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Institute of Psychology and Education
Department of Learning and Instruction

The Relevance of Perceived Academic Control and Achievement Emotions for Undergraduate Academic Success

DISSERTATION THESIS

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I dedicate this dissertation 2 all the people I love*.

*, even if they probably will never read it.

LIST OF SCIENTIFIC ARTICLES OF THIS DISSERTATION

Study I

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GENERAL INTRODUCTION

Lerne, arbeite, leiste was.

So biste, haste, kannste was.

Hedwig Kannegießer

Dissertation Framework

The present dissertation is situated within the demanding context of tertiary education. The university setting presents a number of challenges for students which they are required to adjust to, such as high autonomy and self-responsibility (Credé & Niehorster, 2012). This difficulty adjusting to and persisting through new challenges is indicated through high dropout rates. Thereby, the first academic year of university, characterized by particularly high dropout rates (Heublein, 2014), appears to be crucial, especially when considering the long-term effects on future achievement (Perry, Hladkyj, Pekrun, & Pelletier, 2001). These high dropout rates reflected a call for action in both research and practice. As a result, in the past decades, researchers have acknowledged many predictors of tertiary academic success (cf. e.g., Robbins et al., 2004) and universities have offered various trainings and interventions (cf. e.g., Robbins, Oh, Le, & Button, 2009). Nevertheless, students still face problems adjusting to new learning situations at university, and dropout rates continue to rise. Thus, it appears as though more research is required regarding causes of academic success.

The present dissertation aims to provide insight into possible predictors of undergraduate academic success. A large body of educational research focuses on the relevance of cognition (e.g., Chamorro-Premuzic & Furnham, 2008), personality (e.g., O'Connor & Paunonen, 2007), or self-regulated learning (e.g., Nota, Soresi, & Zimmerman, 2004). In contrast, this dissertation focuses on motivation and emotion as potential resources to persist and to achieve at university.

The first predictor in the current dissertation is perceived academic control, which is an aspect of student motivation. It involves the individual perception or interpretation of one's control over one's own academic outcomes (Perry, 1991). Perceived academic control has been found to be highly relevant for students' success, especially in their first year of university studies (Perry, Hall, & Ruthig, 2005). Furthermore, motivation in general is relevant both for dropout as well as achievement (Richardson, Abraham, & Bond, 2012; Robbins et al., 2004). Based on this, an important question is whether or not perceived academic control is relevant for the overall success at university. A better understanding of the underlying processes involved in this may yield important information for supporting students in meeting the daily challenges at university.

In addition to perceived academic control, emotions are also relevant for predicting student achievement (Pekrun, 2017) and could be an important factor in understanding how to better support students. The demands and challenges presented in university settings elicit a variety of emotional experiences with subsequent consequences regarding students' success (Pekrun & Stephens, 2010). To this end, gaining a better understanding of the underlying processes involved in emotions and undergraduate academic success constitute an important avenue for supporting students, especially as perceived academic control and achievement emotions interact (Pekrun, 2006).

In sum, this dissertation aims to reveal further insights into the relevance of perceived academic control for academic success, while simultaneously considering the role of achievement emotions. Thereby longitudinal field-based studies are especially important in this line of research to capture the challenging learning situation at university over time. To effectively accomplish the aims of this dissertation, a theoretical framework based on prior findings was developed. This framework, named the PACES model, guides the objectives and empirical studies in the current dissertation. The PACES model stands for **p**erceived **a**cademic **c**ontrol and achievement **e**motions for academic **s**uccess (Figure 1). Specifically, it combines

separate lines of research within the educational field including university retention, motivation, and emotion theories through empirical evidence of perceived academic control and achievement emotions. It is important to mention that the present dissertation does not aim to prove the PACES model empirically. It is rather derived from this theoretical background and aims to encourage further research. This unifying PACES framework structures this dissertation and helps to identify common ground in all three scientific articles.

Figure 1. PACES Model as Dissertation Framework

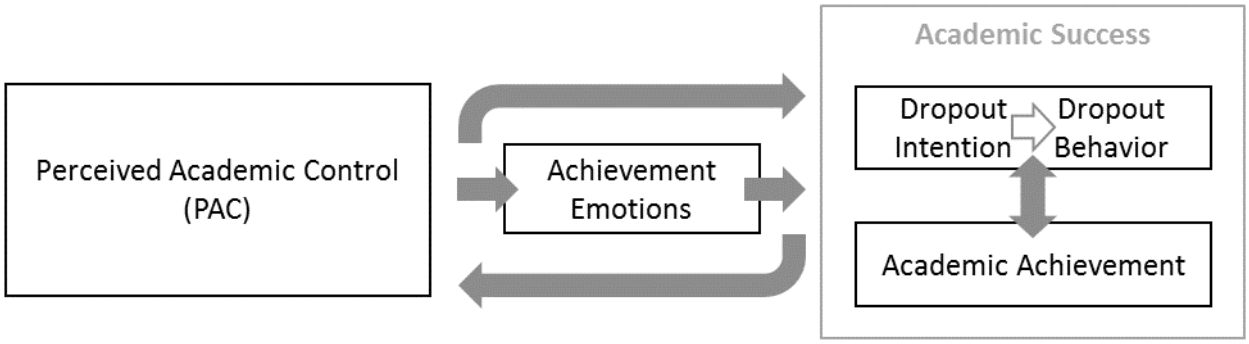


Figure 1. The PACES model describes the relation between **P**erceived **A**cademic **C**ontrol and Achievement **E**motion and Academic **S**uccess. It organizes the aim, research objectives, and scientific articles of the current dissertation.

The following sections describe the theoretical background of the present dissertation. They are structured based on the PACES model, which will be explained in detail. First, the dependent variables will be described, namely retention and achievement. Second, the first predictor (perceived academic control) will be explained, followed by the second predictor (achievement emotions). Third, in line with the PACES model, the relation between these predictors of undergraduate academic success will be mentioned, leading to the overall aims of the current research.

Academic Success

In order to successfully graduate from university, students need to persevere and subsequently achieve good grades. The academic qualification, a higher education degree with possibly high grades is highly important for future career prospects (e.g. financial success Ng, Eby, Sorensen, & Feldman, 2005). Therefore, the research literature classifies academic success into two components: (1) retention or not dropping out of university and (2) academic achievement or university grades (Richardson et al., 2012; Robbins et al., 2004). To fully capture the construct of academic success, the following sections describe both components in detail.

Retention – Absence of dropout.

The first academic success component (defined as retention or absence of university dropout) is commonly defined from the perspective of the university and reflects whether students remain enrolled at that specific university (cf. overview Bahr, 2009; Bernardo et al., 2017; Thomas & Hovdhaugen, 2014; Voelkle & Sander, 2008). Unfortunately, high dropout rates reflect low retention rates, leading to an overall low academic success. Worldwide, approximately one third of students drop out of university (OECD, 2012). In Germany, the dropout rate is between 25% and 33%, and has increased over the last decade, currently standing at 32% (Heublein, 2014; Heublein & Schmelzer, 2018). According to Heublein et al. (2017) most dropout occurs in the first year (47%) or second year (29%). Nevertheless, 12% of students drop out during their third year of studies, and 12% after their third year (Heublein et al., 2017). Therefore, it is also necessary to consider late dropout (cf. Mabel & Britton, 2018; Willcoxson, Cotter, & Joy, 2011). These low retention rates are concerning as university dropout is associated with a host of negative consequences (Sarcletti & Müller, 2011; Thomas & Hovdhaugen, 2014) including societal issues (e.g., fewer qualified employers in the

workforce; Heublein & Wolter, 2011) and personal consequences (e.g., higher reported depression and stress; Faas, Benson, Kaestle, & Savla, 2018). According to these findings, this first academic success component is a current societal and political concern. For instance, political campaigns of educations focus more on prevention of university dropout and supporting retention (e.g., European Commission, 2015 or Federal Ministry of Education and Research, 2016).

In the literature, various definitions of this first academic success component are reported. On one hand, academic success reflects persistence or retention – representing the length of enrollment at an institution (cf. Bahr, 2009; Robbins et al., 2004). On the other hand, academic success represents absence of dropout (cf. Bernardo et al., 2017; Voelkle & Sander, 2008 (the absence of voluntarily withdrawing from a course (e.g., Ruthig, Perry, Hall, & Hladkyj, 2004), and low dropout intention (e.g., Okun, Benin, & Brandt-Williams, 1996; Rump, Esdar, & Wild, 2017). As a consequence of these various definitions, previous research has reported multiple dropout risks including instability in the first two years (Voelkle & Sander, 2008) with most prominently seen in the first year (Alarcon & Edwards, 2013; Heublein, 2014). It is necessary to define this first component of academic success clearly. This dissertation defines it as ‘absence of dropout’, meaning whether not or whether a student is still enrolled in his or her freshman major. This understanding allows for the consideration of various perspectives: of the faculty dean when students transfer to another faculty (major transition), of the university when students transfer to another institution (university transition), and of the German government when students generally withdraw from studying (complete dropout). Further, it represents all possible types of dropout, with the exception of ‘transferring to a lower educational level’ (Bernardo et al., 2017).

Dropout intention – Early-warning sign of dropout.

When considering university dropout, it can be a challenge to track students after they have left the institution or stopped studying (Pascarella & Terenzini, 2005; Thomas & Hovdhaugen, 2014). Once dropout has occurred, it is too late for prevention. Therefore, prior research focused on the self-reported *intention to dropout* prior to students actually dropping out of university. This represents an early-warning sign or first step towards dropout (Brandstätter, Grillich, & Farthofer, 2006; Mashburn, 2000). Theoretically, Bean (1980, 1982, 1985) described dropout intention in his pioneering work as a part of a dropout syndrome which reflects *"[...] a conscious, openly discussed intention to leave an institution coupled with actual attrition."* (Bean, 1985, p. 36). The intent to leave is therefore understood as a pre-stage of dropout or as a part of the decision process to dropout (Heublein et al., 2017). The process to drop out assumably involves successive phases of perception of non-fit, thinking about dropping out, pondering, obtaining information about alternatives, and finally, the actual decision to drop out (Bäulke & Dresel, 2018). Depending on the understanding of dropout intention (e.g., dropout syndrome by Bean (1985), or pre-step by Bäulke and Dresel (2018), Heublein et al. (2017), and Mashburn (2000)), dropout intention can be measured in various ways. Previous research operationalized dropout intention either by a single indicator of whether or not a student thinks about dropping out (e.g., Cabrera, Nora, & Castaneda, 1993; Fellenberg & Hannover, 2006) or more recently, by multiple indicators (e.g., Bäulke & Dresel, 2018; Dresel & Grassinger, 2013; Rump et al., 2017). Empirically, the intent to leave has shown high incremental validity (Bean, 1980, 1982). It decreases throughout the first two academic years (Bean, 1985), and directly affects actual dropout (Bank, Slavings, & Biddle, 1990; Bean, 1985; Bers & Smith, 1991; Cabrera et al., 1993; Mashburn, 2000; Metzner, 1989; Okun et al., 1996). The first thoughts about dropout occur on average in the second semester, while the final decision to drop out is made on average in the third semester, and finally, the actual dropout occurs on average in the fourth semester (Heublein et al., 2017). In conclusion, this dissertation defines the first

academic success component, additionally to the absence of dropout, as no or low dropout intention. Thereby, university dropout intention is operationalized as a process or pre-step to actual dropout, meaning the students' thoughts about not being enrolled in his or her freshman major anymore.

Dropout models – Predictors of dropout.

High reported dropout intentions and dropout rates (e.g., Fellenberg & Hannover, 2006; Heublein, 2014) underline the relevance of understanding why students dropout and analyzing possible predictors. Previous research focused on various perspectives, such as socioeconomic status (Allen, Robbins, Casillas, & Oh, 2008), personality factors (Trapmann, Hell, Hirn, & Schuler, 2007), psychosocial and study skill factors (Robbins et al., 2004), adjustment factors (Credé & Niehorster, 2012), and more (for an overview see e.g., Aljohani, 2016). In Germany specifically, Heublein et al. (2017) found in his national exmatriculation survey with over 6,000 students that the following self-reported reasons influenced their decision: high demands, low motivation, and few practical tasks at university. Following this, theoretical models have helped to structure and cluster these predictors. Most theoretical perspectives focus on either students' interaction, psychological processes, rational decision processes, or cultural capital (for an overview see Sarcletti & Müller, 2011). Out of these perspectives, former research has typically used the first perspective along with Tintos' model of student integration (Tinto, 1975, 2012). Tinto assumed that students with poor academic and social interactions at university would not perceive themselves as academically and socially integrated, which could then lower their goals and commitments, subsequently leading to a decision to leave their studies (Tinto, 1993). The key concept involves how institutional experiences lead to integration and therefore commitment. Tintos' model highlights supporting mechanisms of institutions and instructors (Tinto, 1993). Unfortunately, it lacks an active role of the students as well as intermediate predictors between institutional experiences and perceived integration. To overcome these

limitations, the psychological model of college student retention (Bean & Eaton, 2001) can be considered. Psychological processes explain how interactions influence integration, as Bean and Eaton (2001) added the self-efficacy theory (Bandura, 1997), the coping behavioral theory (French, Rodgers, & Cobb, 1974), and locus of control (Rotter, 1966; Weiner, 1985) to the model (Figure 2). For instance, negative academic interactions (e.g., an unsupportive professor) have negative influences on students' retention (e.g., reducing students' integration, loyalty, and subsequent persistence tendencies) according to the students' self-efficacy, stress, and attributions. If a student would have high positive self-efficacy, effective coping strategies, and internal attributions, single negative interactions would not trigger dropout intentions. Thus, the psychological model of college student retention (Bean & Eaton, 2001) indicates more direct supporting mechanisms, reflects students' own responsibility, and focuses on multiple factors at a time. In comparison, both dropout models consider background variables and highlight possible supporting strategies for institutions and instructors. They differ however in their main non-cognitive predictors (i.e., sociological integration vs. psychological processes). Therefore, Bean and Eaton's (2001) concrete psychological key constructs enable research and practice to support at-risk students compared to Tinto (1975), who focused on global integration and commitment constructs. Empirically, the psychological constructs explained up to 44% of the variance for white students' dropout (Johnson, Wasserman, Yildirim, & Yonai, 2014). Also, the psychological processes are independent of student demographic characteristics (Fong et al., 2017). To conclude, this dissertation is orientated on the psychological model of college students retention (Bean & Eaton, 2001).

Figure 2. Psychological Model of University Dropout

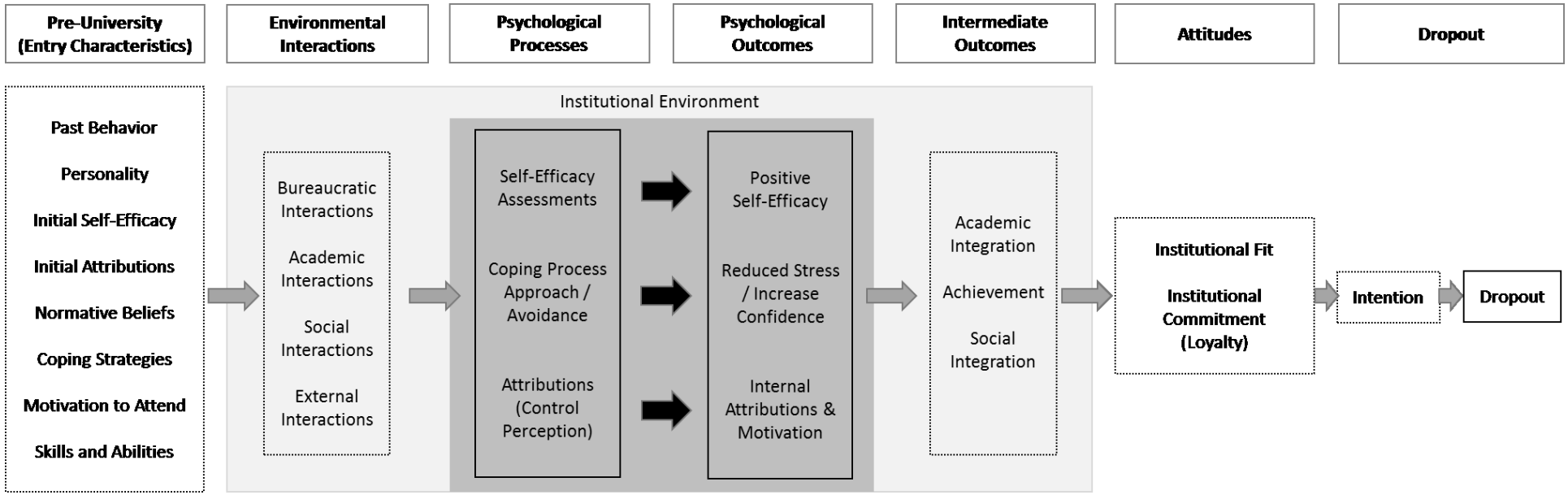


Figure 2. Bean and Eaton's (2001) psychological model of college student retention (adapted from Bean & Eaton, 2001, p.76) The dark gray box in the center represents the key psychological processes, which is framed by the light gray boxes representing Tinto's (1975) key processes.

Academic achievement – University grades.

The second academic success component, academic achievement, is commonly operationalized as university grades, which are typically measured either by a form of cumulative grade point average (GPA, e.g., course-specific or semester-specific), by specific course grades, or by the academic degree (cf. academic achievement search terms by Richardson et al., 2012). It is important to note that achievement is more than 'just' grades. For instance, graduation from university reflects autonomy, self-regulation, volition, project management, and so on. Moreover, academic scholarships or academic awards (e.g., student paper awards) also indicate academic achievement. Further, the amount of voluntarily taken classes or the complexity of chosen courses can also reflect academic achievement (productivity). However, it is enormously complex to add up all achievement elements and the question arises as to how they should be simultaneously considered to operationalize overall achievement. Researchers who have attempted to do this (e.g., Mega, Ronconi, & Beni, 2014) have calculated an incomplete index which is vulnerable to criticism. However, most research uses grades as an operationalization of academic achievement as this is the most feasible option. Moreover, a high usage of GPA as achievement operationalization lies in its relevance for postgraduate selection, graduate employment, occupational status, and employment opportunities (Dye & Reck, 1989; Freire-Seoane, Pais-Montes, & Lopez-Bermúdez, 2019; Strenze, 2007). Despite this, GPA comes with limitations regarding possible grade inflation or grading differences between institutions (Oleinik, 2009; Tucker & Courts, 2010). Still, grade inflation does not reduce the predictive power of GPA (Pattison, Grodsky, & Muller, 2013) and group or cohort specific differences need to be considered to account for possible grading differences: "*Despite problems with grading reliability and disciplinary and institutional grading differences, [cumulative GPA] is still the most widespread performance measure."*

(Robbins et al., 2004, p. 262). Overall, this dissertation uses semester-specific GPA and course specific exam results to operationalize academic achievement.

Regarding a long-term perspective, GPA is highly reliable and stable over time. The influence of annual GPA 'drifts over time' with stronger impacts for short time lags and weaker impacts for longer time lags (Bacon & Bean, 2006; Schneider & Preckel, 2017). As such, high school GPA strongly predicts future undergraduate GPA with a weaker impact on graduate GPA (S. Geiser & Santelices, 2007; Richardson et al., 2012; Schneider & Preckel, 2017). Similar results can be found for course specific grades (Perry et al., 2001).

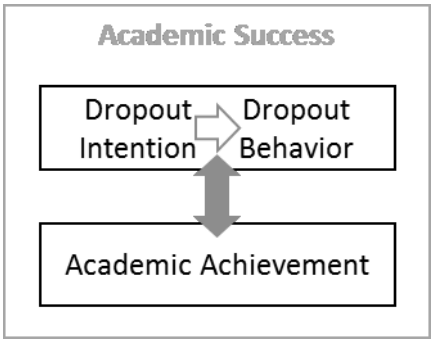
To conclude, the high importance of GPA for students and institutions triggered a number of research studies concerning student variables as predictors of university GPA, such as *"[…] (a) personality traits, (b) motivational factors, (c) self-regulatory learning strategies, (d) students' approaches to learning, and (e) psychosocial contextual influences […]"* (Richardson et al., 2012, p. 355). For instance, conscientiousness is a strong predictor of tertiary achievement (Vedel, 2014), metacognition correlates with online tertiary achievement (Broadbent & Poon, 2015), and effort regulation with college achievement (Credé & Phillips, 2011). In other words, besides prior achievement and intelligence, learning strategies, motivation, and personality are variables which strongly predict achievement in higher education (Schneider & Preckel, 2017). To this end, meta-analyses highlight the relevance of motivation as a non-cognitive predictor of university achievement (Fong et al., 2017; Richardson et al., 2012; Schneider & Preckel, 2017). Thus, most prior research focused on self-efficacy, achievement goals, or effort regulation (e.g., Broadbent & Poon, 2015; Credé & Phillips, 2011).

Relation between university dropout and academic achievement.

Both components of academic success are related, as low achievers are more at risk of dropout (Gramling, 2013; Robbins et al., 2004; Robbins et al., 2009; Voelkle & Sander, 2008). Achievement at the start of university, such as high-school or first-year GPA, especially

influence potential dropout both directly (Allen et al., 2008; Pascarella & Terenzini, 2005; Stewart, Doo Hun Lim, & JoHyun Kim, 2015; Stinebrickner & Stinebrickner, 2014; Wintre & Bowers, 2007) and indirectly through current achievement (Voelkle & Sander, 2008) or for late dropout (Mabel & Britton, 2018). Regarding dropout intention, prior research described students who intend to leave as having low university grades (Bean, 1985) or low high school grades (Porter & Swing, 2006), which highlights the importance of achievement for the dropout decision in the first year of studies. While it appears as though only the poor achievers tend to drop out, the empirical evidence regarding this topic is limited. In sum, most models of university dropout acknowledge the relevance of academic achievement for dropout intention and behavior (e.g., Bean & Eaton, 2001; Heublein, 2014; Tinto, 2012). Moreover, previous meta-analyses have considered both components of academic success (Robbins et al., 2004; Robbins et al., 2009; Trapmann et al., 2007) as achievement explains about a third of dropout variance (Voelkle & Sander, 2008). This dissertation operationalizes academic success as retention, meaning low intention to dropout and the absence of actual dropout behavior, and as academic achievement, meaning high exam results or high annual GPA. Further, this dissertation acknowledges the relation between dropout intention, dropout, and achievement.

Figure 3. Overview of Academic Success



After establishing the two academic success components and their relation to each other, the following sections focus on two predictors of academic success, perceived academic control and achievement emotions, and how they are relevant for academic success.

Perceived Academic Control

Perceived academic control (PAC) reflects students' individual beliefs or perceptions of their own impact on their academic outcomes, mainly concerning achievement (Perry, 1991; Perry et al., 2001). In other words, PAC describes how strongly students perceive themselves as 'being in control' while studying.

The concept of PAC originated within the research area of motivation (for an overview see Murphy & Alexander, 2000), specifically within the expectancy-value tradition, "*one long-standing perspective on motivation*" (Wigfield & Eccles, 2000, p. 68). The fundamental idea of this tradition is that behavior is caused by the interaction of expectations and values. This generated various motivational concepts. For instance, in the well-established Rubicon model (H. Heckhausen & Gollwitzer, 1987), expectancy and value aspects are used to explain how intentions occur, which then lead up to volition and finally to behavior. Another example is the framework of achievement motivation where expectancy and value are two key motivational processes (Dresel & Hall, 2013; Dresel & Lämmle, 2011): Motivational tendencies combined with the learning context, and the interaction of expectancy and value, influence the current situational specific motivation, which leads to planning, initiating, and executing learning behavior and reflecting on it. Particularly focusing on the value component, an important example is intrinsic versus extrinsic motivation of self-determination theory (i.e., doing something out of interest/ joy or doing something due to its expected outcome; Deci & Ryan, 1985; Ryan & Deci, 2000). Regarding the expectancy component, an important example is self-efficacy (students' perceived capabilities; Bandura, 1997) or even PAC (Perry, 1991). Additionally, the academic self-concept (students' perception of themselves; Marsh, 1993) can

be viewed as a facet of expectancy, namely as expectancy-orientated fundamental motivational tendency (Dresel & Hall, 2013; Dresel & Lämmle, 2011). Alternatively, the aspects of expectancy can also be understood as facets of perceived control (Skinner, 1996). It is important to distinguish these close-knit constructs of expectancy from PAC, as PAC is originated in an adaption of the more global construct of perceived control in the academic domain (Perry, 1991; Perry et al., 2001).

The original construct of perceived control itself influenced various research studies regarding the individual beliefs about personal causation or expectancy, which can be organized by the framework of perceived control (Skinner, 1996). First, it separates actual, objective control from perceived, subjective control. Likewise, J. Heckhausen and Schulz (1995) classified perceived control by how strong it is based on actual existing elements of the environment, the so-called degree of 'veridically'. Second, Skinner's framework separates agents (the person or group employing control), means (pathways through which control is employed), and ends of control (sought outcomes of the employed control). Therefore, it can be used to distinguish the close-knit expectancy constructs in that *agent-end* relations reflect the control prototype and describe the general feelings of control, meaning if people believe their can do it (Skinner, 1996). A prominent representative of this is expectancy of success, which describes the competence-expectancy beliefs that are based on the expectancy-value theory of achievement motivation (Wigfield & Eccles, 2002). *Agent-mean* relations reflect if person have access to specific causes (Skinner, 1996). A common construct which illustrates this is self-efficacy; the *"[…] beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments."* (Bandura, 1997, p. 3). Academic domain specific self-efficacy *"[…] represents students' judgments of their capability to do the course work."* (Pintrich, 2004, p.397), or in other words "judgments of competence to perform a task" (Pintrich, 2004, p. 395), or "self-appraisal of one's ability to master a task" (Pintrich, Smith, Garcia, & McKeachie, 1991, p. 13). *Mean-end* relations reflect beliefs about which causes lead

to which outcomes (Skinner, 1996). A common construct which represents this is causal attribution, which is originated in the introduction of locus of control as a perceived cause of achievement (internal vs. external, Rotter, 1966, and later perceived stability and controllability, Weiner et al., 1971; Weiner, 1979). In sum, the aforementioned components of control beliefs (agent-end, agent-mean, and mean-end relations) are not reducible to a single dimension, as the factor analysis structure confirmed their distinction from one another (Shell & Husman, 2001). Again, perceived control is a collection of various beliefs about personal causation.

In addition to perceived control framework, another important control concept is the dual process model (J. Heckhausen & Schulz, 1995; Rothbaum, Weisz, & Snyder, 1982). This model distinguishes between two control processes: either students proactively change their environment (assimilation - primary control) or, if not possible, they psychologically adapt to it (accommodation - secondary control). Prior research revealed that success triggers primary control and failure triggers secondary control (Hall, 2008). If students perceive low primary control they could still adjust to the situation through secondary control strategies (Hall, Perry, Ruthig, Hladkyj, & Chipperfield, 2006) such as reducing one's expectations or the importance of the situation (J. Heckhausen & Schulz, 1995). However, Skinner (1996) theoretically argued that these two types of control instead describe consequences of perceived control, or, in other words, how students react to various experiences of control.

The attribution theory of motivation and emotion was additionally developed within this control debate (Weiner, 1985; 2018). This theory is also inspired by the expectancy-value tradition, although it is much more focused on expectancies than values. It assumes that students seek to understand why they succeed or fail and that through this causal search, they try to explain or attribute their achievement through three causal dimensions: (1) internal vs. external, (2) fluctuating vs. stable, and (3) controllable vs. uncontrollable (see Figure 4). The attribution theory of motivation and emotion (Weiner, 1985) argues that those attributions subsequently influence students' perceived responsibility (e.g., learned helplessness), emotions (e.g., test

anxiety), motivations (e.g., lack of it), learning behavior (e.g., low effort) and their upcoming achievement (e.g., diminishing results). Further, Weiner (1985) assumed that the causal search is more likely when an event is important, indicating a value component. Prior research indicates this relevance of value, with the causal search being especially important for high valued achievement situations (Gendolla & Koller, 2001) and unexpected, important achievement feedbacks also triggered a causal search for freshman students (Stupnisky, Stewart, Daniels, & Perry, 2011).

