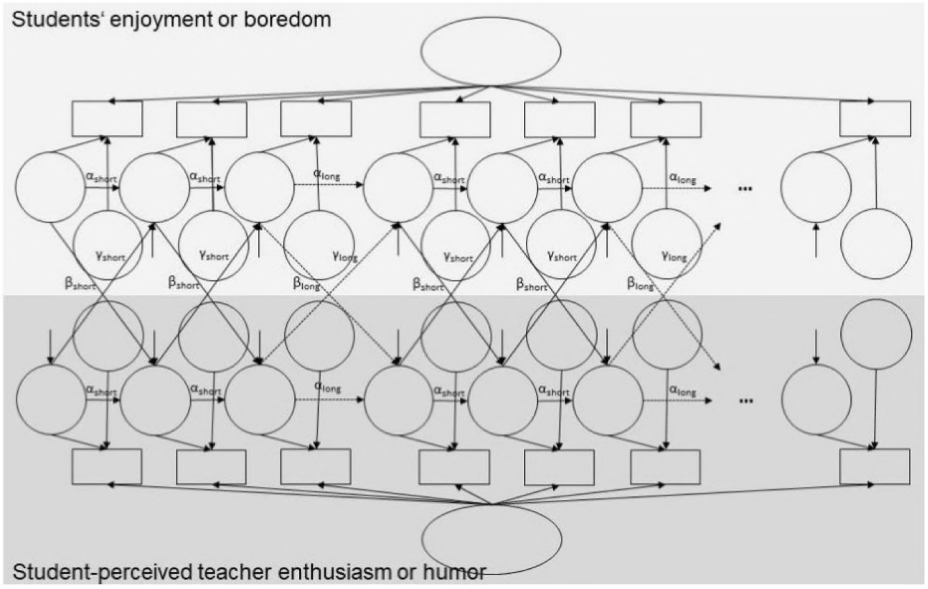

Fig. 3. *Bivariate STARTS Model. Note.* For the bivariate STARTS models, two univariate STARTS models (one emotion and one teaching characteristic) were combined (see Fig. 2) and complemented by cross-lagged effects between the latent autoregressive trait components. Similar to the autoregressive effects, the cross-lagged effects of the same direction within lectures as well as the autoregressive paths between two lectures were fixed to be equal. Furthermore, a cross-sectional correlation between the stable traits and a cross-sectional correlation between the autoregressive traits and the states were added. These correlations were fixed to be equal as well.

the distribution of the measures was considered.

3. Results

3.1. Descriptive results

The means and standard deviations of students' enjoyment and boredom, as well as those for student-perceived teacher enthusiasm and humor, are listed in Table 1. Table 2 presents the cross-sectional correlations between the four constructs for each measurement point. These correlations are all in line with the theoretical assumptions and previous empirical findings and indicate that students' enjoyment and boredom are mostly negatively related, that enjoyment is positively related to student-perceived teacher enthusiasm and humor, and that boredom is negatively related to both teaching characteristics. Student-perceived teacher enthusiasm and humor were positively related.

3.2. Variance components and carry-over effects of students' emotions and perceived teacher enthusiasm and humor

To address the first aim, univariate STARTS models (Fig. 2) were calculated for each of the two emotions (enjoyment and boredom) and two teaching characteristics (teacher enthusiasm and humor). For all four constructs, the model fits of the univariate STARTS models were satisfactory (Table 3).

For enjoyment, 30.5% of the total variance was due to the stable trait component, which can be interpreted as person specific; 31.7% of the total variance was due to previous experiences, which depend partly on a previous state; and 37.8% of the total variance was due to the variable state, which could be interpreted as situation specific. However, this component was confounded by measurement error. There were strong standardized autoregressive effects (α) within lectures that represent carry-over effects of the experience of enjoyment from one situation to the next. There was a medium standardized autoregressive effect from one lecture to the next lecture.

For boredom, most of the total variance, i.e., 36.1%, could be explained by a stable trait, while 30.3% was due to previous experiences, and 33.6% was due to a variable situation-specific state. While the standardized autoregressive effects within lecture courses were strong (see Table 4, column 4, α_{short}), beyond the overall stable trait, no significant carry-over effects from one lecture to the next lecture could be found (see Table 4, column 5, α_{long}).

These results are in line with our first hypothesis that students' emotions are due to person-specific and situation-specific components and would additionally be influenced by previous experiences of enjoyment and boredom during the lecture course.

Table 1
Means and standard deviations of the measures.

		Enjoyment		Boredom		Teacher Enthusiasm		Teacher Humor	
Measurement point	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
11	364/365/366/366	2.77	1.11	2.70	1.14	2.61	1.12	3.55	0.95
12	364/365/365/365	2.64	1.19	2.70	1.25	2.58	1.18	3.45	0.98
13	358/358/359/359	1.53	1.18	2.88	1.27	2.40	1.04	3.26	1.01
21	366/364/365/363	2.69	1.07	2.70	1.06	2.25	1.02	3.30	0.90
22	365/361/354/354	2.79	1.16	2.70	1.22	2.35	1.14	3.34	1.06
23	357/355/356/357	2.62	1.21	2.64	1.26	2.32	1.05	3.30	1.05
31	323/324/322/321	2.56	1.08	2.51	1.12	2.26	1.02	3.20	1.00
32	323/323/322/324	2.41	1.15	2.68	1.25	2.34	1.06	3.27	0.98
33	322/322/323/323	2.35	1.21	2.80	1.28	2.28	1.03	3.08	1.10
41	284/283/281/283	2.49	1.06	2.56	1.17	2.28	1.08	3.20	1.00
42	282/282/281/283	2.37	1.12	2.75	1.22	2.19	1.01	3.04	1.05
43	279/279/278/279	2.30	1.15	2.76	1.26	2.21	1.06	3.06	1.06

Note. Measurement point xy: course session x, measurement y within session.

Table 2
Cross-sectional correlations.