Overall, it becomes clear that motivational research has established various, but similar concepts and theories of control. It is therefore important to define these concepts clearly (Schunk, 2000), especially regarding facets of expectancy and control beliefs. This dissertation distinguishes PAC from objective, veridical control by focusing on students' subjective control perception (cf. Skinner, 1996) and from secondary control by examining students' potential assimilation of their environment (cf. J. Heckhausen & Schulz, 1995). Furthermore, PAC is represented as an academic specific component of perceived control (cf. Perry, 1991) with a focus on agent-means-end relations. PAC is more than the feeling of control (agent-ends relation, e.g., expectancy of success), more than students' self-perception of capability (agents-means relation, e.g., self-efficacy), and more than students' perceived cause (means-end relation, e.g., attribution). PAC is the subjective control belief about a students' own available causes or personal attributes which influence their own academic outcomes. PAC *"[…] was presumed to reflect students' beliefs both about various factors responsible for their academic successes (cause-effect relationships) and about whether they possess those factors as personal attributes, such as intellectual aptitude, physical stamina, effort expenditure, task strategies, social skills, and educational experience"* (Perry et al., 2001, p. 777). As a final note regarding the definition of PAC, the present dissertation assumes that over time and through various academic experiences, a global trait version of students' PAC develops, which can be understood as a component of academic self-concept.

Regarding the origin of PAC, Perry, Hall et al. (2005) posited that all three causal dimensions of the attribution theory of motivation and emotion (Weiner, 1985, 2018) have an impact on the development of PAC. Due to the strong link between PAC and attribution theory, PAC is also thought to help students to maintain an appropriate level of motivation in difficult achievement situations and to be highly relevant for students' efforts, learning behaviors, and achievement (Perry, Hall et al., 2005). Empirically, recent research indicated the link between causal attribution and PAC as a first step for the controllability dimension: If students attribute their failure as uncontrollable (e.g., ability or bad luck) they will perceive low PAC. Whereas students who explain the same failure as controllable (e.g., effort or bad strategy) will perceive high PAC (Hamm, Perry, Chipperfield, Murayama, & Weiner, 2017). Further, PAC is related to self-regulated learning (Cassidy & Eachus, 2000; Shell & Husman, 2008) and effort (Hall et al., 2006; Perry et al., 2001).

Finally, coming back to the expectancy-value tradition, the present dissertation focuses on PAC as an aspect of expectancy. Nevertheless, the importance of value should not be disregarded. On one hand, research has shown that in addition to the expectancy component, the interaction between expectancy and value enhance achievement (Trautwein et al., 2012) with domain-specific differences (Meyer, Fleckenstein, & Köller, 2019). On the other hand, the present dissertation is located within the commonly high valued context of undergraduate education. Students choose if they study as well as where, when, and what they study. As a result of this autonomy, they should theoretically perceive the context of university as very important (Ryan & Deci, 2000). Empirically, research found high values with limited heterogeneity between freshman students (Dresel & Grassinger, 2013). Thus, this dissertation focuses on PAC, while acknowledging its restriction to the expectancy component.

Figure 4. Causal Attributional Theory

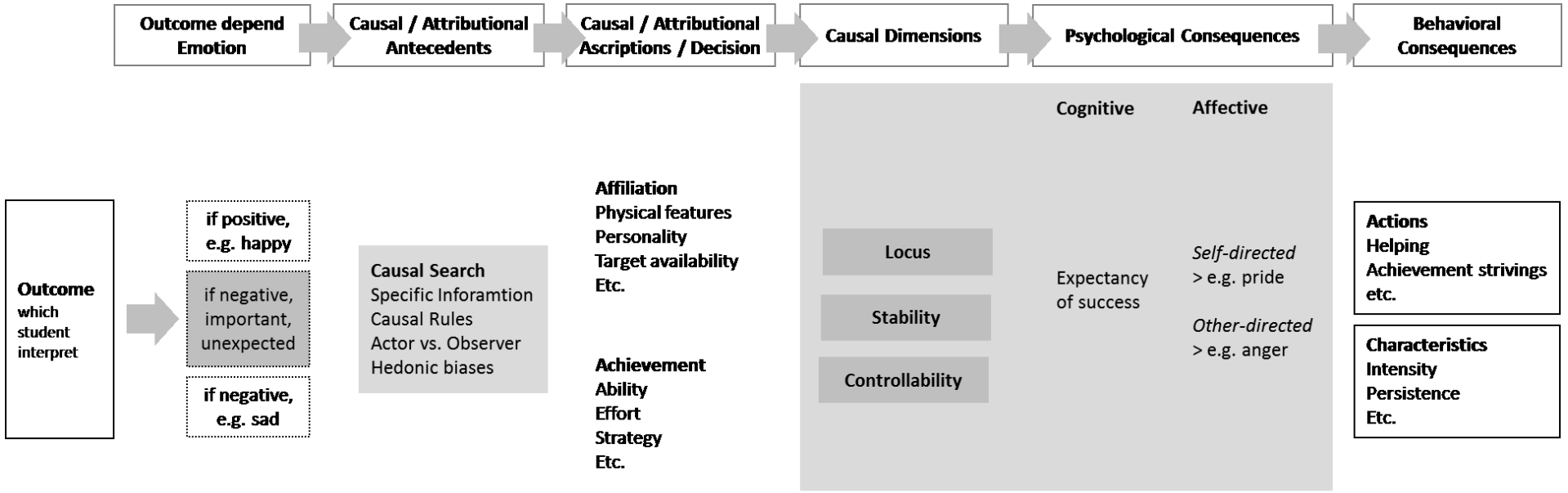


Figure 4. Attributional theory of motivation and emotion (Weiner, 1985, 2018), based on (Weiner, 1985).

Perceived academic control over time.

Regarding the possible development of PAC over time, Perry and colleagues (2005; 2001) argued for a *"relatively stable psychological disposition affecting students' motivation and achievement-striving as revealed in class test, term assignments, course grades, GPA, etc. It is deemed to be 'relatively' stable because assessments of trait perceived control may include the effects of transient elements as well, assuming that periodic environmental intrusions can affect a person's general sense of control to some degree"* (Perry, Hall et al., 2005, p. 370). This information can be referred back to the trait and state distinction of perceived control, where the stable version of perceived control develops from both trait and state (e.g., Eizenman, Nesselroade, Featherman, & Rowe, 1997; Roberts & Nesselroade, 1986; Skinner et al., 1998). On one hand, perceived control is a stable and integral part of one's personality. On the other hand, perceived control is transient as a product of ongoing daily interactions and experiences. It seems probable that students' trait PAC could change as a result of state PAC and that their trait PAC develops from academic experiences. Nevertheless, more research is required regarding the transition from state to trait PAC in explaining how institutions and instructors can support students' PAC (Clifton, Hamm, & Parker, 2015; Haynes, Perry, Stupnisky, & Daniels, 2009; Perry & Hamm, 2017).

Regarding temporal considerations, PAC is theoretically more likely to change after unexpected, negative, and/or important achievement feedback, according to the causal attribution theory (Weiner, 1985, 2018). Empirically, Hall (2008) found freshmen to experience a decrease in PAC after failure achievement feedback as well as an increase after success. Perry et al. (2001) showed stable PAC from the beginning of the first-year to half-through the first-year, in line with Ruthig, Hanson, and Marino (2009). Despite this, first-year PAC showed meaningful instability and intra-individual fluctuation indicating a slow changing process with an overall decrease in the first-year (Stupnisky, Perry, Hall, & Guay, 2012). Based on this, low

PAC students were especially likely to report unstable PAC (Stupnisky, 2009; Stupnisky et al., 2012). Thus, the small overall first-year PAC decrease goes along with high variability between the various students (Niculescu, Tempelaar, Dailey-Hebert, Segers, & Gijselaers, 2016). While it appears likely that the inconsistent PAC change reports may be caused by either the time delay (Stupnisky et al., 2012) or the high variability (Niculescu et al., 2016), more research on this topic is needed.

Finally, the change of PAC is assumed to be relevant particularly for students in new achievement settings, such as the first year of study (Perry, 1991). The transition from school to university entails a number of changes for freshman students. The adjustment to these new circumstances is highly relevant for freshman academic success (Credé & Niehorster, 2012). At university, students are required to be highly self-dependent through situations such as selecting their courses, seeking assistance, self-regulated learning, self-studying, and so forth. These new and unfamiliar learning circumstances can involve unpredictable or uncontrollable academic situations, foster low-control learning circumstances, and potentially lead students to 'feel out of control' (Perry, 1991, 2003; Perry, Hall et al., 2005). A 'paradox of failure' could emerge as former high achievers at school underachieve at the beginning of their studies and are *"[…] seemingly unable to adjust to the increased demands for self-initiative and autonomy."* (Perry et al., 2001, p.776). This could be due to a low PAC and therefore weak motivation and poor self-regulation strategies (Perry et al., 2001). However, this period of transition could also indicate more control due to more self-dependence. Therefore, PAC is highly likely to change in the first academic year, but both directions are possible.

Research gap. In sum, due to the high relevance of the transition from school to university and thereby the importance of PAC with possible change, most prior PAC research focused on the first-year, underlining a current research gap regarding the long-term development or change of PAC and the need of *"a stronger focus in long-term motivation*" (Schunk, 2000, p.118).

Perceived academic control and academic success.

Perceived academic control and university dropout.

In general, as motivational deficits are a main cause of university dropout (Heublein et al., 2017) and students who stay differ from students who dropped regarding motivation (Schiefele, Streblow, & Brinkmann, 2007), this construct is highly relevant in the current. Additionally, reduced motivation increases dropout intention and motivation explains differences in dropout intention even under the consideration of achievement (Dresel & Grassinger, 2013). In particular, for PAC the psychological model of university dropout (Bean & Eaton, 2001) acknowledges attributions and therefore PAC as one key psychological process element regarding the decision to drop out (Figure 2). Additionally, the attributional theory (Weiner, 1985, 2018) also describes persistence as one behavioral outcome of the three PAC shaping attributional dimensions. Despite the theoretical assumed importance, empirically, only a few studies thus far have focused on the preventive effect of PAC for university dropout (Perry, Hladkyj, Pekrun, Clifton, & Chipperfield, 2005) for voluntary course withdrawal (Hall et al., 2006) and for dropout intention by Ruthig (2002, as cited in Perry, Hall et al., 2005). Students with high PAC withdrew from fewer courses with three undergraduate years (Perry, Hladkyj et al., 2005).

Research gap. Little empirical research exists and the theoretical assumed importance of PAC for university dropout needs to be clarified, especially as PAC is assumed to be highly relevant within the first-year of study (Perry, 1991, 2003; Perry, Hall et al., 2005) where most dropouts occur (Heublein et al., 2017).

Perceived academic control and academic achievement.

In general, aside from prior achievement, motivation is also relevant for students' achievement (Richardson et al., 2012; Schneider & Preckel, 2017). In particular, for PAC, the attributional theory (Weiner, 1985, 2018) assumes that the product of the three attributional dimensions (locus, stability, and controllability) and the result of the causal search is relevant for achievement. Adaptive attributional patterns such as high PAC are assumed to enhance students' effort and study strategies, which results in high achievement (Weiner, 1985, 2018). In other words, high PAC is assumed to help students to maintain an appropriate level of effort to perservere in difficult achievement situations (Perry, Hall et al., 2005).

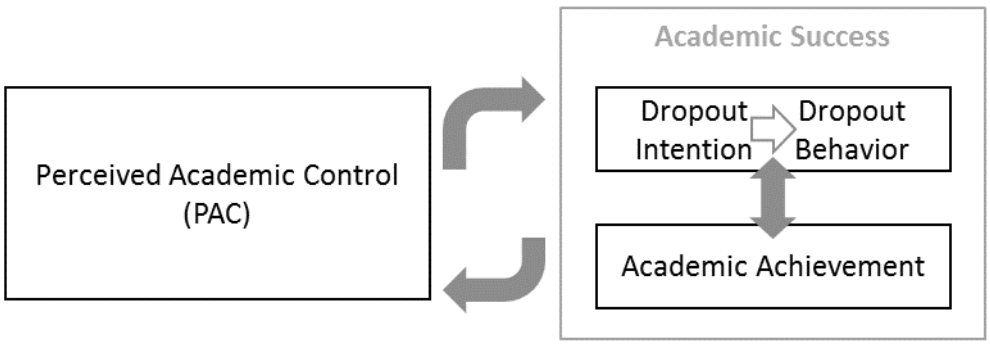
Empirically, high PAC enhances intrinsic motivation and triggers more effort and self-monitoring strategies, which consequently leads to better grades (Perry et al., 2001). However, PAC also shows consistent effects for achievement in the critical first-year (e.g., Daniels et al., 2014; Hall et al., 2006; Perry et al., 2001; Ruthig et al., 2004; Stupnisky et al., 2007). Further, prior research indicated that PAC seems to influence achievement in the long run, as fist-year PAC influences achievement up to three years later, even when controlling for prior achievement (Perry et al., 2001; Perry, Hladkyj et al., 2005). Moreover, first-year PAC is more relevant for overall course grades than current test results (Stupnisky et al., 2012). Besides the level of PAC, Stupnisky et al. (2012) revealed the negative impact of PAC instability on first-year achievement, as high-unstable PAC students achieved poorly compared to their high-stable counterparts.

Research gap. Overall, most prior research focused on the first academic year. Additionally, previous research disregarded possible reciprocal relations between PAC and achievement. According to the attributional theory (Weiner, 1985, 2018), achievement triggers a causal search which influences PAC and later achievement, again triggering a causal search, and so forth (Perry, Hall et al., 2005).

Finally, retention and achievement are related and PAC is theoretically thought to be important for both components of academic success. As one main psychological process, PAC is assumed to influence first achievement, intermediate outcomes, and later, the dropout decision (Bean & Eaton, 2001). As a product of the three attributional dimensions, PAC is expected to influence the two behavioral consequences: achievement and persistence (Weiner, 1985). Empirically, studies have shown the relevance of PAC for both components. Within the first academic year, PAC was related to voluntary course withdrawal, course grades, and first-year GPA (Hall et al., 2006). Furthermore, first-year PAC was related to voluntary course withdrawal and predicted the GPA of the three undergraduate years (Perry, Hladkyj et al., 2005). Despite this, more research is needed.

Research gap. Few studies have acknowledged the theoretically assumed relevance of PAC for both academic success components simultaneously. However, previous research disregarded that achievement could mediate the impact of PAC on dropout.

Figure 5. Overview of assumed Relation of Perceived Academic Control and Academic Success



Achievement Emotions

Another important predictor of academic success is achievement emotions (for an overview see e.g., Pekrun & Linnenbrink-Garcia, 2014a). In general, emotions dynamically consist of various components such as individual feelings, motivational tendencies, cognitions, expressions, and physiological processes (Shuman & Scherer, 2014). In the specific achievement context of higher education, emotions occur which focus on achievement activities and their outcomes (Pekrun, 2006, 2017; Pekrun & Linnenbrink-Garcia, 2014b; Pekrun & Perry, 2014). Thereby, achievement emotions need to be distinguished from the more global construct of affect (Pekrun & Linnenbrink-Garcia, 2014b). Achievement emotions are more precise than affect, which is an accumulation of various states and only distinguished by either a positive or a negative valence (Crawford & Henry, 2004; Watson, Clark, & Tellegen, 1988). Discrete achievement emotions, on the other hand, can be described by two main dimensions: valence (positive versus negative) and activation (physiologically activating versus deactivating; Shuman & Scherer, 2014). Circumplex models use both dimensions to describe emotions by a two by two taxonomy with the four categories: positive-valenced activating or deactivating, and negative-valenced activating or deactivating (e.g., Feldman Barrett & Russell, 1998). Emotions were additionally described by their object focus, meaning on the current activity (e.g., enjoyment during learning) or retro-/prospective on the outcome such as pride after success (Pekrun, 2017; Pekrun & Linnenbrink-Garcia, 2014b). Thus, most prior research on achievement emotions is based on a three by two taxonomy of achievement emotions (Pekrun, 2006; Pekrun & Perry, 2014).

Table 1

Taxonomy of Achievement Emotions

		Valence			
		Positive		Negative	
		Activation			
Object Focus		Activating	Deactivating	Activating	Deactivating
Activity		Enjoyment*	Relaxation	Anger* Frustration	Boredom*
Outcome	Prospective	Hope Joy[a]*	Relief[a]	Anxiety*	Hopelessness
	Retrospective	Joy Pride*	Contentment	Shame Anger	Sadness Disappointment

Note. The taxonomy is based on Pekrun (2006, 2017), Pekrun and Perry (2014); Pekrun and Stephens (2010).
[a] anticipatory, * indicates the achievement emotions which this dissertations focused on

Further, most prior research on achievement emotions measured via the Achievement Emotions Questionnaire (AEQ, Pekrun, Goetz, & Frenzel, 2005; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). The AEQ measures discrete emotions which are context-specific (e.g., class-related, learning-related, and test-related), and intends to measure trait-like emotions. With that being said, it can be adapted to measure state-like emotions (Pekrun et al., 2005; Pekrun et al., 2011). Based on studies using the AEQ within the higher educational context, students most often report anxiety (Pekrun & Stephens, 2010), followed by enjoyment, hope, pride, relief, and anger (Pekrun, Goetz, Titz, & Perry, 2002).

Theoretically, the control-value theory (Pekrun, 2006) "*[…] provides an integrative framework for analyzing the antecedents and effects of emotions experienced in achievement and academic settings.*" (Pekrun, 2006, p. 315). Depending on the environmentally influenced appraisals, control and value discrete emotions occur in academic settings and influence students' learning behaviors and outcomes. For instance, they affect students' cognitive

resources and their attention, learning strategy use, self-regulated learning, and motivation (Figure 6, Pekrun, 2006). Positive achievement emotions can help students to focus on a specific learning object by directing their attention to it (e.g., enjoyment and subsequent flow; Pekrun et al., 2002), whereas negative achievement emotions can distract students from their learning object (e.g., boredom and subsequent daydreaming; Pekrun et al., 2002; Pekrun et al., 2011). Additionally, activating positive emotions enhance self-regulated learning (Pekrun et al., 2011); whereas deactivating negative emotions reduce it (e.g., boredom; Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010) as they reduce students' cognitive flexibly (Pekrun et al., 2011). Finally, activating positive emotions can increase students' interest and intrinsic motivation (e.g., enjoyment; Pekrun et al., 2002), whereas activating negative emotions can reduce them (e.g., anxiety, Pekrun et al., 2011; or boredom, Pekrun et al., 2002; Pekrun et al., 2011). To conclude, this dissertation understands emotions within the academic context according to Pekrun (2006) as achievement emotions. In contrast to affect, a focus here is placed on discrete emotions, based on the taxonomy of achievement emotions (Table 1, Pekrun, 2006).

Achievement emotions from a trait state perspective.

In line with emotions in general (e.g., Lazarus, 1994; Nesselroade, 1988), achievement emotions are theoretically conceptualized as either momentary situation-specific state achievement emotions, or habitual person-specific trait achievement emotions (Pekrun, 2006). *"The defining characteristics separating trait from state achievement emotions is temporal generality rather than situational generality, since trait achievement emotions can be situations-specific as well."* (Pekrun, 2006, p. 317). The trait-state components of achievement emotions were first mentioned for anxiety and anger (Spielberger, Gorsuch, & Lushene, 1970), which can be specific to the mathematic domain (Spielberger, 1966). The temporal generality also implies that over time and repetitive experiences of state emotions, they become trait emotions. Thereby, prior research found small changes in trait-emotions of freshman students

(Ahmed, van der Werf, Kuyper, & Minnaert, 2013; Pekrun, Hall, Goetz, & Perry, 2014; Ranellucci, Hall, & Goetz, 2015). Unfortunately, most previous research focused on either trait (e.g., Pekrun, Lichtenfeld, Marsh, Murayama, & Goetz, 2017) or state (e.g., Goetz, Frenzel, Stoeger, & Hall, 2010) with the exception of a few studies considered trait and state together (Ahmed, van der Werf, Minnaert, & Kuyper, 2010; Nett, Bieg, & Keller, 2017). Thereby, stability and variability appear to be equally distributed. However, the relationship between achievement emotions differs when comparing trait and state emotions. Concerning trait, the discrete achievement emotion of the same valence relates positively to one another and negatively to opposite valence (Pekrun et al., 2011). Concerning state, these correlations are lower (Goetz, 2004). Considering both trait and state simultaneously, different valenced trait emotions were unrelated, but different valenced state emotions were negatively related (Nett et al., 2017).

Research gap. Most prior research has failed to consider both trait and state components of achievement emotions simultaneously, especially within the context of higher education. Furthermore, with the temporal generality in mind, repetitive experienced state emotions become trait emotions and therefore a third mediating component: previous experience or carryover effects appear relevant, comparable to the emotional duration (Verduyn, Delvaux, van Coillie, Tuerlinckx, & van Mechelen, 2009).

Figure 6. Control-Value Theory of Achievement Emotion

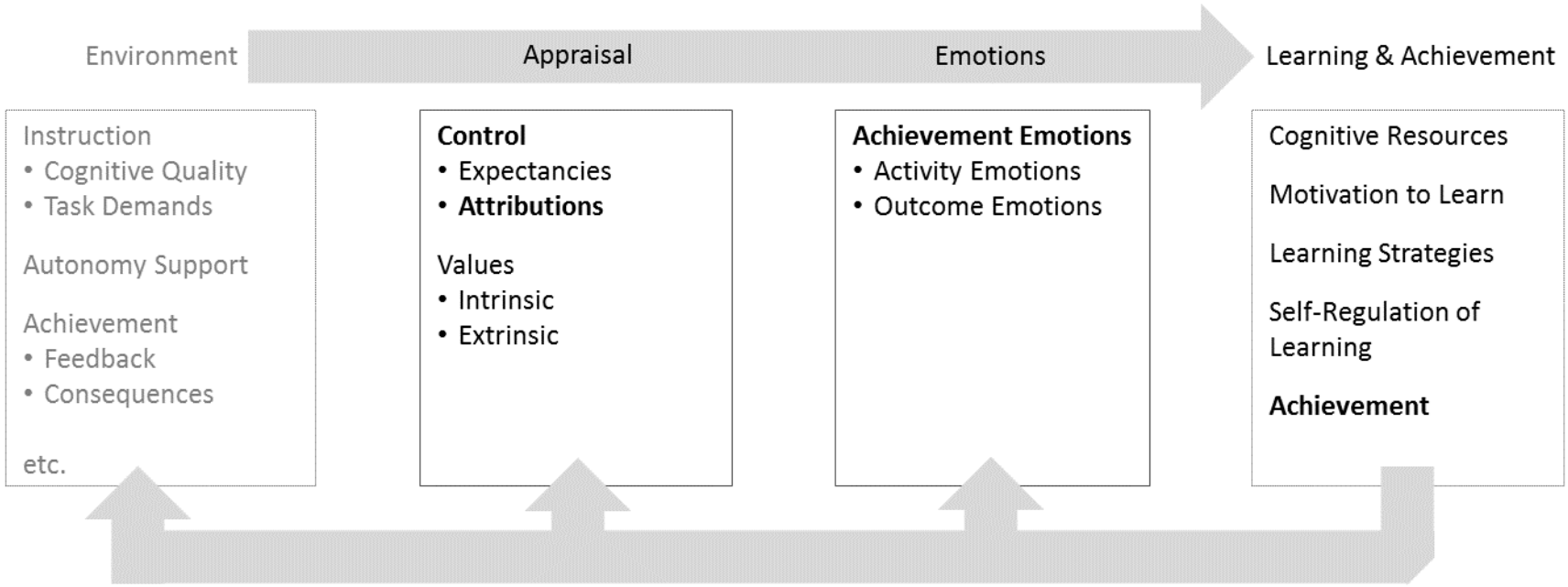


Figure 6. Control-value theory of achievement emotions, based on (Pekrun, 2006). Reciprocal Linkages between antecedents, emotions, and effects. Environmental predictors indicated in gray as they are not the focus of this dissertation as in the original control-value theory (Pekrun, 2006), however, the environment is not negligible.

Achievement emotions and academic success.

Achievement emotions and university dropout.

Achievement emotions have not yet been the focus of prior research on retention. Theoretically, emotions are assumed to be relevant for university dropout intention and behavior as an aspect of the environmental interaction (Figure 2; Bean & Eaton, 2001). Emotional experiences at the university environment trigger students to use strategies which help them to feel comfortable and foremost integrated into the university (Bean & Eaton, 2001). Furthermore, the control-value theory (Pekrun, 2006) assumes an impact of achievement emotion on achievement. As retention and achievement are related, the research by Pekrun (2006) can be applied within the research on retention, by arguing that achievement emotions should also impact retention, possibly mediated by achievement.

Empirically, negative emotions seem to provoke dropout as they relate to voluntary course withdrawal (Ruthig et al., 2008). Exmatriculated students report higher negative emotions than successful students (Pekrun et al., 2002). Students refer to negative emotional experiences (anger, anxiety, and shame) along with their dropout decision (Herfter, Grüneberg, & Kopf, 2015). Finally, a recent study showed the relation of enjoyment, anxiety, and shame to all five phases towards the dropout decision (Bäulke & Dresel, 2018).

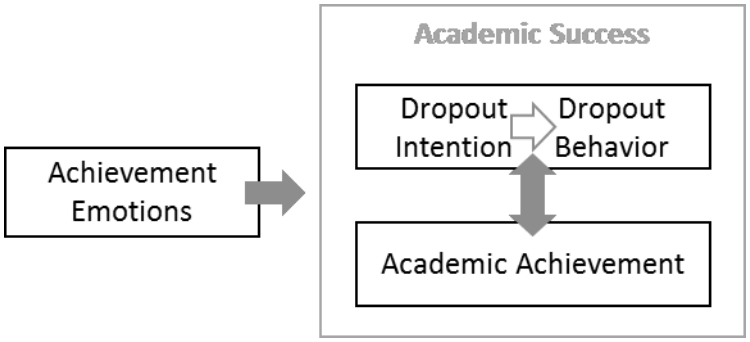
Research gap. In sum, prior research failed to consider achievement emotion when addressing dropout systematically. Thus, experiences of enjoyment while studying could possibly prevent intention to dropout, whereas experiences of anxiety or anger could possibly trigger dropout intentions and consequently, the actual act of dropout.

Achievement emotions and academic achievement.

In contrast to the dropout component of academic success, a rich research body has indicated that positive achievement emotions foster academic achievement, whereas negative emotions hinder achievement (for an overview of correlation studies see e.g. Pekrun & Linnenbrink-Garcia, 2014a; Pekrun & Stephens, 2010). Longitudinal studies highlight this impression and add a reciprocal relation (e.g., Pekrun et al., 2014; Pekrun et al., 2017; Putwain, Becker, Symes, & Pekrun, 2018; Steinmayr, Crede, McElvany, & Wirthwein, 2015). For example, the change in emotions (e.g., increase in enjoyment or pride) related to the change in achievement (e.g., increase in test scores; Ahmed et al., 2013). This fits to their definition of focusing on students' achievement activities and outcome as well as to the theoretically assumed reciprocal linkage between emotions and achievement (Figure 6, Pekrun, 2006). The relevance of emotions for achievement is also important to their functions on learning (e.g., self-regulated learning, motivation), which mediate the impact on achievement (e.g., Mega et al., 2014). In line with the trait state debate, it is important to acknowledge the various emotional components. Again, most research focused on the relevance of trait emotions for achievement (Pekrun & Stephens, 2010). An exception is the study of Ketonen and Lonka (2012), which revealed weaker relations on the situational-level. Also, the emotional relevance for achievement is context-specific, as it was stronger for learning, and test-related compared to class-related emotions (Pekrun et al., 2011).