Measurement point		Enjoyment – Boredom		Enjoyment – Teacher Enthusiasm		Enjoyment – Teacher Humor		Boredom – Teacher Enthusiasm		Boredom – Teacher Humor		Teacher Enthusiasm – Teacher Humor	
	N	r	(p)	r	(p)	r	(p)	r	(p)	r	(p)	r	(p)
11	364	-.28	(<.001)	.20	(<.001)	.24	(<.001)	-.32	(<.001)	-.30	(<.001)	.45	(<.001)
12	364	-.43	(<.001)	.37	(<.001)	.51	(<.001)	-.36	(<.001)	-.38	(<.001)	.55	(<.001)
13	358	-.34	(<.001)	.30	(<.001)	.29	(<.001)	-.28	(<.001)	-.24	(<.001)	.50	(<.001)
21	366	-.28	(<.001)	.23	(<.001)	.32	(<.001)	-.28	(<.001)	-.25	(<.001)	.42	(<.001)
22	365	-.31	(<.001)	.27	(<.001)	.33	(<.001)	-.31	(<.001)	-.29	(<.001)	.55	(<.001)
23	357	-.38	(<.001)	.28	(<.001)	.33	(<.001)	-.33	(<.001)	-.29	(<.001)	.53	(<.001)
31	323	-.20	(<.001)	.22	(<.001)	.21	(<.001)	-.31	(<.001)	-.18	(.001)	.44	(<.001)
32	323	-.15	(.006)	.17	(.003)	.28	(<.001)	-.30	(<.001)	-.22	(<.001)	.44	(<.001)
33	322	-.09	(.108)	.24	(<.001)	.34	(<.001)	-.39	(<.001)	-.21	(<.001)	.44	(<.001)
41	284	-.08	(.203)	.12	(.054)	.20	(.001)	-.19	(.002)	-.22	(<.001)	.57	(<.001)
42	282	-.01	(.824)	.15	(.015)	.19	(.001)	-.26	(<.001)	-.21	(<.001)	.57	(<.001)
43	279	-.09	(.130)	.12	(.044)	.28	(<.001)	-.22	(<.001)	-.18	(.002)	.54	(<.001)

Note. Measurement point xy: course session x, measurement within session y.

Table 3
Fit indices of the univariate STARTS models.

Model	χ^2	χ^2df(p)	RMSEA	SRMR	CFI	TLI	BIC	AIC
Enjoyment	99.37	73(.022)	.025 [.010; .037]	.073	.98	.98	11070.73	10997.18
Boredom	122.59	73(.000)	.035 [.024; .045]	.078	.96	.97	11369.99	11296.47
Teacher Humor	140.16	73(.000)	.041 [.030; .051]	.079	.96	.96	9933.59	9860.04
Teacher Enthusiasm	129.43	73(.000)	.037 [.026; .048]	.090	.96	.97	9548.46	9474.91

Table 4
Variance components and autoregressive effects of the univariate STARTS models.

Model	$Variance_{trait}$(SE)	$Variance_{auto}$(SE)	$Variance_{state}$(SE)	α_{short}(p)	α_{long}(p)
Enjoyment	.398 (.048)	.414 (.051)	.493 (.050)	.81 (<.001)	.33 (.003)
Boredom	.525 (.047)	.441 (.056)	.488 (.056)	.73 (<.001)	.18 (.109)
Teacher Enthusiasm	.410 (.038)	.410 (.055)	.189 (.057)	.60 (<.001)	.08 (.424)
Teacher Humor	.455 (.041)	.313 (.041)	.350 (.029)	.80 (<.001)	.34 (<.001)

Note. α_{short}: = autoregressive effects within lectures; α_{long}: = autoregressive effects between lectures.

Student-perceived teacher enthusiasm was revealed to be a rather stable construct, with 40.6% of the total variance being due to a stable trait, 40.6% being due to previous experiences, and only 18.7% being situation specific or due to measurement error. This rather high stability of the construct was also reflected by strong standardized autoregressive relations between measurement points within lectures, while the standardized autoregressive relations between two lectures were not significant.

Student-perceived teacher humor was also rather person specific, with 40.7% of the total variance due to a stable trait. However, 28% was due to previous experiences, while 31.3% was situation specific. Nevertheless, there were strong standardized autoregressive relations between measurement points within one lecture and medium standardized autoregressive relations between two lectures. As hypothesized, perceived teaching characteristics turned out to be predominantly person-specific in nature, which implies situation-specific components and influence by previous perceptions during a lecture.

3.3. Interrelations between students' emotions and perceived teacher enthusiasm and humor

To explore the interactive relation within our second research aim

between students' emotions and student-perceived teaching dimensions, we calculated bivariate STARTS models (Fig. 3) that each combined one emotion (enjoyment or boredom) with one student-perceived teaching characteristic (enthusiasm or humor). The fit indices of these bivariate models were all satisfactory (Table 5). For the estimates of the models, see Table 6.

The cross-sectional correlations (r) between the trait (Table 6, line 9), previous experience (Table 6, line 10), and state variance (Table 6, line 11) components were all significant, although small. In other words, while all three variance components (trait, previous experiences and state) of students' experiences of enjoyment were positively related to student-perceived teacher enthusiasm and humor, all three components of students' experiences of boredom were negatively related to the two teaching characteristics.

Furthermore, the sizes and directions of the autoregressive carry-over effects (α) in the bivariate STARTS models remained the same as those in the univariate STARTS models (Table 6, lines 1, 2, 3, and 4), with strong carry-over effects within lectures for all four constructs and small to medium carry-over effects from one lecture to the next lecture for students' enjoyment and student-perceived teacher humor. However, no carry-over effects were found for students' boredom and student-perceived teacher enthusiasm (α) from one lecture to the next.

The analyses did not reveal a significant cross-lagged effect of experiences of enjoyment at one specific moment on the perception of teachers' enthusiasm or humor at a later time (β), beyond the cross-sectional and autoregressive relations of the constructs (Table 6, columns 1 and 2, lines 5 and 6).

Additionally, no cross-lagged effects of student perceptions of teachers' enthusiasm on students' enjoyment and boredom were found (γ; Table 6, columns 1 and 3, lines 7 and 8). However, perceptions of teacher humor had an impact on students' enjoyment at a later time within the same lecture (Table 6, column 2, line 7). Most interestingly, there was also an unexpected negative effect of student-perceived teacher humor on students' enjoyment in subsequent lectures (Table 6, column 2, line 8).

In line with our second hypothesis, within a single lesson, students' experiences of boredom at one moment had a negative impact on their perceptions of teachers' enthusiasm and humor at the next time point (Table 6, columns 3 and 4, line 5). The models do not indicate any cross-lagged effects of students' perceptions of teaching characteristics on boredom except for one unexpected positive effect of student-perceived teacher enthusiasm at the end of one lecture on students' boredom at the beginning of the next lecture (Table 6, column 3, line 8). As the bivariate zero-order correlations for both unexpected cross-lagged effects have the expected direction of effect,[1] these findings might be due to suppression effects (see Conger, 1974) and require cautious discussion.

4. Discussion

The current study attempted to attain two different goals. First, we examined the differential contributions of person-specific, situation-specific and previous experience variance components of two prominent emotions, namely, enjoyment and boredom, and of two affectively toned teaching characteristics, namely, teacher enthusiasm and teacher humor at university. Second, we explored both within and between lectures the dynamics and reciprocal processes of students' experienced enjoyment and boredom on the one hand and teachers' enthusiasm and humor as perceived by students on the other hand.

Our findings from the univariate STARTS models supported our first hypothesis that enjoyment and boredom showed different variance components, namely, stable and situational components. In other words, there were both stable dispositional and variable situational impacts on students' experiences of enjoyment and boredom. In summary, for both emotions, all three variance components (traits, previous experiences and states) were rather balanced, they made meaningful contributions to students' emotions experienced during lectures. Students' experiences of enjoyment were rather influenced by the situation, and the remaining variance depended on students' stable traits and on previous emotional experiences to similar degrees. The proportions of students who experienced boredom were slightly different. Students' experiences of boredom are mainly influenced by stable traits, followed by the situation and then previous experiences with the smallest relative impact. Our results differed from prior findings by Respondek et al. (2019) who found that the variance of all examined emotions was mainly explained by time-stable components. They were in line with this study as the negative emotion boredom strongly depended on stable components like the negative emotions anxiety and anger (Respondek et al., 2019). Thus, consistent with the findings by Pekrun et al. (2011), the study offered indications that enjoyment and boredom were not structurally equal and taken together enjoyment was predominantly situation specific and boredom was predominantly trait specific. These findings can have practical implications for teachers by indicating that it could be important to keep in mind that there might be two "ways" to have an impact on their student's emotions. First, teachers can address and promote the experience of enjoyment by shaping specific learning situations in an enjoyable and not boring way (e.g., with content-related humor). Second, they can enhance the value of the subject and the control over the learning situation. Teachers should avoid, for example, low levels of stimulation and should arouse situational interest and focus on mastery goals to address some antecedents of boredom (Goetz & Hall, 2014).

Within the scope of the first hypothesis, students' previous experiences of enjoyment had a positive influence at later time points both within and between lectures. Once a student experienced enjoyment, it seemed more likely that the student will continue to experience enjoyment in the same lecture course and in the next lecture. The results for boredom also showed a strong carry-over effect within a single lecture but not between lectures. For enjoyment, the results indicated that even if enjoyment was promoted situationally, through carry-over effects, this situational impact might also had an "indirect" impact on slow changes toward a more stable experience of enjoyment. For boredom, the results suggested that if students experienced boredom in a lecture at a specific moment, it was very likely that they will continue to experience boredom throughout the whole lecture course. We found no evidence for a carry-over effect for boredom between lectures, which may imply that the experience of boredom in a specific lecture course had no additional impact on the experience of boredom beyond that of overall trait boredom. This missing effect between lectures may be in part explained with a lecture concept, which is often an introductory course and gives an overview to a field, including very diverse topics. Therefore, in this special context, a carry-over effect for boredom between sessions should be less likely than in a school context (in which consecutive sessions should be more closely related on average). Thus, it is possible that even if one lecture course does not meet students' goals and interest, the lectures will be re-evaluated every week. This can be interpreted as positive to a certain extent, as one boring lecture course will not influence students' experience of boredom in the next lecture beyond the overall trait perception of the lecture or subject. A teacher has a new opportunity every week, but if she/he starts the lecture and the students begin to experience boredom, students might become stuck in this negative emotion. Thus, teachers should strive to continuously generate

[1] The bivariate zero-order correlations between student-perceived teacher humor at the end of one lecture and students' enjoyment at the beginning of the consecutive lecture are as follows: $r(p) = .$[1]6(0.010); 0.13(0.046); 0.20(0.004). The corresponding correlations for student-perceived teacher enthusiasm and students' boredom are $r(p) = -0.25(<0.001)$, $-0.05(0.397)$, and $-0.22(0.001)$. As all of these correlations, as well as the cross-sectional correlations (Table 2) have the expected direction in contrast to the cross-lagged effect (Table 6), these findings might indicate a suppression effect (Conger, 1974) and should be interpreted cautiously.

Table 5
Fit indices of the bivariate STARTS models.

Model	χ^2	χ^2df(p)	RMSEA	SRMR	CFI	TLI	BIC	AIC
Enjoyment – Teacher Humor	442.95	283(.000)	.032	.071	.95	.95	20787.77	20610.39
Enjoyment – Teacher Enthusiasm	413.97	283(.000)	.029	.077	.96	.96	20540.83	20363.45
Boredom – Teacher Humor	482.47	283(.000)	.036	.083	.94	.94	21020.84	20843.47
Boredom – Teacher Enthusiasm	447.46	283(.000)	.032	.079	.95	.95	20759.13	20581.76

Table 6
Variance components and regression effects of the bivariate STARTS models.