Research gap. While a rich body of research focused on the importance of emotions for academic achievement, more research is needed regarding potentially varying impacts of trait-like and state-like emotions on achievement.

Figure 7. Overview of assumed Relation between Achievement Emotions and Academic Success



The Relations between Perceived Academic Control, Achievement Emotions, and Academic Success - the PACES model

Based on the attributional theory of achievement motivation and emotion (Weiner, 1985) and the control-value theory (Pekrun, 2006), both relevant predictors of academic success are linked, as PAC influences achievement emotions directly. Specifically, Weiner (1985) argued that the three causal dimensions (which form PAC) lead to specific affective consequences such as pride after success and internal locus or anger after failure and external locus with high controllability by others (Figure 4; Weiner, 2018). With a clear focus on achievement emotions Pekrun (2006) subsequently used control appraisal (e.g., PAC) and additionally value appraisal as antecedents of discrete achievement emotions. Thereby, the theory also assumes reciprocal relations between the two appraisals and achievement emotions (Figure 6). Specific combinations of PAC and value trigger various discrete emotions: Prospective outcome emotions highly depend on how strongly students believe to be able to influence upcoming achievement outcomes, in that failure anticipation and medium control lead up to anxiety (Pekrun, 2006). Retrospective outcome emotions, however, depend on students' causal search and attributional locus, so that success experience with internal locus and high control lead up to pride (Pekrun, 2006). In contrast, activity emotions (e.g., enjoyment, anger, or boredom) depend on value and control appraisal of the current activity and not upcoming or past

outcomes. High control combined with positive value lead up to enjoyment, whereas when combined with negative value lead up to anger (Pekrun, 2006). Moreover, either very high or very low control lead up to boredom (u-shape relation; Pekrun, 2006). In the specific context of the demanding adjustment to university, however, low control typically leads to boredom (Pekrun et al., 2010; Pekrun et al., 2014). Empirically, correlation studies showed that high PAC relates to positive emotions and negative PAC relates to negative emotions (e.g., Pekrun et al., 2011; Stupnisky, Perry, Renaud, & Hladkyj, 2013). However, most previous studies focused on trait-like emotions, whereas the relations for state-like emotions seem to be weaker (Goetz et al., 2010). Further, longitudinal studies showed the importance of PAC for enjoyment and boredom "*[…] over and above the autoregressive relations with prior emotion.*" (Putwain, Pekrun et al., 2018, p. 28) and that increasing PAC relates to increasing enjoyment and to decreasing anxiety or boredom (Buff, 2014; Niculescu et al., 2016).

Moreover, also based on the attributional theory of achievement motivation and emotion (Weiner, 1985) and the control-value theory of achievement emotions (Pekrun, 2006), PAC influence on achievement might be mediated by specific achievement emotions. For instance, unexpected failure feedback in an important exam triggers a causal search, which might result in low PAC and the subsequent experience of anger, which could reduce students' attention, motivation, and effective usage of self-regulated learning strategies, and finally could lead up to another failure experience and so forth (Pekrun, 2006; Weiner, 1985, 2018). A few longitudinal studies focus on this triad between PAC, achievement emotions, and achievement. High-control students reported low boredom or anxiety and subsequently obtain high grades in their first academic year (Perry et al., 2001). Boredom or anxiety predicted worse achievement for high-control students (Ruthig et al., 2008). Unstable PAC relate to negative emotions and poor course achievement (Stupnisky, 2009).

In conclusion, this dissertation adapts the triad of PAC, emotions, and achievement to the context of retention by developing the PACES model, which provides an overview of the

relevance of perceived academic control and achievement emotions for academic success (Figure 1). Concretely, the PACES model assumes that PAC enhances academic success directly, reciprocally, and mediated via achievement emotions. Thus, PACES combines the theoretical assumptions of Bean (1985), Bean and Eaton (2001), Pekrun (2006), and Weiner (1985) under considerations of the work of the Motivation and Academic Achievement Research Laboratory of Raymond Perry (e.g., Perry, 1991; Perry & Hamm, 2017; Perry, Hladkyj et al., 2005; Ruthig et al., 2008; Stupnisky et al., 2013). Overall, the PACES model combines separate lines within the educational field and broadens prior research by considering the relevance of PAC and achievement emotions for both academic success components.

Research gap. Overall, the interaction of PAC and value trigger discrete emotions. However, previous research lacked to analyze the reciprocal linkage of PAC with emotion and subsequent PAC over time and/or under consideration of numerous variance components. PAC additionally influences emotions, which influence achievement, and consequently influence both PAC and emotions. Nonetheless, further research in needed to understand the PAC emotion achievement triad better and to transfer it to the context of university dropout under consideration of reciprocal relations. In other words, further research is need to test the assumption of the PACES model (Figure 1).

AIM OF THE DISSERTATION

Research Objectives

Based on the theoretical background and previous empirical findings summarized in the preceding section and based on the previous highlighted research gaps, this dissertation generally aims to provide more insight into the relevance of PAC for undergraduate academic success, under consideration of achievement emotions. Additionally, this dissertation reflects the relevance of time in the form of comparison of differently advanced students, reciprocal relations, and change. This supports previous research which has suggested the needed for longitudinal multiple measurement data for motivational predictors of academic success (Alarcon and Edwards, 2013).

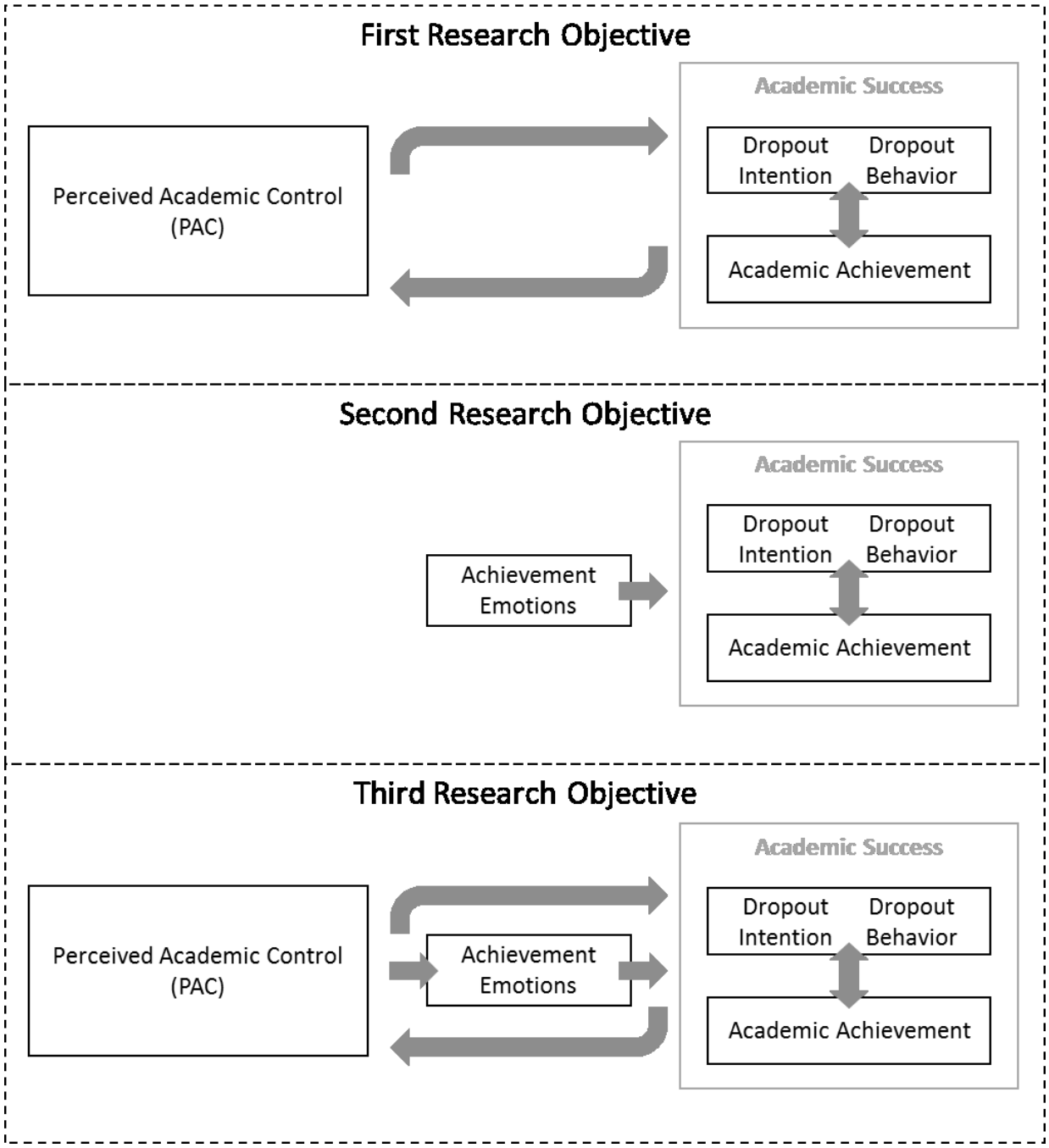
Consequently, there are three main objectives, with each of them looking into a specific aspect of the overall aim of the dissertation (Figure 8). The first objective examines the relation of PAC and academic success. It considers long-term change in PAC. Further it examines the impact of PAC on dropout intention and dropout, in addition to achievement. In addition, it analyzes possible reciprocal relations of PAC with achievement and that achievement might mediate the impact of PAC on dropout.

The second research objective examines achievement emotions and their relevance for academic success. It adds a third component to the trait-state debate of achievement emotions, the relevance of achievement emotions for dropout intentions (the first step towards dropout), and the possibly impacts previously mentioned emotional variance components on achievement.

The concluding research objective investigates the triad of PAC, achievement emotions, and academic success in more detail. It considers the possible reciprocal relation between PAC and achievement emotions as well as possible mediation of achievement emotions of the impact of PAC on academic success.

Finally, all three research objectives can be found within the self-developed PACES model, which reflects the framework of the present dissertation. On the one hand, the PACES model summarizes the theoretical assumptions by providing an overview of the expected relevance of PAC and achievement emotions for academic success. On the other hand, it organizes the dissertations' aim, research objectives, and foremost scientific articles (Figure 1).

Figure 8. Research Objectives of the present Dissertation

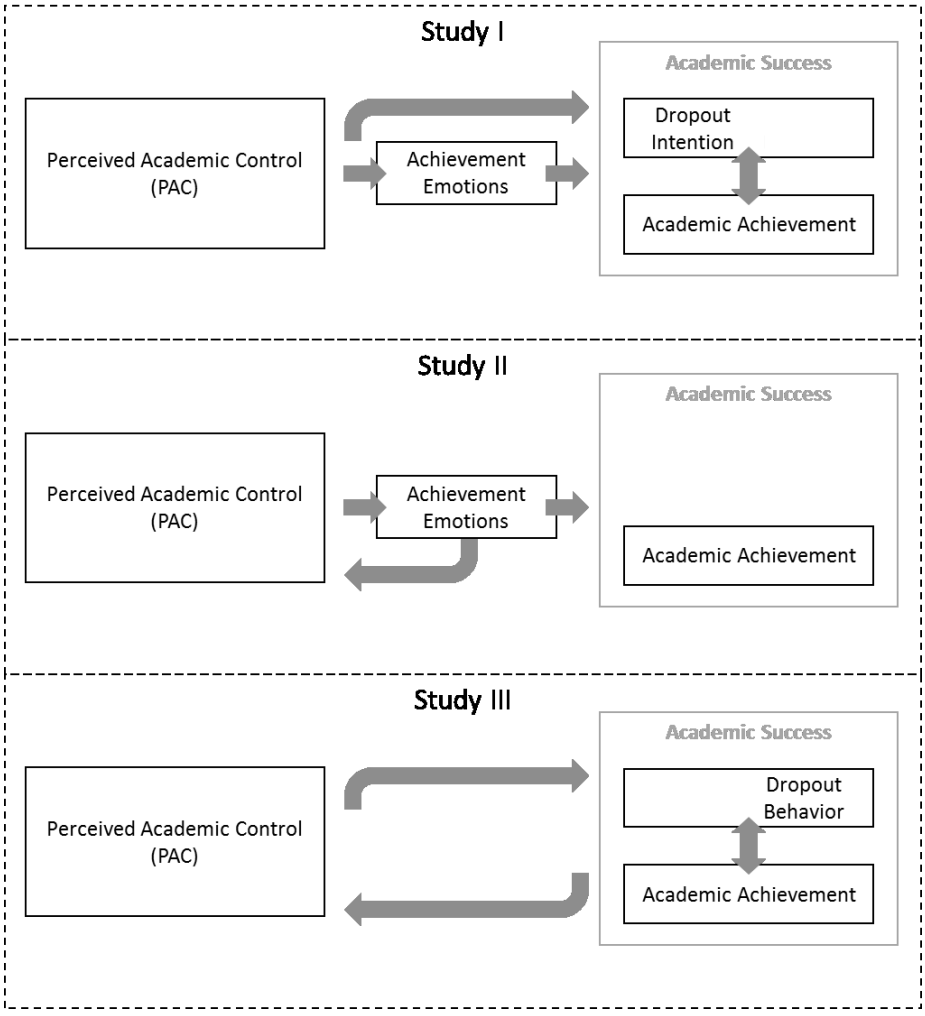


Dissertation Outline

This dissertation consists of three scientific articles that investigated the relevance of PAC for academic successes, while simultaneously considering the role of achievement emotions. The PACES model acts thereby as a framework for the current dissertation (Figure 1). Particularly, the present dissertation contains in the first study the triad of PAC, achievement emotions, and academic success in comparison of freshman and sophomore students. In the second study, it contains the trait-state perspective and emotional variance component short-term relevance for achievement and PAC, reciprocally. In the third study, it contains the long-term change in PAC and the corresponding reciprocal relations with academic success. The empirical studies are ordered by their time of publication and can be read and understood independent of one another. The following s summarizes for each scientific article the specific contribution to the dissertation aim and the three research objectives. *Study I* generally contributed to the dissertation aim by analyzing the triad of PAC, achievement emotions, and academic success. In particular, the goal of Study I was to analyze the impact of PAC on dropout intention in addition to achievement (first research objective). Additionally, this study focused on the relevance of achievement emotions for dropout intentions and achievement simultaneously (second research objective). A final aspect of this study was to look into how achievement emotions mediate the impact of PAC on academic success (third research objective). Time wise, it focused on the critical first academic year and compared freshman students from more advance sophomores' students. Academic success was operationalized by dropout intention as a first step towards dropout, and first-year GPA was operationalized as achievement. The discrete emotions used consisted of enjoyment, boredom, and anxiety (upper rectangle Figure 9). *Study II* generally enhanced the dissertation by accounting for the various variance components of achievement emotions (cf. trait-state debate of achievement emotions) and analyzing their relevance for PAC and achievement. In particular, Study II added previous experiences as a third variance component to the two existing variance components (trait and

state). Moreover, the different impacts on achievement (second research objective) were analyzed. Time wise, reciprocal relations of PAC and achievement emotions (third research objective) were focused on. Academic success was operationalized by course grades as achievement and discrete emotions consisted of enjoyment, pride, anxiety, and anger (middle rectangle Figure 9). *Study III* added value to the goal of this dissertation through the exploration of the long-term change of PAC and its relevance for academic success. In particular, the way in which PAC changes were analyzed, along with how those changes influence dropout and achievement (with achievement as mediator), as well as possible feedback loops between PAC and achievement (first research objective). Time wise, it focused on an entire undergraduate study program. Academic success was operationalized by dropout and year-specific GPA as achievement (lower rectangle Figure 9).

Figure 9. Overview of the Scientific Articles of the Present Dissertation



METHODOLOGICAL ISSUES

In order to achieve the general aims of the present dissertation as stated earlier, two intensive datasets were obtained and several statistical methods were used. The following section summarizes, first, both datasets and, second, the statistical methods with a brief description regarding the earlier stated research objectives.

Datasets

The present dissertation used longitudinal structure to consider the relevance of time and contains the following two longitudinal datasets, where the data was collected within students' daily academic lives. Specifically, a large-scale long-term student survey took place from semester 2013/14 to semester 2016/17 (named the *Longserv* dataset). One thousand and seven students from various disciplines at Ulm University answered annually at the beginning of the academic year a trait questionnaire in an important lecture. Additionally, they provided informed consent which allowed access to their grades and their student status from institutional records. The cross-sectional Study I used the second time points of measurement (semester 2014/15) of the Longserv dataset. The longitudinal Study III used all four time points of measurement.

Figure 10. Longserv Dataset

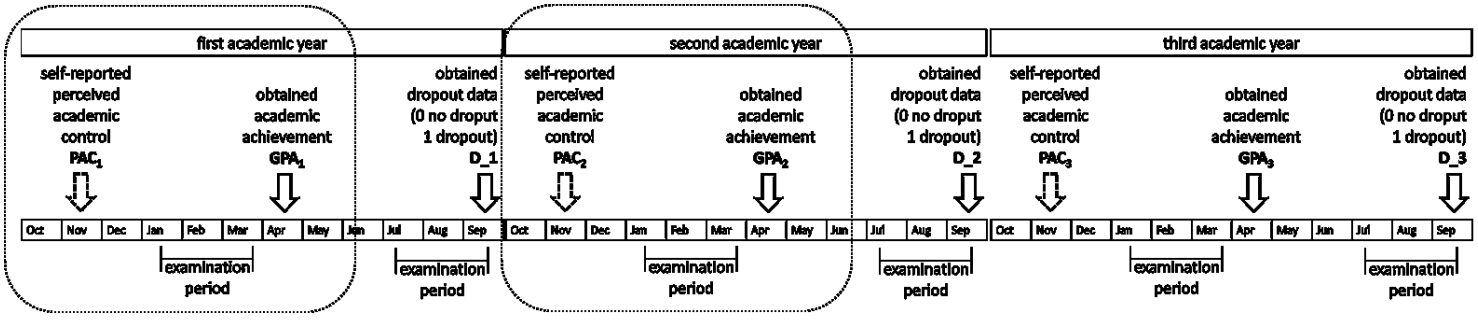


Figure 10. Longserv Layout, dotted rectangles mark cross-sectional fragments for Study I.

Additionally, an intensive short-term experience sampling study took place from 2014 to 2016 (named the *EsMon* dataset). Ninety-eight students from various disciplines at Ulm University answered a daily state questionnaire over an entire week before an important exam. Additionally, they provided their informed consent that allowed for the attainment of their result from this specific exam from the instructor. Thereby, study II used the complete EsMon dataset.

Figure 11. EsMon Dataset

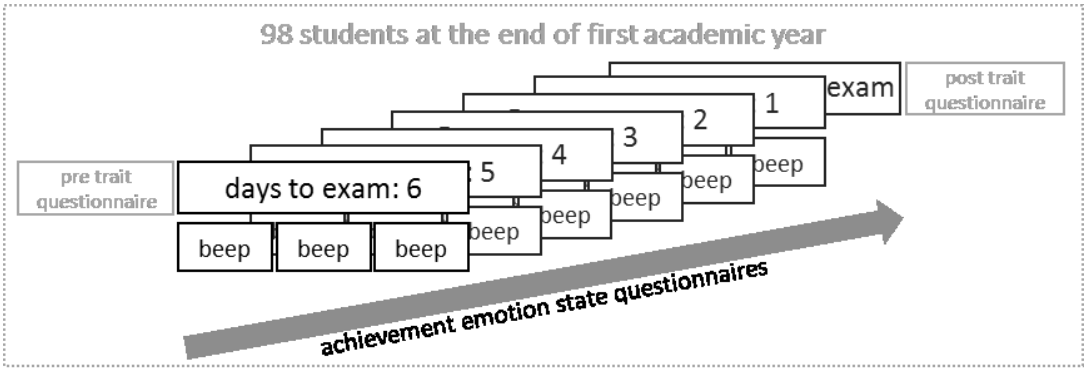


Figure 11. EsMon Layout, beeps started state questionnaire on students' iPod, prior to an important exam (3*6*98=1764 measurements)

Statistical Analyses

Overall, this dissertation used a structural equation modeling approach (SEM, for an introduction see e.g., Little, Schnabel, & Baumert, 2000). SEM typically estimates a system of the direct or indirect regression relationships between several latent unobserved variables (cf. constructs), which are each based on multiple observed manifest variables (cf. indicators). First, the estimation of each latent variable is based on associated manifest variables (measurement model). Second, the SEM estimates the specific modeled direct or indirect relations between the prior established constructs based on a hypothesized model (path model). In the current dissertation, the statistical modeling program Mplus was used for the SEM, as Mplus "*[...] modeling framework draws on the unifying theme of latent variables."* (Muthén & Muthén, 1998-2017, p. 1).

First Research Objective. In order to analyze the relevance of PAC for academic success, PAC was modeled as a construct indicated by four (EsMon dataset) or six (Longserv dataset) items from the PAC scale (Perry et al., 2001). Subsequently, a latent change score model (cf. e.g., McArdle, 2001) estimated the change of PAC over time via latent variables, modeling the change of one PAC measurement to another, under consideration of measurement error (Study III). Auto-correlated error variables accounted for correlations between residual variances due to multiple measurement of the same indicators (cf. e.g., C. Geiser, 2010). Additionally, a multi-group comparison model (cf. e.g., Byrne, 2012) estimated the difference between freshman PAC and sophomores PAC (Study I). Both SEM model variants required strong measurement invariance (cf. e.g., Byrne, 2012; Steyer, Eid, & Schwenkmezger, 1997). Regarding academic success, dropout intention was also defined as a construct indicated by three items (Study I) and achievement was defined as a manifest observed year-specific GPA (Study I & III). To define actual dropout (Study III), this dissertation used discrete time survival analysis (DTSA, cf. e.g., Masyn, 2014). The DTSA uses SEM to model the event of dropout or 'survival' by accounting for time by estimating latent hazard functions, which allows for the calculation of the odds ratio of the dropout risk with, for instance, high and low PAC levels.

Second Research Objective. In order to better understand the relation of achievement emotions and academic success, the present dissertation used an experience sampling approach for the EsMon Dataset (cf. e.g., Csikszentmihalyi & Larson, 2014) to study current emotional experiences (cf. Goetz, Bieg, & Hall, 2016). Each discrete current emotional experience was measured using single-item responses three times a day for six days prior to an important exam. These obtained 18 occasions per person represented the manifest variables, where variance was separated into three latent variables: a person-specific, previous experiences, and situation-specific component using the stable trait autoregressive trait state model (STARTS; Kenny & Zautra, 1995, 2001). To confirm these within-person variance components, the STARTS models were tested against alternative models with less components. Additionally, the

relevance of those various components of current emotional experiences with achievement were assessed by estimating direct regression relations (Study II). Alternatively, achievement emotions were estimated as constructs indicated by three items each of the AEQ (Pekrun et al., 2011) and again, direct regression relations with the latent dropout intention or manifest achievement were tested (Study I).

Third Research Objective. In order to better understand the triad of PAC, emotions, and academic success, this dissertation used mediation estimation through indirect SEM paths (Study I). Here, in addition to the established direct regression path of PAC to academic success, the model tested if an indirect path of PAC on achievement emotions and subsequent achievement emotions on academic success was meaningfully different from zero. Further, mediated mediation compared the possible indirect path of the two students groups (Byrne, 2012). Alternatively, PAC was modeled both as an incoming (exogenous) and as an outgoing (endogenous) latent variable, influencing achievement emotions (Study II).

SCIENTIFIC ARTICLES

The subsequent sections present the three previously described studies as well as a short summary of their relevance to the research objectives prior to the articles themselves. All studies have been published in international peer-reviewed journals. They can be read and understood independent of one another. They are presented in the order of their publication date and in the layout they were published by the corresponding journal.

Study I

In summary, Study I focused on the critical first academic year and analyzed the relevance of PAC for academic success, operationalized by dropout intention[1] and GPA. By using parts of the Longserv dataset (rectangles in Figure 10), the study accounted for the possible mediation of achievement emotions (enjoyment, boredom, and anxiety) and analyzed differences between students at the beginning versus the end of this critical academic year. To analyze possible moderated mediation, Study I used multi-group SEM. All three objectives were partly addressed. Study I was published by Frontiers in Psychology under the terms of Creative Commons Attribution License (CC BY 4.0; https://creativecommons.org/licenses/by/4.0/) with the following citation:

Respondek L, Seufert T, Stupnisky R and Nett UE (2017) Perceived Academic Control and Academic Emotions Predict Undergraduate University Student Success: Examining Effects on Dropout Intention and Achievement. *Front. Psychol*. 8:243. https://doi.org/10.3389/fpsyg.2017.00243

[1] The study focused on dropout intention as an indicator for dropout and thereby broadened prior research by accounting for multiple perceptive of dropout (intention). Besides the clear theoretical derivation of the high relevance of dropout intentions for actual dropout (e.g., Bean, (1982), the study itself could not underline this assumption empirically. Now, however, the student survey Longserv is closed and both cohorts have finished their bachelors degree. It was possible to test the assumption of the positive relationship between dropout intention and actual dropout. By using the complete Longserv dataset, logistic regressions confirmed the impact of intention on actual behavior (cohort-specific average dropout intention: $\tau_1 = 1.86$, $h_{(1)} = 13.5\%$, $OR_{D\_1} = 2.94$, $p_1 < 0.001$; $\tau_2 = 3.08$, $h_{(1)} = 4.4\%$, $OR_{D\_2} = 5.69$, $p_1 < 0.001$; $\tau_3 = 3.53$, $h_{(1)} = 2.9\%$, $OR_{D\_2} = 3.99$, $p_1 = 0.032$). In sum, the present dissertation therefore also underlines the relevance of dropout intention for actual dropout, however, broadens prior research by a wider operationalization of dropout.

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ORIGINAL RESEARCH
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Perceived Academic Control and Academic Emotions Predict Undergraduate University Student Success: Examining Effects on Dropout Intention and Achievement

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The present study addressed concerns over the high risk of university students' academic failure. It examined how perceived academic control and academic emotions predict undergraduate students' academic success, conceptualized as both low dropout intention and high achievement (indicated by GPA). A cross-sectional survey was administered to 883 undergraduate students across all disciplines of a German STEM orientated university. The study additionally compared freshman students ($N = 597$) vs. second-year students ($N = 286$). Using structural equation modeling, for the overall sample of undergraduate students we found that perceived academic control positively predicted enjoyment and achievement, as well as negatively predicted boredom and anxiety. The prediction of dropout intention by perceived academic control was fully mediated via anxiety. When taking perceived academic control into account, we found no specific impact of enjoyment or boredom on the intention to dropout and no specific impact of all three academic emotions on achievement. The multi-group analysis showed, however, that perceived academic control, enjoyment, and boredom among second-year students had a direct relationship with dropout intention. A major contribution of the present study was demonstrating the important roles of perceived academic control and anxiety in undergraduate students' academic success. Concerning corresponding institutional support and future research, the results suggested distinguishing incoming from advanced undergraduate students.

Keywords: perceived control, academic emotion, freshman, academic success, dropout intention, academic achievement, higher education, multi-group structural equation modeling

PREDICTORS OF UNDERGRADUATE UNIVERSITY STUDENTS' ACADEMIC SUCCESS

Many studies have found that freshman university students are at high risk of attrition [NCES (National Center for Education Statistics), 2002; AUSSE (Australasian Survey of Student Engagement), 2011]. These students often face difficulties in the transition to higher education and experience varying degrees of adjustment to university during the first year, which in turn

predict their academic success (Credé and Niehorster, 2012). The first academic year is critical to the overall success in higher education (Perry et al., 2001). In order to successfully manage this critical adjustment to university, one key factor to consider is the undergraduate students' feeling "in control" over their academic outcomes (Perry, 1991). Additionally, the new demands and rising academic pressure of university are likely to elicit a variety of emotions among students, which can influence their academic success (Pekrun and Stephens, 2010). Understanding the role of these variables for undergraduate students' academic success, specifically with respect to lowering dropout and increasing achievement, is a key factor for instructors, professors, and institutions in order to support student development. However, few studies have focused on perceived academic control as a predictor of dropout intention, in addition to its influence on achievement, even though instructors and institutions can effectively support it. Moreover, few studies have examine academic emotions as a predictor for dropout intention, in addition to their influence on achievement. The purpose of the present study therefore was to examine how perceived academic control and academic emotions predict undergraduate university students' academic success. The next section describes the theoretical background of the constructs under investigation, with a focus on their relationship with academic success and the undergraduate university experience.

Undergraduate Students' Academic Success

In the research literature, two components are prevalently discussed as representing undergraduate students' academic success: dropout intention and academic achievement. Engagement in higher education is typically elective and students need to remain enrolled to stay on track. Unfortunately, dropout rates within higher education worldwide suggest approximately one-third of university students leave university in their first year (OECD (Organization for Economic Co-operation and Development), 2012). Dropping out is often seen as an individual failure with negative societal consequences, such as fewer qualified employees in the workforce (Heublein and Wolter, 2011). The European Commission is focusing on reducing dropout rates by encouraging research on this issue (DG EAC (Directorate General for Education and Culture, European Commission), 2015). Research concerning dropout faces the problems of tracking students when they leave institutions or stop studying (Pascarella and Terenzini, 2005). Therefore, prior research has focused mainly on cognate constructs, such as retention, persistence (defined by the length of time a student remains enrolled at an institution; for an overview see Robbins et al., 2004), or voluntary course withdrawal (Ruthig et al., 2004).

Based on the difficulties in measuring and testing factors affecting dropouts that have already occurred, it is essential to know which students *intend to drop out* before they actually do. Bean (1982) analyzed dropout intention, the estimated likelihood of suspending studies, as part of dropout syndrome within his Student Attrition Model. The relationship between dropout intention and actual dropout has been consistently emphasized (cf. Cabrera et al., 1993). Prior research studied possible moderators, such as commitment and engagement (cf. Okun et al., 1996) or possible institutional interventions, such as freshmen seminars for study skills or social integration (Porter and Swing, 2006; DeAngelo, 2014). Bean highlighted the importance of dropout intention: "Students who leave without intending to (e.g., for reasons of health, family crisis, etc.) do not represent failures of the student or the university. They represent residual variance in dropout that can be accurately specified after the fact, but not predicted." (Bean, 1985, p. 36). Dropout intention among undergraduate students seems to decrease in the second academic year compared to the first year (Bean, 1985). Consequently, the current study focused on students' dropout intention, operationalized as students' reported intent to change their major or leave their university, as an early-warning sign of actual dropout (Bean, 1985).

In addition to low dropout intention, prior research traditionally defined academic success as achievement based on course grades or grade point average (GPA; Richardson et al., 2012). University *academic achievement* has been found to predict educational and career success. Meta-analysis demonstrated that grades are positively related to career success, besides intelligence or parental socioeconomic status (Strenze, 2007). For example, course achievement at the very beginning of the first academic year predicted final course grades for the rest of the first year (Perry et al., 2001).

We thus conceptualized academic success as built out of two components: (a) low dropout intention (as a predictor of dropout) and (b) high academic achievement (GPA). Prior research has shown retention (i.e., no dropout) and academic achievement are related to each other (e.g., Robbins et al., 2004, 2009; Gramling, 2013). Furthermore, most studies found a medium relationship between dropout and academic achievement as undergraduate students who achieve high grades are less likely to drop out (e.g., Pascarella and Terenzini, 2005; Allen et al., 2008). Focusing on all undergraduate students there is evidence that dropout intention is significantly related to low academic achievement, although with small effect sizes and without considering the duration of study (Bean, 1985). On the one hand, high achievement will convince students they have made the right choice to enroll in university and hence will reduce the urge to leave. On the other hand, the relationship might work the other way round: Students with low dropout intention might have the feeling of being at the right place, will be able to focus on their studies, and therefore may show high performance. The reducing impact of achievement on dropout intention was shown for high school grades (Porter and Swing, 2006). Allen et al. (2008) suggested that low grades more strongly relate to dropout decisions in the first academic year than later on (similar to Bean, 1985). Thus, the relationship between dropout intention and academic achievement reduces during longer periods of study. Further research is needed on the correlation between these two variables, specifically for freshman students.

It is clear that the first year of university is a critical time for students' early and long-term academic success (Credé and Niehorster, 2012). The answers are less clear, however, for the question of what factors influence academic success. Therefore, in

the present study we explored the impact of perceived academic control and academic emotions on (a) dropout intention and (b) academic achievement.

Perceived Academic Control

Perceived academic control has been found to be an important predictor of academic success in terms of (a) low dropout intention and (b) high achievement (for an overview see Perry et al., 2005b). Perceived control is often described as the subjective perception of individual influence; in other words, being in control (Skinner, 1996). Perceived academic control, the domain specific variant of perceived control, is a person's belief in his or her influence over the success or failure of achievement outcomes. It describes the personal internal attribution of achievement outcomes and is a relatively stable psychological disposition with state qualities (Perry et al., 2001, 2005a). Stupnisky et al. (2012) found perceived academic control to be unstable for some individuals and that this instability can have important consequences for their academic achievement. Perceived academic control is positively linked to several relevant factors, which underlines its importance for undergraduate students' academic success (for an overview, see Skinner, 1996; Perry et al., 2005a). Perceived academic control is closely related to self-efficacy (Judge et al., 2002), as both constructs are part of the expectancy component of students' self-concept (Pintrich and de Groot, 1990). Moreover, perceived academic control has a higher impact on academic success than self-esteem (Stupnisky et al., 2007). Other factors positively related to perceived control are self-regulated learning (Shell and Husman, 2008), effective study strategies use (Cassidy and Eachus, 2000), self-monitoring strategies use (Perry et al., 2001), achievement motivation (Hall et al., 2006), intrinsic motivation (Perry et al., 2001), and personality constructs such as extraversion or conscientiousness (Perry et al., 2005a).

Perceived academic control is also very important for undergraduate students during the challenging transition from secondary school to university. Entry into university means greater academic demands, but also greater autonomy, less academic structure, increased pressure to excel, new social environments, and adaption to new roles or responsibilities. These new demands foster a low-control learning environment in university and can lead students to feel out of control (Perry, 2003). Stupnisky et al. (2012) found that freshman students' academic control levels can be unstable (i.e., fluctuating between high and low) and often decrease within their first year.

Concerning *dropout*, there is evidence that students with high levels of perceived academic control are less likely to dropout (Perry et al., 2005b) and withdraw from courses (Ruthig et al., 2007), specifically within the first academic year (Hall et al., 2006). Similar results were found for secondary school students (Rumberger and Lim, 2008). Perceived academic control is furthermore related to psychology freshman students' *intention to drop out* of university (Ruthig's AERA presentation 2002 as cited in Perry et al., 2005a, p. 384) and students' intention to drop out in high school (Davis et al., 2002).

Within the academic context, perceived control has been linked to several components of university students' *academic achievement* (for an overview see Perry et al., 2005b). Prior research found perceived academic control to positively predict students' achievement over an entire first academic year (e.g., Ruthig et al., 2008; Daniels et al., 2014). Remarkably, perceived academic control significantly predicted academic achievement even after considering students' pre-university academic success, age, and gender (Stupnisky et al., 2007). Freshmen with high unstable perceived academic control were found to have lower academic achievement than high stable perceived academic control students, with low-unstable perceived academic control students to have the worst academic achievement (Stupnisky et al., 2012). Moreover, perceived academic control negatively predicted course-withdrawal and positively predicted achievement over a 3-year period (Perry et al., 2005b).

Due to its crucial role in the difficult transition to university, prior research has focused on the enhancement of perceived academic control in low-control students through Attributional Retraining (Perry et al., 2005a; for an overview of this intervention see Haynes et al., 2009). In order to improve perceived academic control, this teaching method encourages students to reflect on past performances and make controllable, unstable attributions for negative academic experiences. Attributional Retraining early in the academic year has been shown to result in better performance (Perry et al., 2005a).

In summary, the research literature suggests perceived academic control is an important predictor of undergraduate university student academic success for both (a) dropout intention and (b) academic achievement. Furthermore, perceived control can be increased by institutions to assist students. Thus, perceived academic control "provides students with the resources to overcome various educational obstacles" (Perry et al., 2005a, p. 423). In addition to perceived control, the high demands and rising academic pressure of university are likely to raise a variety of emotions among students, which then may also predict students' academic success (Pekrun and Stephens, 2010).

Academic Emotions

Academic emotions are those emotions relating to achievement activities, such as studying at university and test results (Pekrun, 2006). Discrete emotions such as enjoyment, boredom, and anxiety can be distinguished from general affect and are experienced in different frequencies. The most reported emotion within the higher education context is anxiety (Pekrun and Stephens, 2010), while enjoyment and boredom are also frequently reported (Pekrun et al., 2002). These discrete emotions relate to each other (Pekrun et al., 2011) and can change over time. Ranellucci et al. (2015) found that undergraduate students self-reported slightly less enjoyment, less anxiety, and nearly the same experience of boredom during their second academic year compared to their first. Alternatively, Pekrun et al. (2014) reported increasing boredom levels for undergraduate students over one semester. Misra and McKean (2000) showed a negative trend between self-reported anxiety levels for freshmen and second-year students, however it was not significant ($_{\Delta}M = -0.20, p = 0.21$).

Concerning *dropout*, there is evidence that negative academic emotions relate to voluntary course withdrawal, while positive academic emotions do not (e.g., Ruthig et al., 2004, 2007, 2008). Moreover, negative emotions tend to be higher in students who dropped out than in students who completed their studies (Ruthig's AERA 2002 presentation as well as Ziegler's master thesis 2001 as cited in Pekrun et al., 2002). In these studies, anxiety is frequently reported (Pekrun and Stephens, 2010).

Concerning *academic achievement*, previous research revealed that positive academic emotions (e.g., enjoyment) are positively related to future academic achievement, whereas negative academic emotions (e.g., boredom or anxiety) are negatively related (e.g., Pekrun and Stephens, 2010). The predictive effects of academic emotions on achievement seem to be mediated by motivation, learning strategies, and self-regulation (e.g., Pekrun et al., 2011; Putwain et al., 2013; Mega et al., 2014). Furthermore, the relationship between academic emotions and academic achievement might be reciprocal (cf. Pekrun et al., 2014, 2017); that is, emotions can predict future achievement and can be predicted by prior achievement through success or failure experiences. Prior research found that high academic achievement at the beginning of the first academic year predicts positive academic emotions, which then lead to high achievement at the end of the first academic year (Putwain et al., 2013). Overall, these prior findings lead to the question, how do perceived academic control and academic emotions (specifically negative) together predict undergraduate students' academic success?

Relationships between These Predictors and Undergraduate Students' Academic Success

Prior research revealed that perceived academic control and academic emotions are both important predictors of academic success and are strongly interrelated (e.g., Perry et al., 2001; Ruthig et al., 2007; Pekrun et al., 2011). The feeling of being in control is positively associated with positive emotions such as enjoyment, and negatively related to negative emotions such as anxiety (Perry et al., 2001; Pekrun et al., 2004, 2011; Hall et al., 2006).

According to Pekrun (2006), appraisals of perceived academic control and value determine academic achievement directly, but also indirectly via their prediction of academic emotions. Hence, Pekrun's (2006) Control-Value Theory of Emotions offers an explanation of the structural pathways and possible indirect effects between these predictors for undergraduate students' academic success. In the current study, we only investigated the theoretical assumptions concerning perceived academic control as a first step due to its high importance for freshman university students (Perry, 2003), because it differs among undergraduate university students (Stupnisky et al., 2012), and it can be supported through university interventions (e.g., Pekrun, 2006). Subjective value otherwise is relatively high among freshmen as they just chose their major and difficult to increase through institutional activities (Dresel and Grassinger, 2013).

Focusing on perceived academic control's relationship with emotions, low perceived academic control has been found to predict anxiety, whereas high perceived academic control leads to enjoyment (Stupnisky et al., 2013). The relation between boredom and perceived control is assumed to be U-shaped (curvilinear), with extreme high and extreme low control conditions eliciting boredom among students (Pekrun et al., 2014). Focusing on freshman students, however, the demanding circumstances of university make "it likely that the high levels of perceived control that would promote boredom are rarely achieved in these environments" (Pekrun et al., 2014, p. 699). Indeed, prior research found a negative linear relationship between perceived academic control and undergraduate university students' boredom (Pekrun et al., 2010). Moreover, researchers have suggested that the effects of perceived academic control on both components of future academic success are partially mediated by academic emotions. For example, students who feel in control typically experience more emotions that are positive, and therefore are more likely to succeed in their studies (Goetz et al., 2010).

The relationships between perceived academic control and academic emotions in undergraduates are assumed equal across different periods of study (Pekrun, 2006). The mean levels of these variables could differ, however, based on culture (Frenzel et al., 2007) or students' changing frame of reference. For example, freshman students are expected to relate university experiences to those from secondary school, whereas second-year students to those from higher education experiences. As second-year students have adapted to university and gained experience, they should report more university related self-perceptions.

In summary, based on the control-value theory (Pekrun, 2006), we hypothesized both perceived academic control and academic emotions to predict (a) dropout intention and (b) academic achievement. Moreover, we expected that the predictive effect of perceived academic control on success to be partially mediated by academic emotions.

STUDY PURPOSE AND HYPOTHESIS

In the present study, we examined the impact of perceived academic control on the two academic success components, dropout intention and academic achievement, as well as possible mediations through academic emotions. We focused on university students in their first two academic years as this is a critical time for long-term academic success (e.g., Perry, 1991; Credé and Niehorster, 2012). We additionally explored differences amongst the relationships of our study variables for students at the first academic year (freshman group) compared to students at the second academic year (second-year group).

First, we analyzed the relationships of perceived academic control and academic emotions, as well as their connection with undergraduate students' academic success. We hypothesized a model inspired by the control-value theory of emotions (Pekrun, 2006) with a focus on perceived academic control appraisals and the addition of dropout intention (**Figure 1**). In our assumed model, perceived academic control had a direct effect on the two components of academic success by reducing dropout

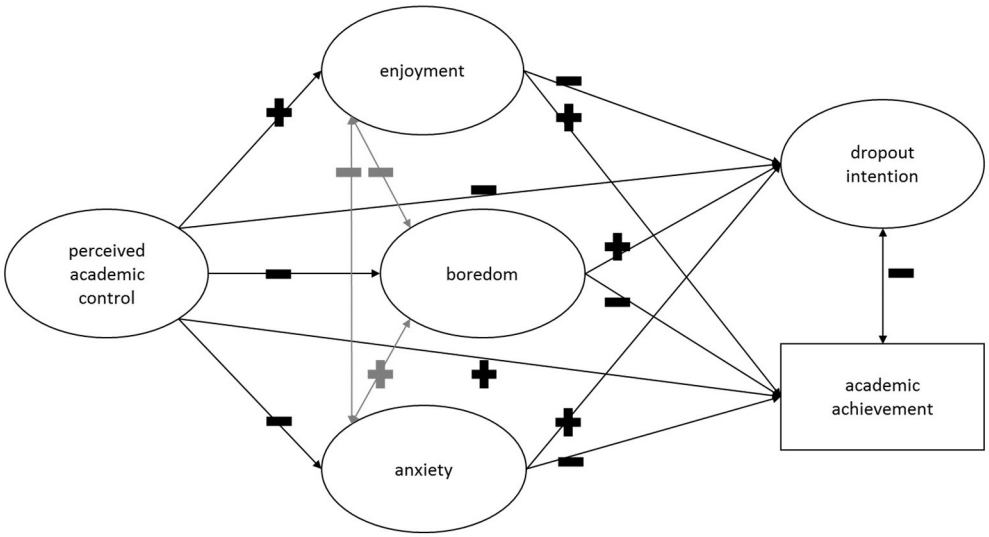

FIGURE 1 | Hypothesized model.[1]

intention and enhancing academic achievement (c.f. Ruthig et al., 2008). Additionally, we hypothesized an indirect effect of perceived academic control on dropout intention and academic achievement through the academic emotions of enjoyment, boredom, and anxiety. Concerning the academic emotions, we expected them to correlate with one another. Specifically, we expected negative relationships between enjoyment and the negative emotions of boredom and anxiety, while we expected the negative emotions to be positively related to each other (Pekrun et al., 2011). Furthermore, we hypothesized that enjoyment relates to great undergraduate students' academic success (c.f. Ruthig et al., 2008). However, we hypothesized a strong negative relationship of boredom and anxiety with academic success (c.f. Stupnisky et al., 2013) due to the high frequency and educational importance (Pekrun and Stephens, 2010). We additionally assumed a correlation between the two components of academic success for undergraduate university students (Bean, 1985; Pascarella and Terenzini, 2005; Allen et al., 2008).

Second, we wanted to compare students of different durations of study within the first two academic years. We tested our model (**Figure 1**) separately for freshmen and second-year students. Based on Pekrun's (2006) theory, we expected to find our model structurally invariant across the two student groups of freshmen and second-year students. However, we hypothesized slightly different mean levels depending on the students' year in university. Specifically, we expected to find less perceived academic control, more enjoyment, less anxiety, less dropout intention, and higher academic achievement for second-year students compared to freshmen based on previous research (Bean, 1985; Perry et al., 2005b; Stupnisky et al., 2012).

[1]Perceived academic control is an independent latent variable that captures students' beliefs about their personal influence and control over their academic outcomes. Academic emotions enjoyment, boredom, and anxiety are represented as latent variables and express students' enjoyment of learning, boredom, and anxiety (respectively) concerning their studies and learning activities within the first two academic years. High values indicated that students feel more enjoyment, boredom or anxiety. Dropout intention is a dependent latent variable. High values on this variable indicated high likelihood of dropout. Academic achievement is a dependent observed variable (low GPA indicated low academic achievement).

MATERIALS AND METHODS

Participants

Participants were 883 undergraduate students (48.4% women), whose mean age was 20.23 years with a standard deviation of 2.54 (range from 16 to 50 years). They were studying across all disciplines offered by a German university with focus on STEM (engineering, computer science, mathematics and economics, psychology as well as physics, biology, chemistry). The German academic year is comprised of two semesters with an exam period at the end of each semester. Freshman students normally experience their first exam in February. This cross-sectional study included participants from two different cohorts in order to test the multi-group hypothesis: 597 first-year students (freshman group, 41.6% response rate of total cohort number one) and 286 second-year students (second-year group, 19.2% response rate of total cohort number two).

The study was conducted in two phases. Participants were recruited about 2–3 weeks into the academic year when students were either at the beginning of their first semester or third semester (Phase 1–survey, November). Thus, we collected data from students at the beginning of their program when they had no exam experience (freshman student cohort—group one), as well as from students at the beginning of their second academic year, when they had just finished their first academic year (second-year student cohort—group two). We distributed the questionnaire during a break in an important lecture of each discipline. Therefore, this was a

convenience sample and participants responded to the survey about experiences at university while being in a typical learning situation. Participation was voluntary and participants had the chance to withdraw their data at any point of the study. In addition to the survey, students gave permission to the authors to obtain the grade point average (GPA) by signing a data privacy statement (grade release form). After the conclusion of the semester, students' GPA was collected from institutional records (Phase 2—GPA collection, April). In the present study, we analyzed data only from students with available grade information ($N = 883$ of the original 1171 participants[2], with 597 freshmen from original 790 participant and 286 second-year students from original 381 participants).

Measures

All measures in the paper-pencil questionnaire were established self-report scales. When necessary, we adapted the items from a secondary to tertiary education context with a general focus on studying and lectures.

Perceived Academic Control

We adapted six items of the Academic Control Scale (PAC; Perry, 1991 in its German version of Pekrun et al., 2004) to the context of higher education, which were measured on a five-point Likert scale (1 = Strongly disagree; 5 = Strongly agree). An example item was, "The more effort I put into my courses, the better I do in them."

Academic Emotion

The discrete emotions of enjoyment, boredom, and anxiety were each measured with three course-related items from the German version of the Academic Emotions Questionnaire (AEQ; Pekrun et al., 2005, 2011) on a five-point Likert scale (1 = Strongly disagree; 5 = Strongly agree). We selected these emotions due to their educational importance (Ruthig et al., 2008) as well as high frequency among higher education students (Pekrun et al., 2002). Example items were for enjoyment "I get excited about going to university," for boredom "I think the courses of my study are boring," and for anxiety "Thinking about my study makes me feel uneasy."

Dropout Intention

We adapted three items from the institutional commitment scale of the Freshman Orientation Survey (Brown, 2012). Students reported the likelihood of changing their major or leave their university (1 = Extremely unlikely; 4 = Extremely likely). An example item was "I am likely to leave university permanently."

Academic Achievement

Similar to prior research, academic achievement was operationalized through students' cumulative grade point averages (GPA). Despite known difficulties with reliability and disciplinary differences, it is still the most common achievement measure (Robbins et al., 2004). GPA was obtained from institutional records at the end of the semester. It contains students' average grade achieved in all courses completed during their semester and ranges from 1.0 (excellent) to 4.0 (passed). In Germany, lower grades represent higher academic achievement. Because of the irregular standards and entrance requirements between the different disciplines, GPA was group centered regarding to students' major before being used in our analysis. We subtracted the group mean for each group of study subject, across the whole sample independent of their student status (freshmen vs. second-year students)[3]. For an easy interpretation, GPA was then multiplied by −1 in order to recode it. For the final analyzed variable, a high GPA reflects high academic achievement, whereas a low GPA reflects low academic achievement.

RESULTS

Rationale for Analyses

We tested our hypotheses with bivariate correlations and multi-group structural equation modeling (SEM). Perceived academic control, academic emotions, and dropout intention were latent variables, while academic achievement was an observed variable. First, we conducted bivariate correlations among all study variables to analyze the relationships. Second, we tested our hypothesized model for the whole sample through SEM, which allowed testing of the theoretical linkages as direct and indirect partial relations (Byrne, 2012). Third, we tested our multi-group hypothesis through multiple invariance tests.

In order to compare the SEM between the two subgroups (freshmen vs. second-year student cohort), we tested the measurement invariance and the structural invariance of the hypothesized model (as recommend by Byrne, 2012; Christ and Schlüter, 2012; Wang and Wang, 2012). We used a series of tests to explore measurement invariance of the hypothesized model (i.e., hierarchical set of measurement invariance tests). We systematically added more constraints and evaluated the cross-group comparability through chi-square difference tests (Brown, 2006). Specifically, we tested for configural measurement invariance through establishing a model with no constraints (model 1) after separately testing the two baseline models within the subgroups (model 0). Here, the hypothesized model of both subgroups was freely estimated and allowed all cross-group differences. Next we tested for weak measurement invariance (Meredith, 1993) through constraining all factor loadings to be equal (model 2). This model assumed no differences between the factorial structures of both subgroups. At least partial invariance is necessary to compare structural differences (Byrne, 2012). Finally, we tested strong measurement invariance (Meredith, 1993) by constraining all intercepts of the manifest variables to be equal (model 6). Again, at least partial invariance is necessary to compare latent means across groups (Christ and Schlüter, 2012). As significant chi-square difference tests and worse model

[2]We tested for significant differences in the study variables between students who did vs. did not consent to their grades being collected. Only perceived academic control differed slightly. Students who did not consent to their grades being collected reported a lower perceived academic control (Bonferroni adj., $t\,(454) = 3.22$, $p = 0.001$, $_{\Delta}M = -0.14$).

[3]A computation with non-centered GPA measures showed very similar results for our hypothesized model (comparable fit indexes, structural pathways and significances).

fits suggested partial invariance, we developed a series of partial invariance models to examine the origin of the lack of invariance by systematically releasing the constraints (model 3, 4 and model 6, 7).

After our successful test for measurement invariance, we examined the structural invariance of the hypothesized model (as recommend by Byrne, 2012). After we knew which of the measurement models were group-invariant, we constrained these to be equal across the two groups while we tested the invariance of structural parameters (latent means and regression paths). Specifically, we systemically constrained single structural weights to be equal across both subgroups. Again, we tested the cross-group comparability through chi-square difference tests. As significant chi-square difference tests suggested the structural weights were non-invariant, we compared the different structural weights across both subgroups. Indirect effects, meaning moderated mediations, were tested through *z*-score difference tests. This allows for comparing indirect effects within SEM across groups (Muthén and Muthén, 1998–2012). After we estimated the values of the single direct effects in both groups, we quantified the indirect effect as the product of the respective direct effects for each group and then we compared these interactions via *z*-score difference tests (cf. Wang and Wang, 2012). A significant *z*-score test suggests a significant difference between the two mediations, meaning a significant moderation of student year at university. In addition to this multi-group analysis, we tested the differences in academic achievement through *t*-tests.

All analyses were executed using Mplus 7 (Muthén and Muthén, 1998–2012) and we considered various fit indices based on Hu and Bentler (1999). Adequate model fit was indicated through chi-square (χ^2), root-mean-square error of approximation (RMSEA $\leq$ 0.05), comparative fit index (CFI $\geq$ 0.95) and standardized root mean square residual (SRMR $\leq$ 0.05). Syntaxes of the models are provided as supplementary materials (Data Sheet 1).

Descriptive Statistics

Table 1 displays the descriptive results. All study variables showed expected average mean levels for the overall sample as well as for both student subgroups separately. We used McDonalds Omega to verify the internal reliability of our scales, with only boredom having omegas slightly under 0.70. All estimates were calculated via maximum likelihood estimation with missing data[4] assumed to be missing at random—MAR (Muthén and Muthén, 1998–2012). Skewness and graphical check for anxiety and dropout intention suggested non-normal distributions (Miles and Shevlin, 2001). Therefore, we used the MLR maximum likelihood estimator to handle missing data, which is robust to non-normality, instead of the full information maximum likelihood estimator ML (Muthén and Muthén, 1998–2012).

Latent variables were tested with confirmatory factor analysis (CFA) in the total sample and the two student groups separately. The CFA for the total sample had a close to adequate model fit: $\chi^2_{(125)} = 437.67$, $p < 0.001$, RMSEA = 0.05, CFI = 0.93, SRMR = 0.04. Focusing on the two student groups separately, we again confirmed our latent study variables, with a slightly lower fit for the second-year student group [freshman sample: $\chi^2_{(125)} = 291.35$, $p < 0.001$, RMSEA = 0.05, CFI = 0.93, SRMR = 0.04; advanced sample: $\chi^2_{(125)} = 270.35$, $p < 0.001$, RMSEA = 0.06, CFI = 0.92, SRMR = 0.06]. We then checked the standardized factor loadings of all latent variables, which were higher than 0.4 (ranged from 0.47 to 0.82) as recommended by Stevens (2009). Thus, all factor structures representing the corresponding latent variable had close to adequate fit to the data with significant factor loadings for the full sample as well as the two subgroups. The latent variables were thus used for all further analyses.