Model	Enjoyment and Teacher Enthusiasm	Enjoyment and Teacher Humor	Boredom and Teacher Enthusiasm	Boredom and Teacher Humor
Autoregressive effects				
1. $\alpha_{emotion\_short}$(p)	.839 (<.001)	.931 (<.001)	.687 (<.001)	.614 (.003)
2. $\alpha_{teaching\_short}$(p)	.632 (<.001)	.890 (<.001)	.574 (<.001)	.755 (<.001)
3. $\alpha_{emotion\_long}$(p)	.361 (.002)	.419 (<.001)	.212 (.091)	-.272 (.110)
4. $\alpha_{teaching\_long}$(p)	.102 (.418)	.414 (.003)	.053 (.616)	.369 (.008)
Cross-lagged effects of students' emotion on student-perceived teaching dimensions				
5. β_{short}(p)	.094 (.124)	.037 (.296)	-.094 (.039)	-.134 (.002)
6. β_{long}(p)	-.042 (.650)	-.176 (.198)	.027 (.762)	.207 (.235)
Cross-lagged effects of student-perceived teaching dimensions on students' emotion				
7. γ_{short}(p)	.017(.746)	.148 (.024)	-.107 (.071)	-.151 (114)
8. γ_{long}(p)	-.112 (.259)	-.385 (.008)	.189 (.030)	-.036 (.766)
Cross-sectional correlations				
9. r_{trait}(p)	.127 (<.001)	.178 (<.001)	-.192 (<.001)	-.263 (<.001)
10. r_{aut}(p)	.109 (.032)	.123 (<.001)	-.108 (.026)	-.120 (.003)
11. r_{state} (p)	.065 (<.001)	.107 (<.001)	-.087 (<.001)	-.120 (<.001)
Variances of students' emotions				
12. Var_{trait}(SE)	.40 (.05)	.39 (.05)	.54 (.05)	.41 (.04)
13. $Var_{autoreg.\ trait}$(SE)	.40 (.05)	.33 (.07)	.43 (.07)	.37 (.15)
14. Var_{state}(SE)	.51 (.05)	.56 (.05)	.47 (.08)	.52 (.15)
Variances of student-perceived teaching dimensions				
15. Var_{trait}(SE)	.41 (.04)	.45 (.04)	.41 (.04)	.47 (.04)
16. $Var_{autoreg.\ trait}$(SE)	.38 (.06)	.28 (.04)	.40 (.07)	.28 (.04)
17. Var_{state}(SE)	.22 (.07)	.39 (.03)	.19 (.08)	.35 (.03)

Note. α: = autoregressive effects; β: = cross-lagged effect of students' emotion on student-perceived teaching dimensions; γ: = cross-lagged effect of student-perceived teaching dimensions on students' emotion.

interest among the students from the very start of the lecture course.

Examining the variance distribution of student-perceived teaching characteristics, we found that teacher enthusiasm and humor are somewhat different. Both teaching characteristics had almost the same amount of person-specific variance. The remaining variance in teachers' enthusiasm depended to a large extent (the same as the trait component) on their previous experiences. Teachers' humor was considerably more situation specific. This outcome supported the findings of that teachers' humor is a unique teaching dimension that can be distinguished from teachers' enthusiasm as perceived by students. Furthermore, there were carry-over effects of student-perceived teacher enthusiasm within a single lecture but not between the lectures that go beyond the effects that are due to stable trait-like perceptions. In contrast, student-perceived teacher humor had strong carry-over effects both within and between lectures. Once students perceived teachers' humor, this experience transfers not only within the same lecture course but also between lectures. Thus, teachers' humor seems to have the potential to create a situation that can be maintained and extended. However, this carry-over effect addressed a rather small proportion of variance. In total, teachers' enthusiasm and humor might be more perceived as a personality trait of the teacher by students, which supported the assumption of dispositional enthusiasm and a dispositional humor orientation (Keller et al., 2014; Booth-Butterfield & Kanjeva, 2018). However, for teachers' humor, their perception was more shaped by specific, humorous situations. Building upon the theoretical basis of CVT (Pekrun, 2006) that emotions are elicited by appraisal antecedents, it seemed that teacher humor fulfilled the criteria of a distal antecedent of students' emotion better than teacher enthusiasm did (Goetz et al., 2020).

Addressing our second research aim, we hypothesized that students' experienced enjoyment and boredom, as well as student-perceived teacher enthusiasm and teacher humor, would be reciprocally related both within and between lectures. This hypothesis was only partially supported. For all three variance components, the constructs were cross-sectionally related with each other, in line with the theoretical assumptions; that is, students' enjoyment was positively related to student-perceived teacher enthusiasm and humor, while students' boredom was negatively related to both constructs. In addition to these relations, there were cross-lagged effects within lecture courses; students' experienced enjoyment at one specific moment had no cross-lagged effect on the perception of teachers' enthusiasm or humor at a later time, but students' experienced boredom at one specific moment had a cross-lagged effect on the perception of teachers' enthusiasm and humor. When students experienced boredom at one moment within a lecture course, they obviously perceived less teacher enthusiasm and humor at later moments within the same lecture course. The teaching format of a lecture is frequently characterized by low stimulation and monotony, which are assumed antecedents of academic boredom (Goetz & Hall, 2014). As boredom withdraws attention from boring activities and reduces students' cognitive resources (Goetz & Hall, 2014), it may be that students become caught up in this negative deactivating emotion, are not predisposed to teachers' instructional efforts and thus do not value them. Once students experience boredom, the teacher seemingly cannot reach them, at least not with enthusiasm or humor. A further explanation for this effect is provided by the concept of emotional contagion (Hatfield et al., 1993). It is possible that when a higher education teacher perceives that students are bored, she/he consequently teaches with less enthusiasm and uses less content-related humor, as she/he does not enjoy teaching in front of many bored students. Somewhat surprisingly and not in line with the assumptions made in CVT, we found no cross-lagged effects of students' enjoyment on the examined teaching characteristics. Therefore, contradictory to students'