Furthermore, we calculated the bivariate Pearson product-moment correlations between the latent variables (enjoyment, boredom, anxiety, perceived academic control, dropout intention) and the observed variable achievement. In general, most bivariate correlations were consistent with prior research, and in some cases were even stronger than in previous research. Strong negative correlations were found between enjoyment and boredom, in all groups and the total sample. We found the following relationships in the complete sample of undergraduate students (see **Table 2**). As expected, perceived academic control related significantly to all three academic emotions, particularly to anxiety. Furthermore, the academic emotions strongly related to each other. Both perceived academic control and academic emotions were moderately to strongly related to dropout intention; however, anxiety had the strongest relationship to dropout intention. Concerning academic achievement, we generally found small correlations, whereas perceived academic control and dropout intention had the largest relations to GPA. The more students self-reported perceived academic control, as well as the less students self-reported boredom, anxiety, or dropout intention, the more likely they achieved highly in the end of the semester.

When the student groups were compared (see **Table 3**), we found a similar pattern of correlations. One exception was that achievement had very different relationships with all other latent variables across the groups. For freshman students, GPA relations were weak or non-significant with other variables, while second-year students showed GPA to have moderate relations with all latent study variables, except for enjoyment. The more second-year students self-reported perceived academic control, and the less they reported boredom, anxiety, or dropout intention, the more likely they achieved highly at the end of the third semester. In addition to these correlations we performed SEM to isolate the specific relationships of our two key study variables from those of other study variables and reduce the measurement error through latent variables.

[4]Some participants dropped out between the two points of data collection. The missing data contains de-registrations from 31 freshmen (5.19% of the freshman group) as well as 5 s-year students (1.77% of the second-year group). Due to various reasons (e.g., no comprehensive survey, no GPA release form from all participants, delay within the institutional records etc.), these dropout rates do not represent the actual dropout rates of these cohorts.

TABLE 1 | Descriptive results of all study variables.

Variable	No. Items	Range	Group	*N*	*M*	*SD*	ω	Skewness	λ standardized
Perceived Academic Control	6	1–5	0	855	3.99	0.61	0.81	−0.87	0.64/0.66/0.56 0.59/0.72/0.72
			1	572	4.04	0.55	0.76	−0.68	0.57/0.61/0.51 0.52/0.67/0.69
			2	283	3.89	0.72	0.87	−0.86	0.72/0.77/0.61 0.68/0.78/0.76
Academic emotion									
Enjoyment	3	1–5	0	856	3.66	0.67	0.81	−0.65	0.79/0.81/0.71
			1	578	3.67	0.67	0.81	−0.63	0.79/0.82/0.72
			2	278	3.62	0.67	0.80	−0.68	0.79/0.79/0.69
Boredom	3	1–5	0	857	2.43	0.79	0.69	0.28	0.74/0.57/0.53
			1	582	2.38	0.78	0.68	0.27	0.73/0.58/0.55
			2	275	2.52	0.80	0.62	0.29	0.79/0.53/0.47
Anxiety	3	1–5	0	855	1.86	0.79	0.75	0.98	0.67/0.68/0.75
			1	581	1.93	0.78	0.72	0.83	0.63/0.64/0.73
			2	274	1.72	0.79	0.81	1.38	0.73/0.76/0.80
Academic success									
Dropout intention	3	1–4	0	870	1.62	0.53	0.74	0.66	0.65/0.66/0.80
			1	585	1.73	0.51	0.70	0.41	0.59/0.59/0.80
			2	285	1.38	0.50	0.77	1.57	0.69/0.72/0.77
Academic achievement	–	−1.52–1.69	0	811	0.00	0.64	–	−0.15	–
		−1.52–1.53	1	530	−0.11	0.67	–	−0.33	–
		−0.99–1.69	2	281	0.18	0.53	–	−0.10	–

λThe numbers refer to standardized MLR maximum likelihood factor loading estimates of the confirmatory factor analyses. Group 0 refer to total sample (N = 883). Group 1 refer to freshman students (N = 597). Group 2 refer to second-year students (N = 286). All significant λ were significant at p < 0.001.

TABLE 2 | Bivariate correlations of all latent study variables (total sample).

Variable	1	2	3	4	5	6
Self-concept						
1. Perceived academic control		0.30***	−0.39***	−0.52***	−0.34***	0.17***
Academic emotion						
2. Enjoyment			−0.80***	−0.54***	−0.42***	0.06
3. Boredom				0.43***	0.26***	−0.14**
4. Anxiety					0.64***	−0.11**
Academic success						
5. Dropout intention						−0.18***
6. Academic achievement						

*The numbers refer to standardized MLR maximum likelihood parameter estimates. **p < 0.01, ***p < 0.001.*

TABLE 3 | Bivariate correlations of all latent study variables (separate subgroup samples).

Variable	1	2	3	4	5	6
Self-concept						
1. Perceived academic control		0.31***	−0.39***	−0.55***	−0.33***	0.13**
Academic Emotion						
2. Enjoyment	0.28***		−0.74***	−0.56***	−0.47***	0.10**
3. Boredom	−0.39***	−0.92***		0.42***	0.31***	−0.16**
4. Anxiety	−0.55***	−0.52***	0.49***		0.62***	−0.05
Academic success						
5. Dropout intention	−0.52***	−0.42***	0.30**	0.69***		−0.06
6. Academic achievement	0.34***	0.00	−0.18**	−0.19**	−0.25**	

*The numbers refer to standardized MLR maximum likelihood parameter estimates. The numbers above the diagonal refer to freshman students. The numbers under the diagonal refer to second-year students. **p < 0.01, ***p < 0.001.*

Research Question 1–Testing the Relationships between Perceived Academic Control and Academic Emotions and Their Effect on Undergraduate Students' Academic Success

We next tested our hypothesized model for the total student data through SEM. **Table 4** (first column) displays the results of the SEM. This initial total sample SEM analysis showed an acceptable model fit [$\chi^2_{(138)} = 489.58$, $p < 0.001$, RMSEA = 0.05, CFI = 0.92, SRMR = 0.05]. Based on *post-hoc* analysis, we allowed measurement errors to correlate, specifically on both boredom and anxiety scales' two items, due to high measurement residual covariance cross-loadings and high expected parameter change (EPC) values (boredom: MI = 80.52, EPC = 0.33; anxiety MI = 32.21, EPC = 0.16). Byrne (2012) argued that high MI and EPC values represent necessary model specification due to

TABLE 4 | Direct and indirect effects on academic success.

Direct relation	Hypothesized model			Final partial invariant multi-group model					
	Total sample ($N = 883$)			Freshman sample ($N = 597$)			Second-year sample ($N = 286$)		
	b/*r* (*p*)	β/r_{stdxy} (*p*)	R^2	*b*/*r* (*p*)	β/r_{stdxy} (*p*)	R^2	*b*/*r* (*p*)	β/r_{stdxy} (*p*)	R^2
Dropout Intention			0.48***			0.49***			0.52***
Perceived academic control	0.00 (0.946)	0.00 (0.946)		0.08 (0.569)	0.06 (0.564)		−0.26*	−0.18†	
Enjoyment	−0.15 (0.102)	−0.21 (0.102)		−0.18 (0.385)	−0.14 (0.392)		−0.91*	−0.66*	
Boredom	−0.12 (0.162)	−0.18 (0.159)		−0.03 (0.883)	−0.02 (0.883)		−0.89*	−0.64*	
Anxiety	0.47***	0.64***		0.75***	0.66***		0.66***	0.54***	
Academic achievement	−0.25*	−0.17*		−0.01 (0.737)	−0.02 (0.737)		−0.08 (0.133)	−0.17(0.141)	
Academic Achievement			0.04*			0.03 (0.139)			0.16*
Perceived academic control	0.20**	0.16**		0.12*	0.18*		0.17***	0.33***	
Enjoyment	−0.05 (0.741)	−0.05 (0.741)		0.09 (0.306)	0.14 (0.306)		−0.31 (0.386)	−0.62 (0.386)	
Boredom	−0.02 (0.893)	−0.02 (0.893)		0.03 (0.725)	0.05 (0.724)		−0.24 (0.504)	−0.47 (0.503)	
Anxiety	0.06 (0.514)	0.06 (0.514)		0.06 (0.317)	0.11 (0.319)		−0.05 (0.371)	−0.11 (0.366)	
Enjoyment			0.10**			0.11**			0.07†
Perceived academic control	0.37***	0.31***		0.35***	0.33***		0.27***	0.27***	
Boredom	−0.30***	−0.82***		−0.74***	−0.74***		−0.94***	−0.94***	
Anxiety	−0.15***	−0.49***		−0.52***	−0.52***		−0.46***	−0.46***	
Boredom			0.12**			0.15**			0.07†
Perceived academic control	−0.43***	−0.35***		−0.42***	−0.39***		−0.28**	−0.27**	
Anxiety	0.09***	0.30***		0.25**	0.25**		0.40***	0.40***	
Anxiety			0.30***			0.34***			0.30***
Perceived academic control	−0.64***	−0.55***		−0.72***	−0.59***		−0.66***	−0.55***	

Indirect relation (tests of mediations)	Hypothesized model		Final partial invariant multi-group model			
	Total sample ($N = 883$)		Freshman sample ($N = 597$)		Second-year sample ($N = 286$)	
	b (*p*)	β (*p*)	*b* (*p*)	β (*p*)	*b* (*p*)	β (*p*)
Dropout intention						
Perceived academic control via enjoyment	−0.06 (0.120)	−0.07 (0.116)	−0.06 (0.397)	–	−0.25 (0.068)	–
Perceived academic control via boredom	0.05 (0.180)	0.06 (0.179)	0.01 (0.883)	–	0.25 (0.088)	–
Perceived academic control via anxiety	−0.30***	−0.35***	−0.54***	–	−0.43***	–
Academic achievement						
Perceived academic control via enjoyment	−0.02 (0.741)	−0.01 (0.742)	0.03 (0.316)	–	−0.09 (0.404)	–
Perceived academic control via boredom	0.01 (0.893)	0.01 (0.893)	−0.01 (0.725)	–	0.07 (0.513)	–
Perceived academic control via anxiety	−0.04 (0.518)	−0.03 (0.516)	−0.04 (0.327)	–	0.03 (0.360)	–

Mediation effects of academic emotions of the impact of perceived academic control on academic achievement. The independent variables of each dependent variable are listed indented below the construct. The estimates presented were derived from the final partial invariant model (refer to the model 7 in ***Table 5****). MLR maximum likelihood parameter estimates.* $^{\dagger}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

systematic measurement errors in item responses from a high degree of overlap in the item content (e.g., for boredom "When I think about class, I get queasy" and "Thinking about class makes me feel uneasy"). After modification, the model showed a better and adequate model fit: $\chi^2_{(136)} = 377.02$, $p < 0.001$, RMSEA = 0.04, CFI = 0.95, SRMR = 0.04.

As expected, perceived academic control related to all three academic emotions, particularly to anxiety. The more students felt in control the less they experienced anxiety. In contrast to the bivariate correlation, perceived academic control had no significant effect on dropout intention when controlling for the shared variance with the academic emotions. The feeling of control itself did not relate to low dropout intention when controlling for academic emotions. However, perceived academic control positively predicted academic achievement, similar to the bivariate correlations, while controlling for the shared covariance of academic emotions. High beliefs about personal control predicted high academic achievement. On the other hand, the moderate to strong correlations between all academic emotions and dropout intention reduced to a strong relationship between only anxiety and dropout intention in the SEM. Taking all three academic emotions and perceived academic control into account, only anxiety significantly related to dropout intention. The more students experienced anxiety the more likely they intended to

TABLE 5 | Structural invariance analysis: summary of model fit and χ^2-Difference-Test-Statistics.

Invariance level	MLRχ^2	χ^2df	CFI	RMSEA	SRMR	Model Comparison	ΔMLR χ^{2*}	Δdf	*p*
Configural model									
(Model 0) Baseline group 1	267.60	136	0.95	0.04	0.04				
(Model 0) Baseline group 2	242.70	136	0.94	0.05	0.06				
(Model 1) Configural model	510.20	272	0.95	0.04	0.05				
Factor loadings									
(Model 2) All factor loadings invariant	549.03	290	0.94	0.05	0.08	1 vs. 2	38.12	18	0.004
(Model 3) All factor loadings invariant except for pac_1	540.50	289	0.94	0.04	0.08	3 vs. 2	6.35	1	0.012
						3 vs. 1	30.53	17	0.023
(Model 4) All factor loadings invariant except for pac_1 & pac_2	533.63	288	0.95	0.04	0.07	4 vs. 3	7.61	1	0.006
						4 vs. 1	24.50	16	0.079
Intercepts									
(Model 5) All intercepts invariant	611.20	301	0.93	0.05	0.07	5 vs. 4	82.67	13	<0.001
(Model 6) All intercepts invariant except for pac_2	573.35	300	0.94	0.05	0.07	6 vs. 5	43.40	1	<0.001
						6 vs. 4	41.32	12	<0.001
(Model 7) All intercepts invariant except for pac_2 & dro_1	547.59	299	0.94	0.04	0.07	7 vs. 6	20.34	1	<0.001
						7 vs. 4	13.11	11	0.286

**MLR corrected values. All χ^2 were significant at $p < 0.001$.*

drop out. Surprisingly, boredom and anxiety had no specific predictive effects on achievement when controlling for perceived academic control, contrary to the correlation results. Moreover, our model for the total sample showed a moderate relationship between the two steps of academic success, dropout intention and academic achievement, similar to the bivariate correlations. Undergraduate students with a strong intention to drop out tended to achieve poorly.

Finally, we analyzed the hypothesized mediations of academic emotions. Concerning dropout intention, the predictive effect of perceived academic control was fully mediated by anxiety[5]. Enjoyment and boredom did not show mediational effects. Undergraduate students with low levels of perceived academic control tended to experience strong anxiety toward studying, and as a result had higher intentions to dropout. Concerning academic achievement, the results showed no mediations, as only perceived academic control had a predictive effect on academic achievement. In addition to this mediation, the durations of study (e.g., first vs. second year) could have moderated these relationships. Therefore, we analyzed moderated mediations through multi-group structural equation analysis, but first we checked for measurement invariance.

Research Question 2–Testing Differences between Freshman and Second-Year Students

Table 5 displays the results of the hierarchical set of measurement invariance tests. We confirmed configural measurement invariance when we found the hypothesized model with free estimated factor loadings via sufficient fit indices in both subgroups separately (model 0) as well as in the configural structural equation model (unrestricted multi-group SEM, model 1). However, due to the weaker model fit and the significant chi-square difference test, model 2 (constrained factor loadings to be invariant across the two subgroups) did not hold up against the configural model (model 1). Therefore, we could not confirm weak measurement invariance. As results of analysis by Byrne et al. (1989), multi-group SEM analysis can continue under the condition of partial measurement invariance. We analyzed the residual covariance of all items one by one (model 3 and model 4) to identify factor loadings that should not be constrained to be equal in order to confirm partial weak measurement invariance (as recommend by Muthén and Muthén, 1998–2012; Byrne, 2012). We started these *post-hoc* analyses with the items that when not constrained suggested the greatest change of the chi-square value (model 3, item pac_1). We stopped these *post-hoc* analyses as the chi-square difference test became non-significant and the model fits were similar to the configural model again (model 4, items pac_1 and pac_2). Two factor loadings of perceived academic control differed across both student groups ("The more effort I put into my courses, the better I do in them" and "No matter what I do, I can't seem to do well in my courses"). We could not confirm full strong measurement invariance, as the chi-square difference test was significant when we constrained all intercepts and factor loadings to be equal across groups, with the exception of the two items of perceived academic control (model 5). Therefore, we again executed *post-hoc* analyses and found the intercept of one perceived academic control item (model 6) and one dropout intention item (model 7) were unequal across the two student groups (perceived academic control: "No matter what I do; I can't seem to do well in my courses" and dropout intention "I am likely

[5]We confirmed the significance of these mediational effects via bootstrapping. The standard bootstrap estimates were obtained based on 10,000 bootstrap samples, as recommend by Mallinckrodt et al. (2006).

to change my major"). The final measurement invariance model (model 7) confirmed partial strong measurement invariance with an adequate model fit. In this model, all factors loadings, besides pac_1 and pac_2, as well as all intercepts, besides pac_2 and dro_1, were constrained to be invariant between the two subgroups.

After establishing partial strong measurement invariance, we were able to compare the latent means of our study variables (Marsh and Grayson, 1994). Only the average level of perceived academic control, anxiety, and dropout intention differed between the two student groups. Compared to freshmen, second-year students reported lower anxiety ($_{\Delta}M = -0.56$, $p < 0.001$, $d = -0.46$) and lower dropout intention ($_{\Delta}M = -0.67$, $p < 0.001$, $d = -0.47$). Interestingly, second-year students also reported significantly lower perceived academic control compared to freshmen ($_{\Delta}M = -0.33$, $p < 0.001$, $d = -0.32$). Additionally, we found a significant mean difference for the observed variable of academic achievement across the two groups ($F = 21.74$, $p < 0.001$; $t_{(693)} = 6.56$, $p < 0.001$[6]). Specifically, freshmen had an average lower GPA than advanced students ($_{\Delta}M = -0.29$, $d = 0.47$). This means second-year students achieved better compared to students of the first academic year, irrespective of their study subject.

Turning now to invariances of the final path model across two different student groups, some structural paths significantly varied depending on the duration of study. After establishing partial strong measurement invariance, we used model 7 as a baseline model. **Table 6** (upper part) displays the results of the individual invariance tests of the structural parameters in the model. Fifteen individual parameter invariance tests were conducted. Five path coefficients were found to be different across student groups. Therefore, we fixed the remaining 10 invariant path coefficients to be equal across student groups in the final multi-group model (model 8). This final model displays the structural differences of first-year students and second-year students, which had an adequate model fit.

Figure 2 displays the results of the final multi-group model (model 8). Concerning the direct relationships with dropout intention, only anxiety was invariant across the students groups (**Table 4**, second column). Independent of the students' year at university, experiences of high anxiety strongly related to high intention to drop out. Alternatively, the predictive effect of perceived academic control, enjoyment, and boredom on dropout intention differed depending on the duration of study. We found expected pathways for students at the second academic year, however, the impact of perceived academic control on dropout intention marginally missed conventional levels of statistical significance ($p = 0.059$). Surprisingly, these relationships with dropout intention were non-significant for freshmen. Concerning the direct relations with achievement, only anxiety was different across the two student subgroups, but with non-significant impact. Due to high standard errors for the paths of second-year students, the moderate to strong path estimates of enjoyment (S.E. = 0.71) and boredom (S.E. = 0.70) were non-significant (**Table 4**, third column). Concerning the relationship of academic achievement and dropout intention, the two components of academic success were not related for either of the two students groups (freshmen vs. second-year students) and their relation was group-invariant.

We additionally tested the invariance of our hypothesized mediations of academic emotions (**Table 6**, lower part). We found no moderated mediation for the two student groups. The strong mediational effect of anxiety on the impact of perceived academic control on dropout intention was not moderated by the duration of study. When students experienced low anxiety, their feeling of control had a negative impact on their dropout intention, independent of whether they were freshmen or second-year students.

DISCUSSION

For a better understanding of student success in terms of dropout intention and academic achievement, the present study focused on the critical first year of university. We examined undergraduate students' perceived academic control and academic emotions using a self-reported survey completed in a typical learning situation to answer two research questions. A summary of the results and a discussion of their implications are presented below.

Research Question 1–How Perceived Academic Control and Academic Emotions Predict Undergraduate Students' Academic Success

As we found mostly expected bivariate correlations, we confirmed our hypothesized relationships with their shared variance accounted for through SEM. The model results emphasized the importance of perceived academic control and anxiety for undergraduate students' academic success.

As stated, the correlations confirmed previous findings (e.g., Perry et al., 2001; Stupnisky et al., 2013) concerning the relationships between perceived academic control with enjoyment, boredom, and anxiety. Our model also confirms the importance of perceived academic control for undergraduate students' academic success (e.g., Stupnisky et al., 2008) based on the expected positive predictive effect of perceived academic control on achievement even when controlling for academic emotions. In our model we did not, however, find a direct relationships between perceived academic control and dropout intention. Interestingly, the direct medium negative correlation between perceived academic control and dropout intention (compared to Ruthig's AERA presentation 2002 as cited in Perry et al., 2005a, p. 384) became non-significant as our model revealed a full mediation through anxiety. This broadened the findings from Ruthig et al. (2008), who found anxiety to moderate the predictive effect of perceived academic control on academic achievement. This result of the present study also emphasizes the importance of anxiety for undergraduate

[6]We used the parametric t-test, because the graphical check suggested normality distributions. However, the non-parametric one sample Kolmogorov-Smirnov test also would have been significant.

TABLE 6 | SEM model fit statistics and results of direct and indirect structural invariance tests.

Individual path coefficient constrained	MLRχ^2	χ^2df	ΔMLR χ^2	ΔMLR χ^2 *p* value	ΔMLR χ^2 test ($\alpha = 0.05$)	CFI	RMSEA	SRMR
Dropout intention								
Perceived academic control	552.12	300	6.55	0.010	Non-invariant	0.94	0.04	0.07
Enjoyment	550.24	300	3.96	0.047	Non-invariant	0.94	0.04	0.07
Boredom	551.17	300	10.68	0.001	Non-invariant	0.94	0.04	0.07
Anxiety	547.42	300	0.22	0.639	Invariant	0.94	0.04	0.07
Academic achievement	548.83	300	1.13	0.288	Invariant	0.94	0.04	0.07
Academic achievement								
Perceived academic control	548.51	300	0.59	0.442	Invariant	0.94	0.04	0.07
Enjoyment	550.20	300	0.70	0.403	Invariant	0.94	0.04	0.07
Boredom	548.81	300	1.03	0.310	Invariant	0.94	0.04	0.07
Anxiety	551.31	300	184.42	< 0.001	Non-invariant	0.94	0.04	0.07
Academic emotion enjoyment								
Perceived academic control	548.06	300	0.63	0.427	Invariant	0.94	0.04	0.07
Boredom	558.44	300	12.57	< 0.001	Non-invariant	0.94	0.04	0.07
Anxiety	547.25	300	0.37	0.543	Invariant	0.94	0.04	0.07
Academic emotion boredom								
Perceived academic control	549.52	300	1.93	0.165	Invariant	0.94	0.04	0.07
Anxiety	548.96	300	1.48	0.224	Invariant	0.94	0.04	0.07
Academic emotion anxiety								
Perceived academic control	547.20	300	0.27	0.603	Invariant	0.94	0.04	0.07
(model 8) Final model[a]								
10 invariant path coefficients constrained	562.13	309	14.79	0.140	Invariant	0.94	0.04	0.07
Indirect effects difference test	**MLRχ^2**	**χ^2df**	**difference *z*-score**	***z*-test *p*-value**	***z*-test ($\alpha = 0.05$)**	**CFI**	**RMSEA**	**SRMR**
Dropout intention								
Perceived academic control (via enjoyment)	547.59	299	1.189	0.235	Invariant	0.94	0.04	0.07
Perceived academic control (via boredom)	547.59	299	−1.422	0.155	Invariant	0.94	0.04	0.07
Perceived academic control (via anxiety)	547.59	299	−0.651	0.515	Invariant	0.94	0.04	0.07
Academic achievement								
Perceived academic control (via enjoyment)	547.59	299	−1.10	0.274	Invariant	0.94	0.04	0.07
Perceived academic control (via boredom)	547.59	299	0.74	0.460	Invariant	0.94	0.04	0.07
Perceived academic control (via anxiety)	547.59	299	1.345	0.179	Invariant	0.94	0.04	0.07

*The estimates presented were derived from the final partial invariant model (refer to model 7 in **Table 5**). MLR corrected values.*

[a] *10 of 15 path coefficients found invariant in the chi-square difference tests were constrained to be equal across groups.*

students. The full mediation could be due to individual significance. Undergraduate students just recently chose to study as well as their major and therefore appreciate university highly. Anxiety occurs when learning situations or their outcomes are highly valued with low perceived control (Pekrun, 2006). Thus, anxiety has a strong relation with the intention to drop out of university, even when controlling for perceived academic control. Furthermore, the model explains nearly 50 percent of the dropout intention variance, which again underlines the importance of perceived academic control and anxiety.

In our models, we could not find specific relationships between academic emotions and achievement, unlike the results of prior research (e.g., Pekrun et al., 2011; Putwain et al., 2013). The small negative relation of the negative emotions with achievement became non-significant when we estimated their predictive effects excluding shared variance with perceived academic control and enjoyment. Therefore, we cannot fully confirm all expected influences of academic emotions, unlike Ruthig et al. (2008). Surprisingly, only perceived academic control had a predictive effect on the academic achievement component of academic success. One possible explanation could be feedback loops as postulated in the control value theory (Pekrun, 2006). Academic emotions can influence perceived academic control and therefore academic achievement. Furthermore, we obtained academic achievement at the end of the semester, unlike previous studies that obtained GPA simultaneously (e.g., Pekrun et al., 2010; Mega et al., 2014) or prior to the study (Pekrun et al., 2011). This time-delayed measurement of achievement possibly showed the importance of time span for the predictive effects of academic emotions. Moreover, the missing effects of the emotions on achievement could be the results of their operationalization. As the external

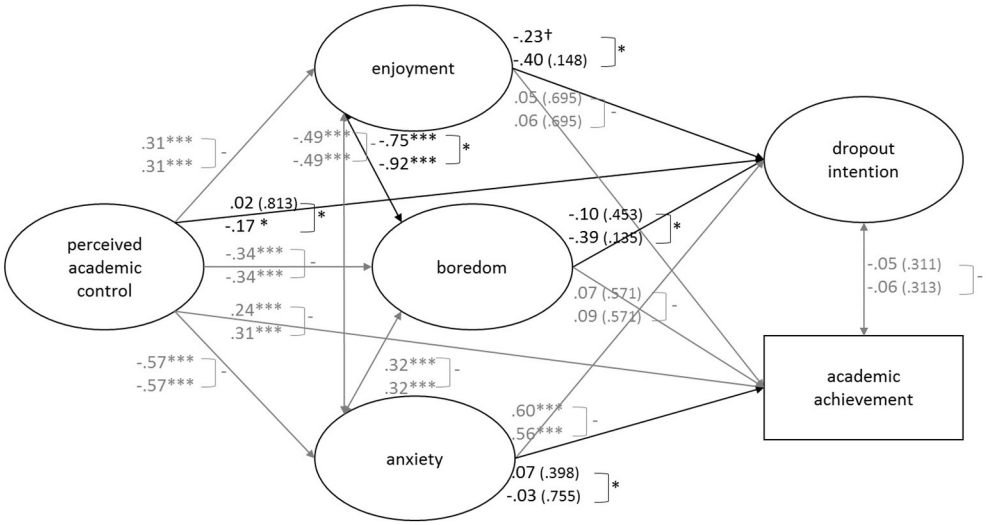

FIGURE 2 | Structural paths of the final multi-group SEM results. The numbers refer to standardized MLR maximum likelihood corrected parameter estimates. Upper numbers refer to group of freshman students. Lower numbers refer to group of second-year students. 10 of 15 path coefficients found invariant in the chi-square difference tests were constrained to be equaled across groups (gray clip with –). The estimates presented were derived from the final partial invariant model (refer to model 8, see **Table 6**), if non-significance: *p*-value within the parenthesis, if marginal significance: $^{\dagger}p < 0.10$, significance level: $^{*}p < 0.05$, $^{***}p < 0.001$.

validation study of the AEQ showed, course-related emotions have a weaker relationships with achievement compared to learning- and test-related emotions (Pekrun et al., 2011). We measured course-related emotions within a subject-critical lecture, as opposed to test-related emotions right after an exam. Other crucial factors may have intervened to result in the non-significant effects of the academic emotions: cognitive resources (Pekrun, 2006), self-regulated learning strategy usage (Pekrun et al., 2002), or goal orientations (as shown for boredom and anxiety; Pekrun et al., 2009). Furthermore, the lack of relationships among academic emotions with academic achievement in our SEM could be due to our interdisciplinary sample that consists of several different disciplines offered by a German STEM university. STEM students are analytically minded and might therefore rarely reflect upon and cope with their emotions while learning (compared to more self-reflexive students such as from psychology). This expands the generalization of our findings, as previous research often focused on psychology students or students of introductory courses and undecided majors (e.g., Perry et al., 2005b; Ruthig et al., 2009; Stupnisky et al., 2013).