negative emotions, enjoyment had no effect on the perceived teaching characteristics. Nevertheless, we found a cross-lagged effect of perceived teacher humor on enjoyment, which indicated that when a teacher used content-related humor, students experienced more enjoyment within the same lecture course. The discovered cross-lagged effects of humor on enjoyment within lecture courses confirmed the reciprocal relations postulated within CVT (Pekrun, 2006) and further confirmed that emotions are reactions to perceived environmental conditions (Lazarus, 1991). It seems that humor is a more interactive element in teaching than teachers' enthusiasm, and it might be that teachers' humor is more easily perceived by students. Thus, at least in higher education, it seems that teacher humor can fulfill the characteristics of a positively valued learning environment better than teachers' enthusiasm. This may be consistent with students' positive value appraisals due to humorous content. Funny examples, cartoons or anecdotes related to course content can support students' experience of enjoyment within a lecture course. As we have seen through carry-over effects, enjoyment can be transferred to the next lecture. Thus, students' perception of teachers' previous behavior (i.e., teacher humor) can influence current enjoyment and, perhaps as a consequence, enhance interest because enjoyment and interest are positively related (Pekrun et al., 2002). Future studies should investigate these assumed relations. Surprisingly, however, teachers' enthusiasm perceived during a lecture course from university students did not predict students' enjoyment. Perhaps the school context with a closer relationship to the teacher is a necessary precondition for such a prediction. School students may know their teachers better and may be more sensitive to their emotions than higher education students in an anonymous lecture.

Regarding the cross-lagged effects between the lectures, we found two unexpected effects: a positive cross-lagged effect from perceived teacher enthusiasm on students' boredom and a negative effect of teachers' humor on students' enjoyment between lectures. These effects certainly has to be replicated in future studies to be perceived as a stable effect. This might be due to students' overly high expectations at the beginning of a lecture when the previous lecture was perceived as being taught very enthusiastically or humorously. A methodical approach known from the education of school teachers may be to start a lecture with enthusiasm and humorous aspects to address students' enjoyment and to avoid boredom. This seems to be important in lectures, too. However, it could not be ruled out that these results might be a statistical artifact due to a suppression effect. Thus, they should be interpreted with caution. However, the results might indicate that student-perceived teacher enthusiasm in one lecture can diminish the effect size of the negative relation with boredom in the next lecture and that student-perceived teacher humor can diminish the effect size of the positive relation with students' enjoyment. These effects certainly require additional research.

5. Limitations

The present study provides an important step for understanding the variance structure of students' emotions and student-perceived teaching characteristics, as well as their interactive dynamics over time. However, the present study also has several limitations with implications for future research. Due to the single-item measures, the situational variance component that was identified via STARTS models (Kenny & Zautra, 2001) also constitutes the measurement error of the item. Although the application of single-item measures was sensible for ecological reasons, there is a remaining limitation of these measures that reliability cannot fully be shown in a classical way. Future studies could reveal even more precise results by applying multi-item measures and thus provide the opportunity to gain more profound information on reliability and more precisely assess situational variance. Our findings are limited in so far as we did not examine differential effects in terms of different effect sizes and impact of teacher enthusiasm and teacher humor for students' emotions. It is possible, that teacher enthusiasm which is based on emotional transmission, has stronger effects on students' enjoyment than teacher humor which demands more cognitive skills. It could be further assumed, that teachers' content related humor is more activating than teacher enthusiasm and therefore rather reduces boredom. These mechanisms should be addressed in future studies applying, example given, specific vignettes or experiments. Furthermore, the inclusion of only seven lectures did not allow us to fully account for the multilevel structure of the data. Future research should focus on this possible additional effect. The method of short-questionnaires was convenient to assess within lectures; however, there might be a common-method bias, such as the same questions provoking a specific answer pattern or the break for filling out the questionnaire itself having an impact on the students' experience of the lecture. Thus, additional, nonquestionnaire-based methods of assessments, such as videography of the lecture, might provide important additional information.

Although they are very common in higher education, lecture courses are also a very unique and usually very homogenous teaching format. Thus, lecture courses might be a teaching format in which person-focused teaching characteristics such as teacher enthusiasm and humor have a very unique impact. Furthermore, the instruction style in lectures is usually rather invariant, and it might be that different teaching formats provide the possibility of a greater variation of instructional styles. Future studies should include different teaching formats that extend beyond lectures and additional teaching characteristics such as other humor types (e.g., unrelated, self-disparaging and aggressive teacher humor, e.g., sarcasm) to further the understanding of the relationship. Thus, a variation in teaching format, as well as a variation in the size of assessment intervals, might have an impact on the stability and variation of students' experiences. Thus, additional studies evaluating these effects are desirable.

When addressing additional emotional experiences, these studies could provide even more insight into the differential structure of students' emotions, student-perceived teaching characteristics and the dynamic interactive relations between these two variables. Furthermore, as control and value appraisals are the central antecedents of emotional experiences in the context of learning (Pekrun, 2006), future studies should address the mediating role of control-value appraisals in the relationship between teachers' enthusiasm and different teacher humor types and students' emotions to understand the interactive dynamics even more precisely.

6. Conclusions

Taken together, our findings replicate previous findings on different variance components and carry-over effects of positive and negative emotions (Nett et al., 2017; Respondek et al., 2019) and suggest that the experience of emotions is highly dynamic. The findings further suggest that for student-perceived teacher enthusiasm and humor, stable traits, previous experiences and situational states have a rather balanced impact and have to be considered. Our study at least partially supports the model of reciprocal causation between students' emotions and student-perceived teacher enthusiasm and humor.

Author contributions

Markus Dresel and Thomas Goetz: Conceptualization. **Ulrike Nett**: Methodology, Formal analysis, Writing-Reviewing and Editing. **Sonja Bieg**: Investigation, Data Curation, Writing- Original Draft preparation.