Additionally, in our model we found a small relationship between dropout intention and academic achievement, as the correlations already suggested and in line with prior research (e.g., Pascarella and Terenzini, 2005; Allen et al., 2008). Undergraduate students who intend to dropout at the beginning of the semester are more likely to achieve poorly at the end of the semester, independent of their level of perceived academic control or experienced academic emotions at the beginning of the semester. This small relationship between the two components of academic success was not present, however, when we compared the two student cohorts.

Research Question 2–How the Prediction of Academic Success Differ for Freshman Students vs. Second-Year Students

The present study compared students from two different cohorts, namely freshman students and second-year students, through multi-group analysis. We found good support for our hypothesized multi-group model: The measurement models were partially invariant and most path coefficients were invariant across the two student groups. Consequently, we validated our model for the total sample for freshman students and second-year students. Only two factor loadings of the perceived academic control latent variable differed between the sub-groups, which could represent the different students' frame of reference for their perceptions (secondary school vs. higher education).

In line with Pekrun (2006) and Frenzel et al. (2007), only the latent means of perceived academic control, dropout intention, and anxiety differed between both groups. As expected, second-year students perceived less academic control (Stupnisky et al., 2012), experienced less anxiety (Ranellucci et al., 2015) and had lower dropout intention (Bean, 1985) compared to freshmen. One possible explanation for the reduction in perceived academic control over the first academic year could be failure experiences. Students tend to decrease their perceived academic control after failure experiences (Hall, 2008). We collected data from freshman students in the first semester before their first university exam. Thus, these students may not have experienced much failure yet, which leads to higher perceived academic control. Additionally, the advanced sample had significantly better grades, with low variance and skewness. Perhaps this sample contained more high-achieving students or the low achieving students had dropped out, while the freshman sample contained a wider variance. Beyond failure experiences, other explanations could

be the transparency of educational requirements. Students who know what to expect in the lecture, what the educational goals are, and how they will be tested should have higher perceived academic control (Stupnisky et al., 2007). However, second-year students' expectancy about goals and tests may have been repeatedly unmet, or they may have missed critical information about the tests as teachers or instructors might failed to provide these as clearly in second year courses, leading to lower perceived control.

Concerning the invariances of the final path model across the two student groups, few structural paths significantly varied depending on students' year in university. Freshman students differed slightly from second-year students, not only in their level of perceived academic control, academic emotions and academic success, but also in some relationships between these crucial variables. In general, the students mainly differed concerning their dropout intention and factors influencing this intention to drop out of university. This difference could have occurred due to the special sample of second-year students. All participants in the second group already successfully completed their first academic year and therefore the sample did not include students who dropped out. This could also explain the lower anxiety and dropout intention mean level reports. Compared to the freshmen cohort, the path results of the second-year students are more in line with prior research, as perceived academic control now related to dropout intention directly (Ruthig's AERA presentation 2002 as cited in Perry et al., 2005a, p. 384). The more second-year students perceived control over their academic outcomes, the less they intended to drop out, independent of their academic emotions and achievement. Additionally, the predictive effect of perceived academic control on the achievement was stronger for second-year students compared to freshmen. These results demonstrate the importance of perceived academic control for the combined components of academic success in the second academic year. Furthermore, the results show the significance of enjoyment and boredom in the second academic year, due to the strong relationships to dropout intention, compared to the freshmen group where we found no relationship. Consistent with prior research (Ruthig et al., 2007), we found that enjoyment was a strong protective factor against dropout intention for second-year students.

Concerning achievement, the correlations differed between the two subgroups regarding enjoyment, only small relations for the freshmen group, and anxiety, only small relations for the second-year student group. Considering their specific predictive effects, enjoyment and boredom had medium to strong relationships with achievement for second-year students compared to freshmen, however were non-significant due to high standard errors. These could be due to multicollinearity between enjoyment and boredom, which are highly correlated ($r = -0.80$, **Table 2**), or due to the heterogeneous advanced sample, consisting of many different majors.

Finally, the results showed a small relationship between the two components of academic success for the total sample, which vanished when the two subgroups were compared. We found no specific relationship between dropout intention at the beginning of the semester with achievement at the end of the semester, when taking perceived academic control and academic emotions into account. These results replicate Bean's (1985), who found a significant relation between dropout intention and academic achievement only when considering all undergraduate students compared to the undergraduate cohorts separately. These path results are contrary to the correlations, where the freshmen group showed no relationship between the components of academic success, but the second-year student group showed a medium relation. This again underlines the importance of perceived academic control and anxiety, particularly for second-year students, as the specific impact of perceived academic control and anxiety reduces the dropout-achievement relation. It looks like freshman students tend to drop out at the beginning of their studies independent of their achievement later on. This suggests that dropout intention is specifically important for freshman students as even high achievers might have intentions to drop out. Moreover, the model for second-year students showed higher explained variance of achievement as well as dropout intention, compared to the model for freshmen. It seems the hypothesized model applies most closely for experienced students.

Strengths and Limitations

The results must be viewed within the strengths and limitations of the study. A major strength of the present study is that it focused on the critical first academic year as it influences overall academic success (Credé and Niehorster, 2012). Another contribution of our study is its extension of the limited research on dropout intention (Bean, 1982). The present study also improves upon prior higher education research that typically focuses on negative emotions (similar to Ruthig et al., 2008). Several methodological strengths of the present study include a field-based design within the natural environment, high ecological validity through a wide range of study subjects, time-delayed measurement of achievement, multi-item and established scales to create latent variables, and SEM to account for measurement errors and shared variance.

Although the study provided insights into the relationships between perceived academic control, academic emotions, and undergraduate students' academic success, there were limitations. One limitation may be that only GPA was measured following a time lag; therefore, causality interpretations are limited to the prediction of achievement. However, it is an important first step to understand the relations between perceived academic control, academic emotions, and academic success as well as the differences between freshmen and second-year students. Another limitation might be our operationalization of dropout intention. It included the likelihood to change majors, which could be understood as transition instead of dropout. However, this distinction is contextual as changing to another major represents a dropout for a particular major, but transition for the head of the university overall. Another limitation concerns the selection bias of the sample, as the students needed to attend the lecture to participate in the study. Considering the second-year students, the reason for the rather low response rates may be multifaceted: they have participated in many other student surveys, have more

complex timetables, practice more self-regulated learning behavior and therefore it could be unnecessary to attend the lecture or participate in the survey due to competing demands. The response rates of the second-year students should not have influenced our study results. However, the generalization of the results could be limited to high-motivated students, which regularly attend lectures. Finally, another limitation of the current study concerns the GPA release form. Students who did not allow us to obtain their GPA might be low-achievers, but many other explanations also could have occurred. In general, this selective sample could have biased the results to create larger effects or limited the variance to undermine our results.

CONCLUSION AND IMPLICATIONS FOR THE HIGHER EDUCATION

One major contribution of the present study is that it extends research on the predictive effects of perceived academic control and academic emotions on academic success by examining the intention to drop out of university as an additional outcome. Prospective research should test the model against actual dropout, despite its methodological challenges (Allen et al., 2008). Another primary finding of the present study is the importance of perceived academic control for academic success, specifically within the first year. An extension to the current study would be to examine the relationships of perceived academic control to other predictors for undergraduate students' academic success, such as achievement motivation (c.f. Hall et al., 2006; Daniels et al., 2014). Freshmen might have different goal orientations or different intrinsic motivation compared to second-year students due to their expectations and lack of experience. Due to multicollinearity, however, future research should analyze the relationships separately for each predictor in multiple studies. Furthermore, future research should include value in order to verify the full control-value theory (Pekrun, 2006) for freshman university students. However, the German freshmen chose their specific major for the whole Bachelor degree, which leads to high subjective value, and it is difficult to increase through institutional activities.

Our results highlight the possible protective effect of enjoyment for dropout intention, in addition to the avoidance of anxiety (similar to Ruthig et al., 2008), which should be established in subsequent research. Moreover, our results show specific characteristics of undergraduate students at certain times during their first two academic years, as we found slightly different results for incoming students compared to advanced students. Therefore, future research should analyze these characteristics in more detail and combine adjustment research with research focused on enhancing academic success. Moreover, researchers should also aim to reanalyze these interrelations with a complete cohort of university students, as our study included a selected sample. Moreover, possible reasons for dropout surrounding the GPA release form should be further investigated. However, due to the practical difficulties of a field study in general, we still achieved a high response rate for freshman students and a moderately acceptable response rate for second-year students. Finally, the present study illuminates the importance of perceived academic control and anxiety for academic success within the first two academic years. It would be interesting to follow up on the intraindividual development of these important predictors, in addition to this interindividual comparison. With a longitudinal design, subsequent researchers could identify possible feedback loops of the mediational effects of academic emotions on the relationship between perceived academic control and academic success, as well as establish the different impacts of course-, learning-, and test-related emotions. Moreover, further longitudinal studies can analyze the causality of perceived academic control on dropout intention via academic emotions.

Our results also have practical implications for higher education institutions. They show the importance of perceived academic control and academic emotions on academic success. Thus, instructors should support students' perceived academic control and positive academic emotions in order to reduce dropout intention and increase achievement. As perceived academic control linked to dropout intention in the current study, perceived academic control enhancement interventions (such as attributional retraining) would thus be logical techniques for universities to implement. Universities should offer attributional retraining early in the academic year (Perry et al., 2005a) or add the principles of it to freshman-level course (Ruthig et al., 2009). This would support students to reframe the way they think about failure as well as perceived control by encouraging them to assume responsibility and adopt a "can-do" attitude (Haynes et al., 2009). Likewise, the instructor can increase perceived academic control through information or discussions about good approaches to prepare for tests. This information enables students to anticipate academic outcomes and make the appraisal of achievement more transparent (Stupnisky et al., 2007; Ruthig et al., 2009). Similarly, instructors can create a high-control environment in their course, for example through clear course structure, transparent grading criteria, or being readily available for questions (Stupnisky et al., 2008) as well as enhancing individualistic and cooperative goal structures, adequate achievement expectations, or avoidance of cumulative failure feedback (Pekrun, 2006). Similarly, Tinto (2010) recommended early assessment and feedback to increase the predictability of the course demands, and therefor increase perceived academic control to reduce dropout intentions. Additionally, professors should pay attention to the students' emotions (Pekrun et al., 2011) in order to reduce dropout intentions. Universities could offer coaching regarding emotion regulation, as recommend by Hall and Goetz (2013). Moreover, our results emphasize the importance of the first months at university, as many freshman-supporting programs within higher education already assumed.

In conclusion, our findings provide new insights into the experiences of university students during their critical first two academic years and possible predictors of academic success, with respect to both reducing dropout intention and increasing academic achievement. Perceived academic control and academic emotions, specifically anxiety, do matter to

undergraduate students. Luckily, as noted above, they can be supported by higher education institutions.

ETHICS STATEMENT

This study was exempt from an ethic committee approval due to the recommendations of the German Research Association: All subjects were in no risk out of physical or emotional pressure, we fully informed all subjects about the goals and process of this study and none of the subjects were patients, minors or persons with disabilities.

AUTHOR CONTRIBUTIONS

LR drafted the work, which was revised critically by UN, RS, and TS. LR and UN contributed to all steps of the work. RS and TS contributed to the interpretation of the data for the work. All authors approve of the final version of the manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: http://journal.frontiersin.org/article/10.3389/fpsyg.2017.00243/full#supplementary-material

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Study II

Overall, Study II focused on the current emotional experiences of enjoyment, pride, anxiety, and anger while preparing for an important exam at the end of the critical first academic year. The study aimed to advance the trait-state debate of achievement emotions and analyzed the variance components, their interaction with PAC[2], and their relevance for achievement, operationalized by course grades. To realize this, the experience sampling method of the EsMon dataset (Figure 11) in combination with the STARTS modeling approach were used. Therefore, the second and third objectives were partly addressed. Study II was published by Contemporary Educational Psychology with the following citation under a Creative Commons Attribution License (CC BY 4.0; https://creativecommons.org/licenses/by/4.0/).

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[2] PAC was measured prior the experience sampling days with the multiple achievement emotion state questionnaires and directly post the exam experience (see EsMon dataset). A latent change score model of the pre and post test revealed no differences (χ^2 (20) = 26.69, p = 0.144, RMSEA = 0.06, CFI = 0.96, SRMR = 0.07; M = -0.03, p = 0.293, SD = 0.15).

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Adding previous experiences to the person-situation debate of achievement emotions

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ABSTRACT

When preparing for exams, students experience various achievement emotions, which are related to their perceived academic control and achievement regarding their exams. These emotions are shaped by a trait-like stable person-specific component and a state-like variable situation-specific component. Furthermore, it is plausible that students' previous emotional experiences might influence their current emotional experiences. Therefore, the present study aimed to disentangle those three components of achievement emotions (namely person, previous-experience, and situation specific components), and to analyze the extent to which these three components relate to perceived academic control and achievement. Using experience sampling, ninety-eight undergraduate students reported their emotions during the final week of exam preparation. Via latent state-trait theory models, including an autoregressive coefficient, our results showed the three expected variance components for enjoyment, anxiety, and anger, with no person-specific variance component for pride. The more stable components (namely person and previous-experience specific components) were significantly associated with perceived academic control and achievement, particularly for negative emotions. Moreover, results suggest a reciprocal relation between anxiety and perceived academic control. Implications for educators seeking to strengthen students' success are discussed.

1. Introduction

In university settings, the final exam period is typically emotional for undergraduate students. They experience various achievement emotions during this demanding phase, such as enjoyment, pride, anxiety, or anger. Consider Rick, who is preparing for an exam. As variability is an essential characteristic of emotional experiences (Frijda, 2007), we can assume that Rick's current exam-related emotional experiences are likely to vary throughout the day, from one day to the next, and might be influenced by different components. In general, Rick might feel anxious. This person-specific, trait-like factor might have an impact on his current emotional experience in each specific learning situation. Furthermore, quite intuitively, previous emotional experience might also have an impact on Ricks' current emotional experience, for example, previous experiences of anxiety after learning failure. Finally, the current experience of emotions is certainly also influenced by a situation-specific, state-like factor (e.g., current experiences of success). Overall, Rick's current experience of exam-related emotions might be simultaneously influenced by all three components; a person-specific, a previous emotional experience-specific, and a situation-specific component. A few prior research studies have already distinguished between trait and state components of achievement emotions and found these components to be quite balanced within achievement emotions (e.g., Nett, Bieg, & Keller, 2017). Nevertheless, prior research in the achievement setting usually did not consider previous experiences. Taking into account all three perspectives and disentangling these different components of students' experiences of achievement emotions might help to better understand achievement emotions in general. Thus, the first study purpose focused on understanding meaningful components of exam-related emotional experiences while preparing for an exam (using the aforementioned example of enjoyment, pride, anxiety, and anger). In turn, this could help to conceptualize the relation of emotional experiences with relevant variables, such as students' perception of being in control of their own learning progress, or with academic achievement itself. On a general person-specific trait level, we know that achievement emotions are related to students' perceived academic control (e.g., Ruthig et al., 2008) and to achievement (e.g., Pekrun, Lichtenfeld, Marsh, Murayama, & Goetz, 2017). Specifying how they relate when taking the three different components of achievement emotions into account might have an impact on research and practice in terms of improving the understanding of

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interrelations and processes of emotional experiences. Thus, the second study purpose focused on the relations of the postulated three components of students' current emotional experiences with the perception of their academic control and their academic achievement.

2. Theoretical background

2.1. Person, previous-experience, and situation specificity of achievement emotions

Achievement emotions can be defined as "emotions tied directly to achievement activities or achievement outcomes" (Pekrun, 2006, p. 317). According to Pekrun, Goetz, Titz, and Perry (2002), students most often reported the following emotions: anxiety, enjoyment, hope, pride, relief, and anger. The taxonomy of achievement emotions (Pekrun, 2006) defines specific emotions by differentiating those emotions on the dimensions of valence (positive vs. negative), object focus (activity vs. outcome), and activation (activating vs. deactivating). The present study sought out to describe the most frequent emotions by simultaneously representing positive and negative, as well as prospective and retrospective emotions of both activity and outcome foci (Pekrun, 2006) in a balanced way. Specifically, we focused on enjoyment (positive, activity focused, activating), pride (positive, retrospective outcome focused, activating), anxiety (negative, prospective outcome focused, activating), and anger (negative, activity focused, activating).

In general, prior research has mostly operationalized achievement emotions as either a trait, which is person-specific (e.g., Pekrun et al., 2017), or as a state, which is situation-specific (e.g., Goetz, Frenzel, Stoeger, & Hall, 2010). A few studies have considered both trait and state components together, and have distinguished between the influence of person-specific and situation-specific components on achievement emotions (e.g., Ahmed, van der Werf, Minnaert, & Kuyper, 2010; Nett et al., 2017). The results of these studies indicate that the variability of achievement emotions is equally distributed, with approximately 50% being person-specific and 50% being situation-specific (Nett et al., 2017; similar to mood Eid, 1997; or affect Yasuda, Lawrenz, van Whitlock, Lubin, & Lei, 2016). The differences between person-specific and situation-specific aspects also become more apparent when considering how they relate to different valanced emotions. For instance, person-specific (trait) components of different valenced emotions are typically unrelated to one another, whereas situation-specific (state) components of these emotions can be negatively related to one another (i.e., enjoyment or pride with anxiety or anger; Nett et al., 2017).

Prior research into emotions outside of the achievement context points to the importance of previous emotional experiences through the duration of emotional experiences. Specifically, the duration is longer for intense emotional experience and in highly valued situations, for instance, longer duration for enjoyment compared to anxiety or anger (Verduyn, Delvaux, van Coillie, Tuerlinckx, & van Mechelen, 2009). These longer durations imply that the emotions continue from one situation to the next. Such *carryover effects* between subsequent situations also suggest an influence of previous experience on the current emotional experience. For instance, Olatunji and Cole (2009) found that children's anxiety symptoms have a time-invariant trait, time-varying state influences, and an additional slow time-varying influence, which can be interpreted as an influence by previous experiences. In summary, it can be concluded that up until now, theory as well as research focused mainly on a stable, trait-like, person-specific variable, and a state-like, situation-specific component of achievement emotions. This study addresses a third and new component: previous experiences (which theoretical fundaments of achievement emotions mostly fail to consider).

2.2. Disentangling the person, previous-experience, and situation specificity of achievement emotions

One prominent theoretical framework concerning the person-situation debate and separating different components is the latent state-trait (LST) theory (Steyer, Mayer, Geiser, & Cole, 2015). It states that most psychological constructs have both person-specific (cf. trait) and situation-specific (cf. state) components (Steyer, Ferring, & Schmitt, 1992). Therefore, the LST simultaneously defines a latent trait, a latent state residual, and a measurement error variable as the sources of variance for a psychological construct. Moreover, recent developments in LST theory research have additionally considered the specific relationship between two consecutive occasions by including an autoregressive coefficient (Geiser, Hintz, Burns, & Servera, 2017; Prenoveau, 2016). Those methodologically similar models (e.g. Anusic & Schimmack, 2016; Cole, Martin, & Steiger, 2005; Eid, Holtmann, Santangelo, & Ebner-Priemer, 2017; Kenny & Zautra, 2001) labeled this autoregressive coefficient very differently, such as a "carryover effect" (Eid et al., 2017, p. 291), an "autoregressive trait" (Kenny & Zautra, 2001, p. 246), or a "change factor" (Anusic & Schimmack, 2016, p. 769). The autoregressive coefficient represents the shared variance of the current and the previous measurement after accounting for stable trait variance. Consequently, it can be interpreted as the influence of the previous measurement on the current measurement, independent from the trait influence.

Kenny and Zautra (1995) established a more economical single indicator model that separates stable from less stable variance components of constructs (cf. Fig. 1), introduced as the trait-state-error (TSE) model (Kenny & Zautra, 1995), and subsequently labeled as the STARTS model (Kenny & Zautra, 2001). A construct, measured by a single-item measurement n times, can be disentangled from a stable person-specific component (labeled as a stable trait), n previous experience-specific components (labeled as an autoregressive trait), and n situation-specific components (labeled as a state; Kenny & Zautra, 2001.) Thus, in this model, the situation-specific coefficient is confounded by the measurement error, contrary to the multi-indicator models (e.g., Eid et al., 2017).

2.3. Achievement emotions and their relation to students' perceived academic control and achievement

According to Pekruns' Control-Value Theory (2006), appraisals regarding the amount of subjective control and the value of the situation are important antecedents of achievement emotions. Thereby, the subjective control appraisal can be understood as perceived academic control (Pekrun et al., 2002). Perceived academic control is an internal attribution of achievement outcomes and reflects the individual students' belief in their capacity to influence their achievement outcome (Perry, Hladkyj, Pekrun, & Pelletier, 2001). This is considered to be essential for academic achievement, for instance, freshmen are at particularly high risk of experiencing low feelings of perceived academic control (Perry, 1991). Moreover, perceived academic control is considered to be a relatively stable psychological disposition, which changes mostly due to achievement experience, such as success or failure (Hall, 2008; Perry et al., 2001; Stupnisky, Perry, Hall, & Guay, 2012).

As stated in Control-Value Theory (Pekrun, 2006), students' perception of their academic control is related to achievement emotions (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011; Ruthig et al., 2008). In theory, the relationship between achievement emotions and perceived academic control can be reciprocal in nature (Pekrun, 2006); that is, emotions are predicted by prior control perceptions and could have an impact on future perceived control. However, prior research lacked an analysis of this reciprocal causation assumption.

Going back to the different variance components of achievement emotions, prior empirical research confirms the relevance of

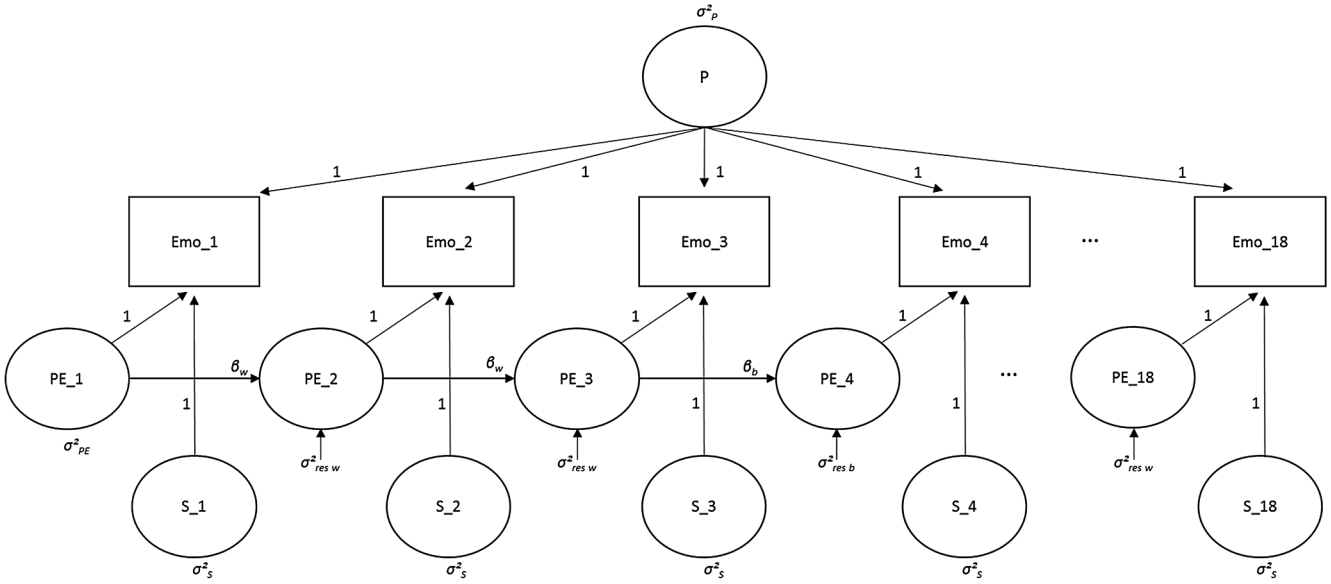

Fig. 1. Path diagram of the person/previous experience/situation model (analog to STARTS model by Kenny and Zautra (2001) with 18 measurements (cf. occasions). P = person-specific component (labeled as stable trait by Kenny and Zautra (2001); σ^2_P = variance of the person-specific component; all factor loadings are fixed to be equal. Emo = single-item measurement of an achievement emotion with 18 measurements. PE = previous experience-specific component (or autoregressive coefficient, labeled autoregressive trait by Kenny and Zautra (2001); β_w = path coefficients representing the autoregression of PE_{t-1} on PE_t within days; β_b = path coefficients representing the autoregression of PE_{t-1} on PE_t between days. S = situation-specific component (labeled as state by Kenny and Zautra (2001)); σ^2_S = variance of the situation-specific component, fixed to be equal across all measurements.

achievement emotions for perceived academic control and vice versa, when applying trait measures (stable person level). Perceived academic control was found to be positively related with positively valenced emotions, such as academic enjoyment (Buff, 2014) and pride (Schonwetter, Perry, & Struthers, 1993), and negatively related with negatively valenced emotions, such as anxiety (Niculescu, Tempelaar, Dailey-Hebert, Segers, & Gijselaers, 2016). In general, the effect size of the interrelations with positive trait emotions seems to be weaker than with negatively valenced trait emotions (e.g., Respondek, Seufert, Stupnisky, & Nett, 2017). When applying state measures (variable situational-level), slightly weaker relations were found (Goetz et al., 2010).

Also reflected in Pekruns' Control-Value Theory (Pekrun, 2006) is the fact that students' achievement emotions while preparing for an important exam are related to the anticipated result of this exam (Pekrun et al., 2017). Again, it is important to differentiate which component of emotions interact with achievement. Prior research mostly measured stable person-specific emotions: Students who experience positively valenced achievement emotions (i.e., enjoyment and pride) are more likely to achieve good grades, whereas negatively valenced achievement emotions (i.e., anger and anxiety) are related to low achievement (Pekrun & Stephens, 2010). Initial research results indicate that there are weak relations on a situational-level (Ketonen & Lonka, 2012).

To our knowledge, prior research failed to systematically separate person-specific, previous experience-specific, and situation-specific components of achievement emotions when analyzing the relation to perceived academic control or achievement. However, understanding the component-specific relations with constructs of academic success may further our understanding of what elicits achievement emotions on a person- or a situation-specific level, and how previous experience contributes. Imagine our initial example of Rick, who is slightly anxious about exams on a person-specific level. He is more likely to achieve a poor outcome. A way to support him might be to encourage his perceived academic control by reducing his anxiety level. Thus, it is interesting to consider whether the emotional support in specific situations could reduce his person-specific anxiety, and thereby change his odds.

2.4. Study purpose and hypotheses

The first purpose of the current study focused on the different emotional variance components and aimed to analyze if and how discrete achievement emotions differ proportionally. We hypothesized that students' current emotional experiences are substantially due to the person-specific (cf. trait) and the situation-specific (cf. state) component (cf. Nett et al., 2017), and additionally, to students' previous emotional experiences (see Fig. 1).

Furthermore, the second purpose focused on the relationship between the achievement emotion components and perceived academic control or achievement. We hypothesized that the more stable components (i.e., the person-specific and, to a lesser extent, the previous experience-specific components) would be related to perceived academic control reciprocally (cf. Pekrun, 2006), and additionally to the exam results (cf. Hall, 2008), with these relationships to be positive with positive achievement emotions, and negative with negative achievement emotions (cf. Ruthig et al., 2008).

Finally, we focused on enjoyment, pride, anxiety, and anger, which we selected due to their high frequency among higher education students (Pekrun et al., 2002), as reference to prior research (e.g., Ruthig et al., 2008), and primarily to cover positive and negative as well prospective and retrospective emotions of both activity and outcome foci (Pekrun, 2006). Moreover, we analyzed this by using an experience sampling approach during the final exam period (a highly relevant personal experience for undergraduate students).

3. Material and methods

3.1. Participants and procedure

Participants included 98 undergraduate students (60.8% women), whose mean age was 21.09 years, with a standard deviation of 2.41 (range from 18 to 35 years), from different disciplines (computer science, economics, physics, and psychology) attending a German university, with a focus on Science, Technology, Engineering, and Mathematics (STEM). All participants were at the end of their first academic year, and in their second exam period. Participants were

recruited using convenience sampling at an exam preparation training session at university. Participation was voluntary, and students signed an informed consent form and were able to withdraw their participation from the study at any time.

Data was collected via the experience sampling method (Augustine & Larsen, 2012; Csikszentmihalyi & Larson, 2014; Goetz, Bieg, & Hall, 2016) via iPod touch®, pre-programmed with the iDialogPad software (Mutz, 2014). Participants were assessed for six days prior to a very important exam. A randomized signaling protocol activated the device to signal at three randomly selected times between 10 AM and 8 PM, with a minimum time lag of two hours and a maximum time lag of three hours between signals. At each signal, the device prompted participants with a digital questionnaire about their current achievement emotions, which was to be completed immediately. This assessment procedure resulted in a maximum of 18 completed state questionnaires for each participant (6 days × 3 signals per day) or, in other words, 1774 measurement points in total (98 participants × 18 questionnaires per person). The participants missed 246 signals (86.05% compliance). The original sample of 100 participants was reduced based on the self-reports of two of the participants, who stated having simply clicked through the state questionnaires, resulting in a final sample size of 98 participants.

In addition to the experience sampling data collection, participants answered a trait questionnaire concerning their trait emotions and their perceived academic control both before the experience sampling phase, and right after finishing their exam. The questionnaire also included sociodemographic data. Additionally, all participants gave permission to release their exam results.

3.2. Measures

Established self-report scales were used for all measures. When necessary, items were adapted to the tertiary education context, with a specific focus on the upcoming exam (see Appendix A1 for concrete wording of items).

Achievement emotions. The short experience sampling questionnaires measured participants' current experience of enjoyment, pride, anxiety, and anger.[1] Each emotion was measured with a single-item using a five-point Likert-type scale (0 = *strongly disagree*; 4 = *strongly agree*). Achievement emotion items were adapted from the class-related emotions scale from the Achievement Emotions Questionnaire (AEQ; Pekrun et al., 2011). The items referred to the exam, which participants were preparing for and were introduced to with the wording "At the moment…" (for descriptive statistics, see Table1). The exact item wordings for enjoyment was "… I am looking forward to the exam" for pride "… I am proud of what I already achieved for the exam" for anxiety "… I am afraid of the exam" and for anger "… I am angry about the exam" (cf. Appendix A1). Due to the highly important context of exam preparation, overly long questionnaires were avoided. Therefore, single-items were used, which were found to be sufficiently valid in previous studies (cf. Cheung & Lucas, 2014; Gnambs & Buntins, 2017; Goetz et al., 2016; Gogol et al., 2014).

Perceived academic control. Participants' perceived academic control was measured using a trait questionnaire. Again, to avoid long questionnaires, perceived academic control was measured via four items from the Academic Control Scale (PAC; Perry, 1991) in its German version of Pekrun et al. (2004). An example item would be "I have a great deal of control over my academic performance." These items were also rated on a five-point Likert-type scale (0 = *strongly disagree*; 4 = *strongly agree*; M_{prior} = 3.02, SD_{prior} = 0.54; M_{post} = 2.97, SD_{post} = 0.61; Ω_{prior} = 0.67, Ω_{post} = 0.79; α_{prior} = 0.60, α_{post} = 0.70; $\gamma_{prior} = -0.36$, $\gamma_{post} = -0.39$).

[1] The present study focused on test-related emotions according to the Achievement Emotions Questionnaire (Pekrun et al., 2011), which does not include test-related boredom (Pekrun et al., 2011).

Table 1
Means and standard deviation of the achievement emotion measures.

Occasion	Enjoyment		Pride		Anxiety		Anger	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	1.28	1.05	2.27	1.14	1.99	1.27	1.59	1.27
2	1.31	1.07	2.17	1.08	1.91	1.25	1.72	1.28
3	1.37	1.09	2.13	1.11	2.02	1.19	1.80	1.23
4	1.28	1.17	2.16	1.21	2.09	1.29	1.92	1.36
5	1.23	1.05	2.09	1.19	1.94	1.25	1.79	1.24
6	1.12	1.05	2.06	1.08	1.92	1.19	1.81	1.27
7	1.05	1.00	1.89	1.07	2.03	1.19	1.74	1.29
8	1.13	1.00	1.86	1.11	2.07	1.21	1.86	1.25
9	1.24	1.00	2.01	1.08	1.91	1.23	1.71	1.27
10	1.13	0.99	1.98	1.18	1.97	1.22	1.62	1.33
11	1.24	1.02	1.79	1.06	1.93	1.32	1.67	1.39
12	1.20	0.95	1.82	1.03	1.99	1.20	1.76	1.24
13	1.15	1.03	1.81	1.17	2.09	1.29	1.61	1.25
14	1.19	1.05	1.80	1.12	2.03	1.27	1.81	1.23
15	1.37	1.06	1.98	1.10	1.92	1.24	1.29	1.08
16	1.12	0.98	1.95	1.09	2.00	1.20	1.56	1.20
17	1.22	1.16	1.71	1.16	2.18	1.28	1.74	1.32
18	1.15	1.15	1.73	1.14	2.28	1.30	1.74	1.28

Note. Each emotion was measured with a single-item using a five-point Likert-type scale (0 = strongly disagree; 4 = strongly agree).

Academic achievement. Academic achievement was operationalized via participants' exam results (grades), obtained from each lecturer. The exam results were transformed and group-centered by each specific course cohort overall mean, in order to accommodate for the various course requirements of the different disciplines. However, complexity or difficulty of the exam were quite similar. The exam was characterized as being foremost mathematical in nature, vital, and obligatory for participants' studies, and as having a high failure rate. In the presented data, a higher exam result reflects higher academic achievement (M = 0.02, SD = 1.05; ranging from −3.00 to 2.00).

3.3. Rationale for analyses

Concerning the first study purpose, we estimated a STARTS model (Kenny & Zautra, 2001; Fig. 1) for each achievement emotion (enjoyment, pride, anxiety, and anger) and verified the three variance components by comparing them with alternative models (as recommended by Kenny & Zautra, 1995). We tested if a model that contained only the person-specific and the situation-specific component (first estimated *person/situation model*) or a model that contained only the previous experience-specific and the situation-specific component (second estimated *previous experience/situation model*) fit the observed data better than a model that specifies all three components (third estimated *person/previous experience/situation model*). In this final model (Fig. 1), the total amount of variance of all three components is assumed to be equal at all times (all factor loadings fixed at 1 and state variance σ_S set as equal). Moreover, we assumed that the autoregressive paths estimates were equally spaced within a day (morning to midday to evening; β_w) and between two days (evening to morning; β_b). Although the signaling was slightly randomized (in contrast to the autoregressive structure assumption; Biesanz, 2012; Kenny & Zautra, 1995, 2001), we assessed similar time lags within one day (from two at minimum to a maximum three-hour lag between signals). When interpreting the data, we are aware that due to our single indicator model, our state coefficient is confounded with the measurement error, and we cannot account for the method effects or measurement invariance (Prenoveau, 2016).

Concerning the second study purpose, we added perceived academic control prior to the experience sampling period, or perceived academic control after the exam, or achievement separately to each

final emotional variance component model. Using linear regression, we tested the effect of each emotional variance component on perceived academic control either prior to or following the exam, and on the exams' achievement. All analyses were executed using the M*plus* software 7.31 (Muthén & Muthén, 1998–2012). Missing data was accounted for by using the full information maximum likelihood estimator (FIML),[2] applying the robust full maximum likelihood estimator (MLR) to address possible concerns about the distributions of the variables (Muthén & Muthén, 1998–2012). We considered various fit indices based on Hu and Bentler (1999). Model fit was assessed using chi-square (χ^2), root-mean-square error of approximation (RMSEA ≤ 0.06), comparative fit index (CFI ≥ 0.95), and standardized root mean square residual (SRMR ≤ 0.08). Syntaxes of the models are provided as Supplementary materials.

4. Results

4.1. Person, previous-experience, and situation specificity of achievement emotions

Regarding our first study purpose, we compared three alternative models for each achievement emotion (Table 2) in order to distinguish between person-specific, previous experience-specific, and situation-specific components. Considering a potential multi-level structure due to the students' different disciplines, the effect of these clusters was negligible (ICCs ≤ 0.01). Moreover, we found similar results regarding model fit and model estimates when considering the multi-level structure via the command TYPE IS COMPLEX. As the number of parameters was more than the number of clusters minus the number of strata, with more than one cluster, this resulted in unreliable standard errors. Thus, we have reported the results of the model that did not consider the multi-level structure.

Considering the fit indices for *enjoyment*, the observed data fit the person/previous experience/situation model best (Table 2), with strong standardized autoregression coefficients linking two measurements ($\beta_{within\ day} = 0.92$, $p < .001$; $\beta_{between\ days} = 0.87$, $p < .001$). The variance of enjoyment was mainly explained by the person-specific component (46.83% [43.62%–47.63%], $p < .001$), followed by the previous experience-specific component (29.01% [17.02%–32.16%], $p = .010$) and the situation-specific component (24.16% [39.36%–20.21%], $p < .001$).

Concerning *pride*, the observed data fit the alternative previous experience/situation model the best (Table 2), with very strong standardized autoregression coefficients linking two measurements ($\beta_{within\ day} = 0.98$, $p < .001$; $\beta_{between\ days} = 0.94$, $p < .001$). The more complex person/previous experience/situation model had a worse model fit, and a nonsignificant variance for the person-specific component and autoregressive coefficient. The variance of pride did not depend on a person-specific component, and was mainly explained by the previous experience-specific component (76.59% [75.20%–77.45%], $p < .001$), and the situation-specific component (23.41% [24.80%–22.55%], $p < .001$).

The observed data for *anxiety* fit the person/previous experience/situation model the best (Table 2), with strong standardized autoregression coefficients linking two measurements ($\beta_{within\ day} = 0.86$, $p < .001$; $\beta_{between\ days} = 0.77$, $p < .001$). The current experience of anxiety depends on the amount of person-specific anxiety, the previous experience of anxiety, and the current situation-specific anxiety. The variance of anxiety was mainly explained by the person-specific component (55.66% [56.24%–55.40%], $p < .001$), followed by previous experience-specific component (24.72% [23.05%–25.55%], $p < .001$), and the situation-specific component (19.62% [20.71%–19.05%], $p < .001$).

Finally, we confirmed the person/previous experience/situation model for *anger* (Table 2), with strong standardized autoregression coefficients linking two measurements ($\beta_{within\ day} = 0.84$, $p < .001$; $\beta_{between\ days} = 0.72$, $p < .001$). The current experience of anger depends on the amount of person-specific anger, previous experiences of feeling angry, and the feelings of anger in the current situation. The variance of anger was also mainly explained by the person-specific component (49.05% [47.94%–49.63%], $p < .001$), followed by previous experience-specific component (27.41% [25.25%–28.38%], $p < .001$), and the situation-specific component (23.54% [26.81%–21.99%], $p < .001$).

Overall, the results suggest three variance components for achievement emotions experienced while preparing for an exam (with the exception of pride). Moreover, the results also suggest equal variance distribution between the person-specific component and the sum of the previous experience-specific component, and the situation-specific components. We could therefore confirm our first hypothesis regarding enjoyment, anxiety, and anger.

4.2. Achievement emotions and their relation to students' perceived academic control and achievement

Concerning our second study purpose, we separately tested for meaningful relationships between each of the previously confirmed emotional variance components of each achievement emotion and perceived academic control and achievement (Tables 3–6).

First, we tested for meaningful reciprocal relationships between the emotional variance components and perceived academic control. For *enjoyment*, there was no systematic relationship between the three variance components and perceived academic control prior to or following the exam (Table 3). Only for a few occasions is the situation-specific variance component of enjoyment meaningfully positively related to perceived academic control following the exam. For *pride*, there were positive relationships between most of the previous experience-specific components and perceived academic control following the exam (Table 4). For *anxiety*, there were negative relationships between the person-specific component and perceived academic control prior to and following the exam, similar to the previous experience-specific component (Table 5). Occasionally, however, the situation-specific anxiety components were positively related to perceived academic control prior to and following the exam. For *anger*, the person-specific variance component was negatively related to perceived academic control following the exam. Further, there were just a few negative relationships between the previous experience-specific variance components with perceived academic control prior to, and following, the exam (Table 6). Additionally, occasionally the previous anger experience-specific component and the situations-specific anger component showed relations with perceived academic control prior to and following the exam, both positively and negatively.

In a second step, we tested for meaningful relations between the emotional variance components and achievement in the exam (Tables 3–6). For *enjoyment*, there was a positive relation between the person-specific enjoyment component and achievement (Table 3). Furthermore, the results indicated a relationship between half of the previous experience specific enjoyment components and achievement, thus not immediately before the exam. For *pride*, there was a similar positive relationship between the previous experience specific variance component and achievement, and very few meaningful relationships with the situation-specific component (Table 4). For *anxiety*, there was a negative relationship between the person-specific component and achievement. Furthermore, negative relationships occurred between previous experience-specific variance components and achievement (Table 5). Few of the situation-specific anxiety measures were positively related to the exam results. For *anger*, there was a negative relationship between the person-specific component and achievement.

[2] The assumption of missing completely at random (MCAR) was confirmed via Little's MCAR-test ($\chi^2 = 4167.62$, χ^2df = 4360, $p = .981$).

Table 2
Fit indices of variance decomposition models.

Model	χ^2	χ^2df	RMSEA (90% C.I.)	CFI	SRMR	BIC[1]	AIC
Enjoyment							
1. Person/situation	337.97***	169	0.10 (0.05 0.12)	0.83	0.09	3259.98	3271.44
2. Previous experience/situation	229.20***	167	0.06 (0.04 0.08)	0.94	0.08	3125.10	3137.70
3. Person/previous experience/situation	228.14***	166	0.06 (0.04 0.08)	0.94	0.08	3124.33	3137.51
Pride							
1. Person/situation	372.89***	169	0.11 (0.10 0.13)	0.82	0.10	3430.51	3441.97
2. Previous experience/situation	227.43**	167	0.06 (0.04 0.08)	0.95	0.08	3260.78	3273.38
3. Person/previous experience/situation	226.69***	166	0.06 (0.04 0.08)	0.95	0.08	3261.11	3274.29
Anxiety							
1. Person/situation	391.87***	169	0.12 (0.10 0.13)	0.81	0.10	3632.09	3643.55
2. Previous experience/situation	254.92***	167	0.07 (0.06 0.09)	0.93	0.07	3463.82	3476.43
3. Person/previous experience/situation	250.56***	166	0.07 (0.05 0.09)	0.93	0.07	3459.45	3472.63
Anger							
1. Person/situation	326.21***	169	0.10 (0.08 0.11)	0.84	0.11	3920.76	3932.21
2. Previous experience/situation	208.10***	167	0.05 (0.02 0.07)	0.96	0.09	3780.11	3792.72
3. Person/previous experience/situation	200.00*	166	0.05 (0.01 0.07)	0.97	0.08	3771.94	3785.11

Note. person/situation model = decomposes a person-specific and situation-specific component, previous experience/situation model = decomposes a previous experience-specific and situation-specific component, person/previous experience/situation model = decomposes a person-specific, previous experience-specific, and situation-specific component. $N = 98$.

[1] Sample-size adjusted BIC.

* $p \leq 0.050$.

** $p \leq 0.010$.

*** $p \leq 0.001$.

There were only a few negative relationships between some previous experience-specific variance components and achievement (Table 6).

In summary, perceived academic control a week before, and immediately following, the exam was strongly related to anxiety, especially during the days before the exam. We could only confirm the impact of perceived academic control on anxiety prior to the exam. However, we could confirm the impact of the more stable variance components (person-specific and previous experience-specific) on perceived academic control following the exam. Additionally, achievement was strongly related to the more stable components of negative emotions. Overall, the results indicate different patterns for the achievement emotions' variance components. Our results also support our second hypothesis concerning the relationship between the person-specific variance component and the previous experience-specific component and achievement emotions. Those relationships were mostly as expected: positive for positive emotions and negative for negative emotions. Finally, the situation-specific component of the current emotional experience showed almost no meaningful relationship to perceived academic control and achievement.

5. Discussion

Preparing for an important exam is highly relevant for undergraduate students. Various emotions arise and can influence students' success. Therefore, the first purpose of the present study was to analyze to what extent a current emotional experience depends on either the person-specific, the previous experience-specific, or the situation-specific component. The second purpose was to analyze the relationships of these three emotional variance components with perceived academic control and achievement.

5.1. Person, previous-experience, and situation specificity of achievement emotions

Our findings confirmed all three variance components for enjoyment, anxiety, and anger. Thereby, around 50% of the variance distribution of the person-specific component is in line with previous studies (Nett et al., 2017). Students' emotional experiences of enjoyment, anxiety, and anger in a specific learning situation are predominantly influenced by their time-stable habitual tendencies. In addition to prior research, however, the study suggests that the remaining variance is not only associated with the situation-specific component, but also depends on previous emotional experiences. The study provides further evidence that achievement emotions are characteristically different, boarding Pekrun et al. (2011), as the relative proportion of the three variance components differ considerably across the three achievement emotions. The experience of negative emotions strongly depends on the person-specific component compared to positive emotions. Thus, anxiety showed the highest amount of person-specific variance (cf. Nett et al., 2017; Spielberger, 1966) and the lowest amount of situation-specific variance. Enjoyment had the highest amount of situation-specific variance. Therefore, the study suggests that of the emotions explored, enjoyment might be the most variable emotion, and anxiety the most stable emotion.

For pride, however, previous experiences and the situational component seem to predominate the person-specific component. The person specificity might be unimportant because pride is a retrospective emotion, whereas it might be important to acknowledge the influence of previous emotional experiences rather than the influence of the person-specific component. The study supports the assumption of Pekrun (2006) that pride, an outcome orientated emotion, occurs after achievement feedback. Further, students constantly monitoring their own knowledge or learning outcome might suggest carryover effects for pride while preparing for an exam. Overall, the difference in the variance components demonstrates the importance of carefully distinguishing the different variance components of achievement emotions when considering the person–situation debate.

Regarding the strength of the autoregressive path (cf. carryover effect) for all four emotions, the confirmed high impact of previous experience on current emotional experiences might be due to the high importance of the exams in our study (cf. Verduyn et al., 2009). However, the small-time lags between the experience sampling assessments might also be a reason for the relatively high autoregressive path estimates (Eid, Courvoisier, & Lischetzke, 2014). Similarly, the study revealed smaller values overall for the autoregressive path between days (overnight) compared to within days (few hours apart). Interestingly, positive emotions seem to have stronger emotional carryover effects than negative emotions. Perhaps the experience of positive

Table 3
Linear regressions between emotional variance components of enjoyment and perceived academic control and achievement.

Variable		PAC_{prior}			PAC_{after}			Achievement		
Variance component		Person	Previous experience	Situation	Person	Previous experience	Situation	Person	Previous experience	Situation
Occasions	1	−0.10 (0.526)	0.31 (0.110)	0.47**	#128;0.19 (0.214)	0.41*	0.37*	0.33**	0.38**	0.08 (0.448)
	2		0.20 (0.336)	−0.06 (0.783)		0.36*	−0.18 (0.295)		0.38**	0.09 (0.394)
	3		0.13 (0.575)	0.15 (0.430)		0.36*	0.39*		0.39**	0.22*
	4		−0.03 (0.871)	−0.22 (0.179)		0.23 (0.244)	0.06 (0.607)		0.34**	0.07 (0.360)
	5		−0.06 (0.763)	0.07 (0.736)		0.15 (0.542)	−0.11 (0.457)		0.30**	−0.07 (0.436)
	6		−0.11 (0.540)	−0.15 (0.287)		0.10 (0.749)	−0.25 (0.072)		0.29***	−0.01 (0.973)
	7		−0.14 (0.505)	0.24 (0.132)		0.12 (0.672)	0.28*		0.27**	0.13 (0.391)
	8		−0.22 (0.301)	−0.23 (0.131)		0.06 (0.864)	−0.17 (0.373)		0.24*	−0.12 (0.357)
	9		−0.24 (0.298)	−0.09 (0.622)		0.04 (0.913)	−0.22 (0.196)		0.23*	−0.08 (0.458)
	10		−0.24 (0.364)	−0.01 (980)		0.10 (0.708)	0.12 (0.430)		0.24 (0.068)	−0.02 (0.862)
	11		−0.24 (0.398)	0.08 (0.548)		0.11 (0.703)	0.08 (0.586)		0.24 (0.077)	−0.10 (0.195)
	12		−0.27 (0.293)	−0.03 (0.893)		0.08 (0.789)	0.06 (0.698)		0.28 (0.053)	0.11 (0.313)
	13		−0.26 (0.271)	0.16 (0.232)		−0.01 (0.971)	0.42*		0.29 (0.052)	0.27**
	14		−0.29 (0.181)	−0.08 (0.633)		−0.20 (0.460)	−0.43*		0.24 (0.132)	−0.10 (0.396)
	15		−0.31 (0.138)	0.02 (0.892)		−0.23 (0.306)	−0.24 (0.053)		0.22 (0.197)	−0.02 (0.862)
	16		−0.41 (0.085)	−0.18 (0.208)		−0.13 (0.581)	0.01 (0.952)		0.19 (0.357)	0.03 (0.800)
	17		−0.38 (0.102)	−0.09 (0.402)		−0.06 (0.770)	−0.09 (0.541)		0.16 (0.515)	−0.07 (0.457)
	18		−0.33 (0.165)	−0.01 (0.983)		−0.01 (0.963)	0.21 (0.083)		0.16 (0.536)	0.06 (0.552)

Note. standardized correlation estimates, PAC_{prior} = perceived academic control prior to the experience sampling phase, PAC_{after} = perceived academic control after the taken exam, person-specific = person-specific component of the person/previous experience/situation model, previous experience = previous experience-specific component of the person/previous experience/situation model, situation = situation-specific component of person/previous experience/situation model, nonsignificant p-value in parentheses. $N = 98$.

* $p \leq 0.050$.

** $p \leq 0.010$.

*** $p \leq 0.001$.

Table 4
Linear regressions between emotional variance components of pride and perceived academic control and achievement.

Variable		PAC_{prior}		PAC_{after}		Achievement	
Variance component		Previous experience	Situation	Previous experience	Situation	Previous experience	Situation
Occasions	1	0.16 (0.256)	0.10 (0.682)	0.57***	0.32 (0.099)	0.30**	0.09 (0.473)
	2	0.15 (0.250)	0.20 (314)	0.56***	0.21 (0.264)	0.30**	0.26*
	3	0.15 (0.265)	0.08 (0.603)	0.55***	0.19 (0.268)	0.29**	−0.01 (0.948)
	4	0.12 (0.363)	−0.14 (0.339)	0.49***	−0.25 (0.084)	0.27**	−0.02 (0.849)
	5	0.11 (0.368)	0.11 (0.401)	0.49***	0.21 (0.101)	0.27**	0.16 (0.074)
	6	0.11 (0.397)	0.00 (0.994)	0.48***	−0.12 (0.436)	0.25*	−0.17 (0.188)
	7	0.09 (0.505)	−0.13 (0.456)	0.49***	−0.09 (0.563)	0.25*	0.12 (0.396)
	8	0.08 (0.516)	0.04 (0.736)	0.49***	−0.04 (0.757)	0.23*	−0.02 (0.869)
	9	0.08 (0.542)	−0.13 (0.442)	0.49***	−0.03 (0.824)	0.23*	−0.10 (0.514)
	10	0.08 (0.518)	0.20 (0.128)	0.49***	0.31*	0.21*	0.04 (0.710)
	11	0.07 (0.580)	0.03 (0.867)	0.48***	0.02 (0.913)	0.21*	0.01 (0.855)
	12	0.06 (0.652)	−0.19 (0.419)	0.47***	−0.26 (0.122)	0.20 (0.059)	−0.31**
	13	0.04 (0.770)	−0.10 (0.458)	0.43**	0.01 (0.958)	0.20*	0.11 (0.221)
	14	0.04 (0.775)	0.17 (0.257)	0.43**	0.04 (0.756)	0.20*	0.11 (0.270)
	15	0.02 (0.858)	0.10 (0.490)	0.42**	−0.01 (0.976)	0.19 (0.068)	0.03 (0.814)
	16	−0.03 (0.829)	−0.20 (0.192)	0.38*	−0.19 (0.189)	0.16 (0.138)	−0.11 (0.336)
	17	−0.04 (0.775)	−0.16 (0.370)	0.37*	−0.09 (0.563)	0.16 (0.152)	−0.05 (0.724)
	18	−0.04 (0.759)	−0.06 (0.679)	0.38**	0.17 (0.139)	0.16 (0.157)	−0.00 (0.971)

Note. standardized correlation estimates, PAC_{prior} = perceived academic control prior to the experience sampling phase, PAC_{after} = perceived academic control after the taken exam, previous experience = previous experience-specific component of the previous experience/situation model, situation = situation-specific component of previous experience/situation model, nonsignificant p-value in parentheses. $N = 98$.

* $p \leq 0.050$.

** $p \leq 0.010$.

*** $p \leq 0.001$.

emotions is more memorable to students in the context of exam preparations. Further, the study also indicated very high autoregressive paths for pride, which could reflect a single latent variable rather than an autoregressive coefficient (Cole et al., 2005). Although the model comparison indicates that pride seems to have a rather different variance components structure compared to other achievement emotions, future research should investigate if these findings are stable across different time lags (see Implications for Future Research).

Overall, we assume that those high short-term stabilities or carryover effects (Anusic & Schimmack, 2016; Eid et al., 2017) could manifest as changes of the person-specific component mean, which would expand on previous theoretical assumptions (Pekrun, 2006). In other words, if the experience of a specific emotion within a learning situation can be intensified by the experience of the same emotion in previous learning situations, these experiences in specific situations might carryover to the person-specific component. Thus, the impact of previous experiences could explain how generally stable person-specific traits might be influenced by situation-specific components via carryover effects. This assumption, however, should be further elaborated in future research (see Implications for Future Research).

5.2. Achievement emotions and their relation to students' perceived academic control and achievement

Our results partially confirmed that positive emotions generally enhance perceived academic control and achievement, and are enhanced by perceived academic control, with reverse relations to negative emotions. It should be noted that this pattern of results must be seen within the context of an exam that is highly valued, as achievement emotions are less relevant when the test is of low importance to students (Peterson, Brown, & Jun, 2015).

For *enjoyment*, the mostly nonsignificant relationships between all three variance components of enjoyment and perceived academic control were, to some extent, in line with prior research (cf. e.g., Ruthig et al., 2008). Further, similar to prior research (cf. e.g., Ahmed, van der Werf, Kuyper, & Minnaert, 2013), the more stable variance components of students' enjoyment while preparing for an exam (person- and previous experience-specific components) related positively with higher achievement on the exam.