References

Ahmed, W., van der Werf, G., Minnaert, A., & Kuyper, H. (2010). Students' daily emotions in the classroom: Intra-individual variability and appraisal correlates. *British Journal of Educational Psychology, 80*, 583–597. https://doi.org/10.1348/000709910X498544

Aleamoni, L. M. (1999). Student rating myths versus research facts from 1924 to 1998. *Journal of Personnel Evaluation in Education, 13*, 153–166.

Banas, J. A., Dunbar, N., Rodriguez, D., & Liu, S.-J. (2011). A review of humor in educational settings. *Communication Education, 60*, 115–144. https://doi.org/10.1080/03634523.2010.496867

Becker, E. S., Goetz, T., Morger, V., & Ranellucci, J. (2014). The importance of teachers' emotions and instructional behavior for their students' emotions – an experience sampling analysis. *Teaching and Teacher Education, 43*, 15–26. https://doi.org/10.1016/j.tate.2014.05.002

Bieg, M., Goetz, T., Sticca, F., Brunner, E., Becker, E., Morger, V., et al. (2017). Teaching methods and their impact on students' emotions in mathematics: An experience-sampling approach. *ZDM Mathematics Education, 49*, 411–422. https://doi.org/10.1007/s11858-017-0840-1

Bieg, S., & Dresel, M. (2016). Construction and validation of the German questionnaire to assess students' perceptions of teacher humor. *Diagnostica, 62*, 3–15. https://doi.org/10.1026/0012-1924/a000132

Bieg, S., & Dresel, M. (2018). Relevance of perceived teacher humor types for instruction and student learning. *Social Psychology of Education, 21*, 805–825. https://doi.org/10.1007/s11218-018-9428-z

Bieg, S., Grassinger, R., & Dresel, M. (2017). Humor as a magic bullet? Associations of different teacher humor types with student emotions. *Learning and Individual Differences, 56*, 24–33. https://doi.org/10.1016/j.lindif.2017.04.008

Bieg, S., Grassinger, R., & Dresel, M. (2019). Teacher humor: longitudinal effects on students' emotions. *European Journal of Psychology of Education, 34*, 517–534. https://doi.org/10.1007/s10212-018-0402-0

Biesanz, J. C. (2012). Autoregressive longitudinal models. In R. H. Hoyle (Ed.), *Handbook of structural equation modeling* (pp. 459–471). Guilford Press.

Booth-Butterfield, M., & Kanjeva, P. (2018). Extending humor enactment research. *Communication Research Reports, 35*, 356–362. https://doi.org/10.1080/08824096.2018.1513835

Booth-Butterfield, M., & Wanzer, M. B. (2016). Humor enactment in learning environments. In P. L. Witt (Ed.), *Communication and learning* (pp. 211–240). De Gruyter Mouton.

Brophy, J. E., & Good, T. L. (1986). Teacher behavior and student achievement. In M. Wittrock (Ed.), *Handbook of research on teaching* (Vol. 3, pp. 328–375). Macmillan.

Conger, A. J. (1974). A revised definition for suppressor variables: A guide to their identification and interpretation. *Educational and Psychological Measurement, 34*, 35–46. https://doi.org/10.1177/001316447403400105

Daumiller, M., Bieg, S., Dickhäuser, O., & Dresel, M. (2019). Humor in university teaching: Role of teachers' achievement goals and self-efficacy for their use of content-related humor. *Studies in Higher Education*. https://doi.org/10.1080/03075079.2019.1623772

Eid, M., Holtmann, J., Santangelo, P., & Ebner-Priemer, U. (2017). On the definition of latent-state-trait models with autoregressive effects. *European Journal of Psychological Assessment, 33*, 285–295. https://doi.org/10.1027/1015-5759/a000435

Feldman, K. A. (1988). Effective college teaching from the students' and faculty's view: Matched or mismatched priorities. *Research in Higher Education, 28*, 291–344. https://doi.org/10.2307/40195871

Frenzel, A. C., Becker-Kurz, B., Pekrun, R., Goetz, T., & Lüdtke, O. (2018). Emotion transmission in the classroom revisited: A reciprocal effects model of teacher and student enjoyment. *Journal of Educational Psychology, 110*, 628–639. https://doi.org/10.1037/edu0000228

Frenzel, A. C., Goetz, T., Lüdtke, O., Pekrun, R., & Sutton, R. E. (2009a). Emotional transmission in the classroom: Exploring the relationship between teacher and student enjoyment. *Journal of Educational Psychology, 101*, 705–716. https://doi.org/10.1037/edu0000228

Frenzel, A. C., Goetz, T., Stephens, E. J., & Jacob, B. (2009b). Antecedents and effects of teachers' emotional experiences: An integrated perspective and empirical test. In P. A. Schutz, & M. Zembylas (Eds.), *Advances in teacher emotion research* (pp. 129–151). Springer.

Frenzel, A. C., Pekrun, R., & Goetz, T. (2007). Perceived learning environment and students' emotional experiences: A multilevel analysis of mathematics classrooms. *Learning and Instruction, 17*, 478–493. https://doi.org/10.1016/j.learninstruc.2007.09.001

Frenzel, A. C., Taxer, J. L., Schwab, C., & Kuhbandner, C. (2019). Independent and joint effects of teacher enthusiasm and motivation on student motivation and experiences: A field experiment. *Motivation and Emotion, 43*, 255–265. https://doi.org/10.1007/s11031-018-9738-7

Frijda, N. H. (2007). *The laws of emotion*. Lawrence Erlbaum Associates Publishers.

Frymier, A. B., Wanzer, M. B., & Wojtaszczyk, A. M. (2008). Assessing students' perceptions of inappropriate and appropriate teacher humor. *Communication Education, 50*, 314–326. https://doi.org/10.1080/03634520701687183

Geiser, C., Hintz, F., Burns, G. L., & Servera, M. (2017). Latent variable modeling of person-situation data. In D. Funder, J. Rauthman, & R. Sherman (Eds.), *The Oxford handbook of psychological situations*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190263348.013.15.

Goetz, T., & Hall, N. C. (2014). Academic Boredom. In R. Pekrun, & L. Linnenbrink-Garcia (Eds.), *International Handbook of emotions in education* (pp. 311–330). Routledge.

Goetz, T., Keller, M. M., Lüdtke, O., Nett, U. E., & Lipnevich, A. A. (2020). The dynamics of real-time classroom emotions. Appraisal mediate the relation between students' perceptions of teaching and their emotions. *Journal of Educational Psychology, 112*, 1243–1260. https://doi.org/10.1037/edu0000415

Goetz, T., Lüdtke, O., Nett, U. E., Keller, M. M., & Lipnevich, A. A. (2013). Characteristics of teaching and students' emotions in the classroom: investigating differences across domains. *Contemporary Educational Psychology, 38*, 383–394. https://doi.org/10.1016/j.cedpsych.2013.08.001

Goetz, T., Frenzel, A. C., Hall, N., Nett, U. E., Pekrun, R., & Lipnevich, A. A. (2014). Types of boredom: An experience sampling approach. *Motivation and Emotion, 38*, 401–419. https://doi.org/10.1007/s11031-013-9385-y

Goetz, T., & Nett, U. E. (2012). *Boredom in university students. Unpublished codebook*. Konstanz, Germany: University of Konstanz.

Gogol, K., Brunner, M., Goetz, T., Martin, R., Ugen, S., Keller, U., & Preckel, F. (2014). "My questionnaire is too long!": The assessments of motivational-affective constructs with three-item and single-item measures. *Contemporary Educational Psychology, 39*, 188–205. https://doi.org/10.1016/j.cedpsych.2014.04.002

Goodboy, A. K., Booth-Butterfield, M., Bolkan, S., & Griffin, D. J. (2015). The role of instructor humor and students' educational orientations in student learning, extra effort, participation, and out-of-class communication. *Communication Quarterly, 63*, 44–61. https://doi.org/10.1080/01463373.2014.965840

Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods, 20*, 102–116. https://doi.org/10.1037/a0038889

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1993). Emotional contagion. *Current Directions in Psychological Science, 2*, 96–100. https://doi.org/10.1111/1467-8721.ep10770953

Keller, M. M., Goetz, T., Becker, E., Morger, V., & Hensley, L. (2014). Feeling and showing: A new conceptualization of dispositional teacher enthusiasm and its relation to students' interest. *Learning and Instruction, 33*, 29–38. https://doi.org/10.1016/j.learninstruc.2014.03.001

Keller, M. M., Woolfolk Hoy, A., Goetz, T., & Frenzel, A. C. (2016). Teacher enthusiasm: Reviewing and redefining a complex construct. *Educational Psychology Review, 28*, 743–769. https://doi.org/10.1007/s10648-015-9354-y

Kenny, D. A., & Zautra, A. (1995). The trait-state-error model for multiwave data. Journal of. *Consulting and Clinical Psychology, 63*, 52–59. https://doi.org/10.1037/0022-006X.63.1.52

Kenny, D. A., & Zautra, A. (2001). Trait-State models for longitudinal data. In L. M. Collins, & A. G. Sayer (Eds.), *New methods for the analysis of change: Decade of behavior* (pp. 243–263). American Psychological Association. https://doi.org/10.1037/10409-008.

Kunter, M., Frenzel, A. C., Nagy, G., Baumert, J., & Pekrun, R. (2011). Teacher enthusiasm: Dimensionality and context specificity. *Contemporary Educational Psychology, 36*, 289–301. https://doi.org/10.1016/j.cedpsych.2011.07.001

Kunter, M., Klusmann, U., Baumert, J., Richter, D., Voss, T., & Hachfeld, A. (2013). Professional competence of teachers: Effects on instructional quality and student development. *Journal of Educational Psychology, 105*, 805–820. https://doi.org/10.1037/a0032583

Larson, R. W., & Richards, M. H. (1991). Boredom in the middle school years: Blaming schools versus blaming students. *American Journal of Education, 99*, 418–443. https://doi.org/10.1086/443992

Lazarides, R., & Buchholz, J. (2019). Student-perceived teaching quality: How is it related to different achievement emotions in mathematics classrooms? *Learning and Instruction, 61*, 45–59. https://doi.org/10.1016/j.learninstruc.2019.01.001

Lazarus, R. S. (1991). *Emotion and adaptation*. Oxford University Press.

Luhmann, M., Schimmack, U., & Eid, M. (2011). Stability and variability in the relationship between subjective well-being and income. *Journal of Research in Personality, 45*, 186–197. https://doi.org/10.1016/j.jrp.2011.01.004

Marsh, H. W. (1982). SEEQ: A reliable, valid, and useful instrument for collecting students' evaluations of university teaching. *British Journal of Educational Psychology, 52*, 177–195. https://doi.org/10.1111/j.2044-8279.1982.tb02505.x

Marsh, H. W. (1984). Students' evaluation of university teaching: Dimensionality, reliability, validity, potential biases, and utility. *Journal of Educational Psychology, 76*, 707–754. https://doi.org/10.1037/0022-0663.76.5.707

Marsh, H. W. (1994). Weighting for the right criteria in the Instructional Development and Effectiveness Assessment (IDEA) system: Global and specific ratings of teaching effectiveness and their relation to course objectives. *Journal of Educational Psychology, 86*, 631–648. https://doi.org/10.1037/0022-0663.86.4.631

Marsh, H. W., & Bailey, M. (1993). Multidimensional students' evaluations of teaching effectiveness: A profile analysis. *The Journal of Higher Education, 64*, 1–18. https://doi.org/10.2307/2959975

Martin, R., & Ford, T. (2018). *The psychology of humor: An integrative approach*. Elsevier.

Martin, R. A., Puhlik-Doris, P., Larsen, G., Gray, J., & Weir, K. (2003). Individual differences in uses of humor and their relation to psychological well-being: Development of the humor styles questionnaire. *Journal of Research in Personality, 37*, 48–75. https://doi.org/10.1016/S0092-6566(02)00534-2

Muthén, L. K., & Muthén, B. O. (1998–2017). *Mplus user's guide* (8th ed.). Muthén & Muthén.

Nett, U. E., Goetz, T., & Hall, N. C. (2011). Coping with boredom in school: An experience sampling perspective. *Contemporary Educational Psychology, 36*, 49–59.

Patrick, B. C., Hisley, J., & Kempler, T. (2000). What's everybody so excited about?': The effects of teacher enthusiasm on student intrinsic motivation and vitality. *The Journal*

of Experimental Education, 68, 217–236. https://doi.org/10.1080/00220970009600093
Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review, 18*, 315–341. https://doi.org/10.1007/s10648-006-9029-9
Pekrun, R. (2017). Emotion and achievement during adolescence. *Child Development Perspectives, 11*, 215–221. https://doi.org/10.1111/cdep.12237
Pekrun, R., Goetz, T., Daniels, L. M., Stupnisky, R. H., & Perry, R. P. (2010). Boredom in achievement settings: Exploring control-value antecedents and performance outcomes of a neglected emotion. *Journal of Educational Psychology, 102*, 531–549. https://doi.org/10.1037/a0019243
Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology, 36*, 36–48. https://doi.org/10.1016/j.cedpsych.2010.10.002
Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational Psychologist, 37*, 91–105. https://doi.org/10.1207/S15326985EP3702_4
Pekrun, R., Hall, N. C., Goetz, T., & Perry, R. P. (2014). Boredom and academic achievement: Testing a model of reciprocal causation. *Journal of Educational Psychology, 106*, 696–710. https://doi.org/10.1037/a0036006
Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., & Goetz, T. (2017). Achievement emotions and academic performance: Longitudinal models of reciprocal effects. *Child Development, 88*, 1653–1670. https://doi.org/10.1111/cdev.12704
Pekrun, R., Muis, K. R., Frenzel, A. C., & Goetz, T. (2018). *Emotions at school*. Routledge.
Pekrun, R., & Stephens, E. J. (2012). Academic emotions. In *, Vol. 2. APA Educational Psychology Handbook: Individual differences and cultural and contextual factors* (pp. 3–31). American Psychological Association.
Pekrun, R., vom Hofe, R., Blum, W., Frenzel, A. C., Goetz, T., & Wartha, S. (2007). Development of mathematical competencies in adolescence: The PALMA longitudinal study. In M. Prenzel (Ed.), *Studies on the educational quality of schools: The final report on the DFG Priority Programme* (pp. 17–37). Waxmann.
Praetorius, A.-K., Lenske, G., & Helmke, A. (2012). Observer ratings of instructional quality: Do they fulfill what they promise? *Learning and Instruction, 22*, 387–400. https://doi.org/10.1016/j.learninstruc.2012.03.002
Praetorius, A.-K., Pauli, C., Reusser, K., Rakoczy, K., & Klieme, E. (2014). One lesson is all you need? Stability of instructional quality across lessons. *Learning and Instruction, 31*, 2–12. https://doi.org/10.1016/j.learninstruc.2013.12.002
Prenoveau, J. M. (2016). Specifying and interpreting latent state-trait models with autoregression: An illustration. *Structural Equation Modeling: A Multidisciplinary Journal, 23*, 731–749. https://doi.org/10.1080/10705511.2016.1186550
Respondek, L., Seufert, T., & Nett, U. E. (2019). Adding previous experiences to the person situation debate of achievement emotions. *Contemporary Educational Psychology, 58*, 19–32. https://doi.org/10.1016/j.cedpsych.2019.02.004
Spitzberg, B. (1983). Communication competence as knowledge, skill, and impression. *Communication Education, 32*, 323–329. https://doi.org/10.1080/03634528309378550
Stenlund, K. V. (1995). Teacher perceptions across cultures: The impact of students on teacher enthusiasm and discouragement in a cross-cultural context. *Alberta Journal of Educational Research, 41*, 145–161. Retrieved from http://www.redi-bw.de/db/ebsco.php/search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ508939&site=ehost-live.
Steyer, R., Ferring, D., & Schmitt, M. J. (1992). States and traits in psychological assessment. *European Journal of Psychological Assessment, 8*(2), 79–98.
Steyer, R., Mayer, A., Geiser, C., & Cole, D. A. (2015). A theory of states and traits – Revised. *Annual Review of Clinical Psychology, 11*, 71–98. https://doi.org/10.1146/annurev-clinpsy-032813-153719
Steyer, R., Schmitt, M., & Eid, M. (1999). Latent state–trait theory and research in personality and individual differences. *European Journal of Personality, 13*, 389–408. https://doi.org/10.1002/(SICI)1099-0984(199909/10)13:5<389::AID-PER361>3.0.CO;2-A
Trautwein, U., Lüdtke, O., Schnyder, I., & Niggli, A. (2006). Predicting homework effort: Support for a domain-specific, multilevel homework model. *Journal of Educational Psychology, 98*, 438–456. https://doi.org/10.1037/0022-0663.98.2.438
Wanzer, M. B., & Frymier, A. B. (1999). The relationship between student perceptions of instructor humor and students' reports of learning. *Communication Education, 48*, 48–62. https://doi.org/10.1080/03634529909379152
Wanzer, M. B., Frymier, A. B., & Irwin, J. (2010). An explanation of the relationship between instruction humor and student learning: Instructional humor processing theory. *Communication Education, 59*, 1–18. https://doi.org/10.1080/03634520903367238
Wanzer, M. B., Frymier, A. B., Wojtaszczyk, A. M., & Smith, T. (2006). Appropriate and inappropriate uses of humor by teachers. *Communication Education, 55*, 178–196. https://doi.org/10.1080/03634520600566132
Ziv, A. (1988). Teaching and learning with humor. *The Journal of Experimental Education, 57*, 5–15. https://doi.org/10.1080/00220973.1988.10806492