For *pride*, the meaningful and strong positive relationships between the previous experience-specific component of pride and perceived academic control (cf. e.g., Schonwetter et al., 1993) and achievement (cf. e.g., Pekrun & Stephens, 2010) highlights the importance of the previous experience-specific component. Interestingly, the perceived control reported a week prior to the exam did not meaningfully relate to prideful experiences during the exam preparation week, contrary to the assumption of Control-Value Theory (Pekrun, 2006). This could be due to the retrospective character of pride. Perhaps participants first need to positively evaluate their learning, and experience positive learning outcomes (i.e., successfully self-testing their learning content of the upcoming exam) before experiencing pride.

For *anxiety*, the person-specific component was negatively related to perceived academic control and achievement, in line with prior research (cf. e.g., Pekrun & Stephens, 2010). Anxiety was the only emotion in our study to support the postulated feedback loops in Control-Value Theory (Pekrun, 2006). This could possibly be due to the highly valued situation of exam preparation, where the interfering effects of test anxiety might be stronger. In addition, carryover effects indicated that anxious experiences while preparing for the exam might possibly lead to maladaptive cycles: The higher the number of anxious previous experiences students had, the lower their perceived control following the exam, and the lower their achievement in the exam. These results strengthen prior research on test anxiety (for an overview, see Zuckerman & Spielberger, 2015).

Table 5
Linear regressions between emotional variance components of anxiety and perceived academic control and achievement.

Variable		PAC_{prior}			PAC_{after}			Achievement		
Variance component		Person	Previous experience	Situation	Person	Previous experience	Situation	Person	Previous experience	Situation
	1		0.20 (0.412)	0.19 (0.442)		−0.39**	−0.08 (0.643)		−0.01 (0.961)	0.16 (0.283)
	2		0.14 (0.579)	−0.06 (0.800)		−0.39**	−0.06 (0.636)		−0.10 (0.770)	−0.12 (0.194)
	3		0.11 (0.647)	−0.03 (0.894)		−0.39**	0.05 (0.743)		−0.28 (0.112)	−0.03 (0.837)
	4		0.10 (0.626)	−0.21 (0.339)		−0.39**	−0.49**		−0.31*	−0.23 (0.118)
	5		0.16 (0.427)	−0.05 (0.839)		−0.35**	0.15 (0.396)		−0.05 (0.976)	0.25 (0.067)
	6		0.34 (0.118)	0.44***		−0.35**	0.37***		−0.33*	0.11 (0.438)
	7		0.01 (0.979)	−0.32 (0.095)		−0.48***	−0.26 (0.109)		−0.46***	−0.17 (0.330)
	8		−0.02 (0.958)	0.09 (0.611)		−0.47***	0.02 (0.873)		−0.46***	−0.04 (0.747)
	9		−0.11 (0.797)	0.21 (0.240)		−0.47***	0.11 (0.547)		−0.46***	−0.06 (0.696)
Occasions		−0.29*			−0.38***			−0.37***		
	10		−0.37 (0.112)	−0.39*		−0.54**	−0.53***		−0.48***	−0.08 (0.576)
	11		−0.40 (0.058)	−0.16 (0.445)		−0.50*	−0.19 (0.270)		−0.48***	−0.14 (0.400)
	12		−0.44*	0.07 (0.674)		−0.48*	0.06 (0.682)		−0.49***	0.17 (0.335)
	13		−0.48*	−0.07 (0.652)		−0.40*	−0.15 (0.422)		−0.50***	−0.17 (0.198)
	14		−0.47*	−0.01 (0.974)		−0.36**	0.23 (0.078)		−0.48***	−0.04 (0.724)
	15		−0.51**	−0.14 (0.333)		−0.37**	−0.17 (0.302)		−0.48***	−0.09 (0.479)
	16		−0.53*	0.01 (0.928)		−0.36**	−0.03 (0.827)		−0.44***	0.06 (0.517)
	17		−0.51*	−0.04 (0.789)		−0.34**	−0.04 (0.794)		−0.43***	0.03 (0.739)
	18		−0.50*	−0.13 (0.387)		−0.33*	0.03 (0.850)		−0.43***	−0.11 (0.288)

Note. standardized correlation estimates, PAC_{prior} = perceived academic control prior to the experience sampling phase, PAC_{after} = perceived academic control after the taken exam, person-specific = person-specific component of the person/previous experience/situation model, previous experience = previous experience-specific component of the person/previous experience/situation model, situation = situation-specific component of person/previous experience/situation model, nonsignificant p-value in parentheses. $N = 98$.

* $p \leq 0.050$.

** $p \leq 0.010$.

*** $p \leq 0.001$.

Table 6
Linear regressions between emotional variance components of anger and perceived academic control and achievement.

Variable		PAC_{prior}			PAC_{after}			Achievement		
Variance component		Person	Previous experience	Situation	Person	Previous experience	Situation	Person	Previous experience	Situation
	1		−0.04 (0.843)	−0.11 (0.560)		−0.22 (0.267)	−0.29 (0.213)		−0.38 (0.116)	0.05 (0.749)
	2		−0.01 (0.985)	0.08 (0.654)		−0.18 (0.411)	0.31*		−0.41*	−0.25*
	3		−0.01 (0.966)	−0.04 (0.832)		−0.27 (0.154)	−0.36**		−0.40 (0.122)	−0.10 (0.501)
	4		0.02 (0.919)	−0.16 (0.345)		−0.15 (0.434)	−0.13 (0.386)		−0.21 (0.612)	−0.08 (0.555)
	5		0.13 (0.504)	−0.01 (0.981)		−0.01 (0.994)	0.04 (0.827)		−0.02 (0.960)	0.06 (0.702)
	6		0.25 (0.185)	0.32*		0.12 (0.594)	0.26*		0.11 (0.663)	0.26*
	7		0.07 (0.700)	−0.16 (0.474)		−0.03 (0.889)	−0.07 (0.735)		−0.15 (0.705)	−0.26 (0.126)
	8		0.04 (0.832)	−0.02 (0.919)		−0.08 (0.706)	0.09 (0.597)		−0.17 (0.715)	0.20 (0.132)
	9		0.02 (0.918)	0.16 (0.371)		−0.17 (0.356)	−0.04 (0.798)		−0.27 (0.428)	−0.02 (0.883)
Occasions		−0.28 (0.057)			−0.31*			−0.39***		
	10		−0.15 (0.439)	−0.09 (0.573)		−0.31 (0.083)	−0.03 (0.862)		−0.41*	−0.13 (0.379)
	11		−0.21 (0.265)	−0.04 (0.874)		−0.40*	−0.19 (0.238)		−0.47***	−0.28**
	12		−0.29 (0.125)	−0.04 (0.825)		−0.43*	−0.20 (0.172)		−0.49***	0.04 (0.768)
	13		−0.42*	−0.36*		−0.37 (0.089)	−0.35 (0.073)		−0.49***	−0.04 (0.842)
	14		−0.35 (0.174)	0.14 (0.392)		−0.21 (0.510)	0.35*		−0.48**	−0.14 (0.303)
	15		−0.38 (0.164)	−0.04 (0.894)		−0.17 (0.632)	−0.01 (0.955)		−0.46**	0.04 (863)
	16		−0.38 (0.210)	−0.07 (0.725)		−0.06 (0.840)	0.16 (0.450)		−0.36 (0.225)	0.11 (0.364)
	17		−0.32 (0.288)	0.12 (0.340)		−0.06 (0.788)	0.01 (0.941)		−0.11 (0.777)	−0.03 (0.825)
	18		−0.37 (0.105)	−0.27*		−0.08 (0.682)	−0.08 (0.592)		−0.05 (0.861)	0.06 (0.573)

Note. standardized correlation estimates, PAC_{prior} = perceived academic control prior to the experience sampling phase, PAC_{after} = perceived academic control after the taken exam, person-specific = person-specific component of the person/previous experience/situation model, previous experience = previous experience-specific component of the person/previous experience/situation model, situation = situation-specific component of person/previous experience/situation model, nonsignificant p-value in parentheses. $N = 98$.

* $p \leq 0.050$.

** $p \leq 0.010$.

*** $p \leq 0.001$.

For *anger*, the negative relationship between the person-specific component and perceived academic control following the exam, and upon getting their grades, expands prior research findings, which mainly focused on anxiety as a representation of negative achievement emotions (cf. e.g., Niculescu et al., 2016). In general, only the person-specific component of the current experience of anger seems to be relevant for perceived academic control or achievement.

Overall, this study expands on previous research by analyzing the relationships separately for all three emotional variance components. Thereby, we confirmed the relevance of the more stable variance components (person- and previous experience-specific component) for the relatively stable constructs of perceived academic control and achievement, broadening the works of Perry et al. (2001) or Schonwetter et al. (1993). This was especially the case for negative or outcome-related emotions, such as pride or anxiety. If the experienced emotions are partly stable (previous experience-specific component), then those partially stable portions of emotion are still relevant for the rather stable constructs of perceived academic control and achievement. Furthermore, we only found the expected reciprocal relationship between control perception and achievement emotions for person-specific anxiety, and most of the previous experience anxiety, reflecting high significance of anxiety for exam preparation. An explanation for this could be that the postulated reciprocal relationships only occur for highly frequent emotions. Finally, the highly variable portion of emotions (situation-specific component) showed generally no meaningful relevance. However, in some occasions, the relationships were unexpectedly meaningful (contrary to the hypothesized direction). For instance, the situation-specific anxiety sometimes related negatively or even positively to prior-examination perceived academic control. These results were most likely confounded by measurement error and chance, and highlight the emotional situation-specificity or variability. Overall, the relevance of achievement emotions for perceived academic control and academic achievement appears to rise with repetitive experiences.

6. Implications and conclusions

In conclusion, the present study expands the person–situation debate for achievement emotions with a third variance component: previous experience. This approach could help researchers and practitioners to find more ways to evaluate students' emotions more precisely and support students' emotion regulation.

6.1. Implications for future research

The present study used an application of latent state–trait models with autoregressive effects and intensive longitudinal data. Future research could use this method combination for a clear separation and detailed analysis of the impact of different variance components. We established a single-indicator STARTS model (Kenny & Zautra, 2001) via adequate model fit. The single-item indicators were used in this highly intensive academic context to minimize fatigue in respondents, nonresponse, and careless responding (Gnambs & Buntins, 2017). However, our results—especially for pride—should be verified via multi-indicator latent state-trait models, such as the latest adaption from Eid et al. (2017). These models distinguish between state and measurement error, and can account for method effects (Geiser & Lockhart, 2012). Additionally, future research should vary the time lag for the autoregressive path. Future longitudinal studies with different time lags between the measurements (e.g., each week for one semester) might provide further insight into the structure of emotions (cf. e.g., discussion of Anusic, Lucas, & Donnellan, 2012; Eid et al., 2014; Wagner, Lüdtke, & Trautwein, 2016). The present study provides supplementary evidence concerning students' emotional experiences in highly valued learning situations during their first year at university. However, the proportion of the three variance components might differ based on the context. Future research should further explore the emotional structure in different contexts, add more variability to the specific learning situations (e.g., studying during the semester without an upcoming exam), and systematically vary situational conditions (e.g., teaching methods, as recommended by Nett et al. (2017); or value, as recommend by Verduyn et al. (2009)). Moreover, the current study focused on approximately 100 freshman students. It would be beneficial to broaden the sample size and type; for instance, replicate the results for younger secondary school or older adult education students. Additionally, the present study focused only on four achievement emotions to keep the participants' workload low; however, still balanced frequency and taxonomy. Future research should address further achievement emotions throughout test preparation, such as test-related hope or boredom (e.g. boredom while test taking cf. Goetz, Frenzel, Pekrun, & Hall, 2007). Overall, more research is needed to understand, first, the variability of achievement emotions and, second, the importance of their more stable variance components for students' success. The present study is an important first step.

6.2. Implications for educational practice

Our results have practical implications for higher education institutions. Concerning our first aim, the present study underlines the importance of creating learning situations that enhance students' positive achievement emotions when they are preparing for highly valued exams, especially for students more prone to be anxious or angry. We found previous experience to be highly relevant for the current emotional experience. This emphasizes the importance of an early, but also consistent, support, especially in order to maintain the positive effects of enjoyment. Moreover, focusing on pride, practitioners should establish opportunities for students to repeatedly experience their own progress (e.g., perhaps via exercises, supervised learning groups, or mock exams). Concerning our second aim, the present study highlights the relevance of more stable variance components for perceived academic control and achievement. If institutions want to foster high levels of perceived academic control in their students, they can make use of interventions, such as Attributional Retraining programs (e.g., Haynes, Perry, Stupnisky, & Daniels, 2009), which enhance attributions of controllability, reduce negative emotions, and therefore enhance achievement (Hamm, Perry, Chipperfield, Murayama, & Weiner, 2017). Our results revealed that interventions might also need to consider students' previous emotional experiences. Apart from interventions, teaching characteristics—such as clear, precise language, or receptive, respectful attitudes toward students, or demonstrated interest in the subject matter—could also enhance positive emotions and perceived academic control (Muntaner-Mas, Vidal-Conti, Sesé, & Palou, 2017). Teaching characteristics could be easily implemented in specific learning situations, and could boost positive emotions over time, for example, via the impact of the previous experience-specific component.

6.3. Conclusions

Overall, we aimed to expand on previous research by considering previous experience as a crucial source of emotional experiences in an academic context, therefore broadening the person-situation debate. Results indicated that previous experiences possibly explain how person-specific traits might be influenced by situation-specific states via carryover effects. Subsequently, we analyzed their relationships with perceived academic control and achievement, revealing new insights for possible reciprocal effects, as postulated by the Control-Value Theory (Pekrun, 2006). Methodically, we successfully demonstrated a new analysis application for experience sampling datasets. Finally, the present study provided new information for researchers and

practitioners regarding the variability of emotional experiences as well as indications for possible supporting mechanisms, all within the context of a highly relevant experience of undergraduate students: the exam period.

Conflict of interest

None.

Appendix A

See Tables A1–A3.

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Table A1
Specific item wordings.

Perceived academic control	German wording adapted from Pekrun et al. (2004)	English wording (Perry, 1991)
	Ich habe ziemlich viel Kontrolle über meine Studienleistungen.	I have a great deal of control over my academic performance.
	Je mehr ich mich in meinem Studium anstrenge, umso besser schneide ich ab.	The more effort I put into my study, the better I do at it.
	Was auch immer ich tue, ich scheine immer schlecht in meinen Leistungen zu sein. (R)	No matter what I do, I can't seem to do well in my courses. (R)
	Ich sehe mich selber als hauptverantwortlich für meine Leistungen im Studium.	I see myself as largely responsible for my academic performance.
Achievement emotions	**German wording adapted from Pekrun et al. (2011)**	**English translation**
Enjoyment	Im Moment freue ich mich auf die Prüfung.	At this moment, I am looking forward to the exam.
Pride	Im Moment bin ich stolz darauf, was ich für die Prüfung bisher geschafft habe.	At this moment, I am proud of what I already achieved for the exam.
Anxiety	Im Moment habe ich vor der Prüfung Angst.	At this moment, I am afraid of the exam.
Anger	Im Moment ärgere ich mich über die Prüfung.	At this moment, I am angry about the exam.

Table A2
Occasions-specific relations of the achievement emotion measures (enjoyment and pride).

Occasion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	–	0.87	0.77	0.64	0.67	0.65	0.59	0.64	0.60	0.65	0.52	0.62	0.68	0.41	0.47	0.61	0.52	0.53
2	0.87	–	0.80	0.75	0.79	0.64	0.64	0.74	0.65	0.66	0.56	0.63	0.63	0.54	0.58	0.63	0.55	0.50
3	0.76	0.77	–	0.75	0.80	0.74	0.72	0.75	0.68	0.65	0.57	0.73	0.66	0.55	0.56	0.65	0.49	0.56
4	0.66	0.71	0.69	–	0.79	0.70	0.68	0.71	0.79	0.62	0.51	0.64	0.64	0.55	0.50	0.60	0.59	0.59
5	0.70	0.74	0.75	0.81	–	0.70	0.62	0.68	0.71	0.66	0.52	0.62	0.56	0.46	0.48	0.56	0.50	0.44
6	0.68	0.66	0.71	0.68	0.73	–	0.79	0.68	0.76	0.67	0.51	0.62	0.65	0.58	0.68	0.55	0.49	0.53
7	0.71	0.70	0.64	0.70	0.65	0.82	–	0.78	0.82	0.80	0.65	0.74	0.68	0.61	0.68	0.62	0.62	0.45
8	0.54	0.55	0.78	0.71	0.70	73	0.66	–	0.79	0.71	0.60	0.71	0.64	0.60	0.63	0.66	0.66	0.61
9	0.61	0.55	0.61	0.61	0.66	0.80	0.81	0.73	–	0.75	0.65	0.69	0.68	0.62	0.67	0.67	0.67	0.68
10	0.61	0.59	0.65	0.60	0.66	0.65	0.68	0.73	0.67	–	0.66	0.76	0.70	0.59	0.63	0.70	0.60	0.61
11	0.57	0.54	0.48	0.51	0.49	0.70	0.71	0.61	0.65	0.76	–	0.65	0.57	0.62	0.53	0.60	0.70	0.45
12	0.56	0.56	0.59	0.63	0.61	0.71	0.72	0.70	0.68	0.76	0.74	–	0.75	0.58	0.63	0.64	0.62	0.69
13	0.58	0.53	0.46	0.56	0.54	0.71	0.73	0.62	0.64	0.68	0.72	0.81	–	0.73	0.72	0.71	0.66	0.64
14	0.53	0.57	0.59	0.59	0.61	0.63	0.59	0.71	0.60	0.64	0.57	0.67	0.73	–	0.65	0.65	0.77	0.61
15	0.50	0.51	0.62	0.49	0.59	0.58	0.68	0.65	0.55	0.64	0.68	0.74	0.79	0.64	–	0.70	0.54	0.63
16	0.67	0.60	0.66	0.67	0.69	0.71	0.72	0.74	0.71	0.62	0.52	0.71	0.67	0.66	0.65	–	0.71	0.74
17	0.47	0.48	0.60	0.53	0.62	0.61	0.63	0.69	0.61	0.66	0.54	0.75	0.68	0.75	0.88	0.82	–	0.69
18	0.55	0.46	0.57	0.54	0.59	0.52	0.50	0.65	0.53	0.66	0.55	0.74	0.60	0.69	0.81	0.70	0.74	–

Note. Estimates of the MLR estimator standardized bivariate correlation, above diagonal correlations of Enjoyment, underneath diagonal correlations of Pride, all correlations significant at level $p \leq 0.010$, $N = 87–98$.

Table A3
Occasions-specific relations of the achievement emotion measures (anxiety and anger).

Occasion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	–	0.81	0.74	0.78	0.78	0.77	0.76	0.69	0.74	0.71	0.73	0.67	0.68	0.61	0.70	0.56	0.60	0.65
2	0.74	–	0.72	0.72	0.72	0.65	0.69	0.63	0.58	0.65	0.62	0.67	0.64	0.53	0.66	0.53	0.53	0.66
3	0.71	0.74	–	0.80	0.75	0.66	0.73	0.65	0.58	0.62	0.61	0.60	0.63	0.52	0.58	0.49	0.53	0.52
4	0.80	0.65	0.67	–	0.86	0.79	0.78	0.69	0.69	0.68	0.73	0.71	0.72	0.59	0.65	0.51	0.58	0.55
5	0.64	0.62	0.60	0.62	–	0.76	0.72	0.61	0.65	0.71	0.71	0.66	0.67	0.53	0.57	0.45	0.48	0.51
6	0.65	0.55	0.58	0.59	0.71	–	0.70	0.64	0.62	0.69	0.68	0.62	0.68	0.55	0.60	0.48	0.54	0.51
7	0.65	0.58	0.55	0.65	0.65	0.71	–	0.68	0.70	0.92	0.77	0.76	0.78	0.60	0.81	0.61	0.70	0.65
8	0.71	0.65	0.63	0.71	0.65	0.59	0.74	–	0.80	0.69	0.70	0.68	0.68	0.53	0.67	0.59	0.56	0.61
9	0.70	0.50	0.51	0.55	0.50	0.54	0.77	0.74	–	0.83	0.79	0.73	0.74	0.62	0.67	0.57	0.60	0.63
10	0.66	0.58	0.62	0.71	0.65	0.73	0.84	0.74	0.77	–	0.89	0.83	0.80	0.67	0.79	0.67	0.68	0.69
11	0.70	0.70	0.72	0.73	0.63	0.66	0.78	0.64	0.69	0.83	–	0.73	0.81	0.67	0.81	0.68	0.65	0.66
12	0.68	0.58	0.54	0.58	0.58	0.62	0.72	0.67	0.79	0.76	0.76	–	0.77	0.54	0.71	0.62	0.65	0.67
13	0.63	0.60	0.59	0.63	0.52	0.50	0.68	0.59	0.63	0.67	0.74	0.74	–	0.82	0.83	0.65	0.75	0.75
14	0.63	0.55	0.49	0.62	0.53	0.44	0.65	0.53	0.59	0.61	0.67	0.60	0.73	–	0.77	0.75	0.69	0.73
15	0.73	0.64	0.54	0.61	0.53	0.45	0.72	0.51	0.57	0.66	0.71	0.67	0.77	0.77	–	0.69	0.73	0.75
16	0.59	0.58	0.57	0.51	0.47	0.40	0.52	0.49	0.51	0.60	0.62	0.54	0.57	0.68	0.76	–	0.74	0.69
17	0.53	0.49	0.47	0.42	0.37	0.30	0.50	0.47	0.54	0.53	0.51	0.49	0.48	0.56	0.50	0.72	–	0.77
18	0.57	0.52	0.49	0.48	0.43	0.37	0.60	0.56	0.60	0.52	0.61	0.51	0.60	0.60	0.67	0.73	0.61	–

Note. Estimates of the MLR estimator standardized bivariate correlation, above diagonal correlations of Anxiety, underneath diagonal correlations of Anger, all correlations significant at level $p \leq 0.010$, $N = 87–98$.

Appendix B. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cedpsych.2019.02.004.

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Study III

Study III focused on the change of PAC over an entire undergraduate program and its relevance for academic success, operationalized by dropout and GPA. The aim was to broaden prior research focus in the first year and analyze reciprocal relations between PAC and achievement over time under consideration of dropout. In order to do so, the complete Longserv dataset (Figure 10) was used along with a latent change score model of PAC with a discrete time survival model of dropout. Therefore, the first objective was addressed completely. Study III was published by Journal of Educational Psychology[3] with the following citation:

Respondek, L., Seufert, T., Hamm, J. M., & Nett, U. E. (2019). Linking Changes in Perceived Academic Control to University Dropout and University Grades: A Longitudinal Approach. *Journal of Educational Psychology*. https://doi.org/10.1037/edu0000388

[3] Due to the APA copyright the final accepted, pre-formatted version of the manuscript is attached.

Abstract

Although research shows higher levels of perceived academic control are associated with academic adjustment in the first year of university, little is known about how changes in perceived control over multiple years relate to longitudinal university dropout and grades. Our three-year study (N = 1007) thus examined whether changes in perceived control predicted university dropout and whether this relationship was mediated by university grade point average (GPA). Latent change score models showed that although first-year perceived control declined on average, we observed high levels of variability between students, so that perceptions of control increased for some students. Discrete time survival analysis models showed that such positive changes in perceived control were associated with reduced dropout rates. Increases in perceived control also predicted higher subsequent university grades. Finally, we confirmed that the relationship between perceived control and dropout was mediated by university grades. Findings advance the literature in highlighting longitudinal linkages between perceived academic control and university grades and their influence on subsequent dropout. Implications for instructors and institutions to support adequate control perceptions, especially in the first academic year, are discussed.

Keywords: perceived academic control, university dropout, university grades (GPA), latent change score model, discrete time survival analysis

Educational Impact and Implications Statement

The present study focuses on students' control beliefs over their academic outcomes and its relevance for university dropout and grades. Results suggest an overall decline of students' control beliefs within a three-year degree program, and this decline was associated with a higher risk of university dropout and poorer university grades. These findings highlight the importance of developing evidence-based methods to support students' control beliefs.

Linking Changes in Perceived Academic Control to University Dropout and University Grades: A Longitudinal Approach.

Students transitioning from high school to university face a variety of new and highly demanding challenges, among them increased autonomy, unfamiliar learning environments, increased pressures to excel, more frequent failure experiences, and greater responsibility for their educational outcomes (Credé & Niehorster, 2012; Perry, 2003). These transition-related challenges have the potential to precipitate negative changes in students' perceptions of control (Perry, 2003). Reductions in academic control have been shown to undermine motivation and achievement striving in otherwise committed students and can lead to negative consequences such as university dropout or poor grades (e.g., Perry, Hladkyj, Pekrun, Clifton, & Chipperfield, 2005; Perry, Hladkyj, Pekrun, & Pelletier, 2001). However, not all students experience declines in their perceived control. Some may even experience increased perceived control if initial successes give rise to positive reciprocal associations between perceived control and grades. However, little is known about the longitudinal interrelationships between perceived academic control, university dropout and university grades that unfold over multiple years of students' academic programs. The present study thus examined how perceived academic control changed over an entire undergraduate program and how such changes predicted university dropout and university grades.

Perceived Academic Control (PAC) of University Students

Perceived academic control (PAC) refers to beliefs about personal influence over one's academic achievement outcomes (Perry, 1991). This individual perception is distinguished from students' 'veridical' influence over their outcomes, for example due to having high levels of autonomy or flexibility (Heckhausen & Schulz, 1995). Specifically, Heckhausen and Schulz (1995) argued that PAC can be distinguished by its degree of

veridicality, meaning to what extent it is based on well-grounded elements of the university setting and causality of action and outcome. PAC is the domain-specific component of perceived control, which has significant implications for motivation and achievement (for an overview see Skinner, 1996).

Theoretically, PAC is connected to the attributions students make for their achievement outcomes (Weiner, 1985, 2018). According to Weiner (2018), attributions can be classified based on three causal dimensions that involve locus of causality (internal vs. external), stability (stable vs. unstable), and controllability (controllable vs. uncontrollable). Students' attributions have been posited to impact their PAC (Perry, Hall, & Ruthig, 2005). For example, if students attribute a failure to internal, stable, and uncontrollable causes (e.g., low ability), they will perceive a low level of PAC. In contrast, if students explain the same failure as due to internal, unstable, and controllable causes (e.g., low effort), they will perceive higher level of PAC (Hamm, Perry, Chipperfield, Murayama, & Weiner, 2017). Increasing evidence shows PAC is positively associated with the motivation to learn, use of effective study strategies, adjustment to university, mastery orientation and so forth (Cassidy & Eachus, 2000; Hall, Perry, Ruthig, Hladkyj, & Chipperfield, 2006; Perry et al., 2001).

PAC has been shown to be particularly important for freshman students who must adjust to the unfamiliar learning circumstances of university and to overcome, for example, increased pressure to excel, frequent failures, or unfamiliar learning tasks (Perry, 1991; Perry, Hall et al., 2005). This transition to university has the capacity to undermine students' PAC, which can lead to negative consequences as mentioned earlier. In order to prevent such outcomes, prior research therefore mostly focused on the first-year experience.

PAC is assumed to be a relatively stable psychological disposition (Perry et al., 2001; Perry, Hall et al., 2005). For instance, Ruthig, Hanson, and Marino (2009) showed PAC to be fairly stable within the first year of university. Other research showed PAC exhibited change

only when measured over long durations compared to daily measures, pointing to a slow changing process, with overall levels slightly decreasing with time (Stupnisky, Perry, Hall, & Guay, 2012). Similarly, Niculescu, Tempelaar, Dailey-Hebert, Segers, and Gijselaers (2016) showed a minor negative trend within a freshman introductory course, with high individual variability concerning those changes. First-year university students typically report increased levels of PAC after successes and decreased levels after failure experiences (Hall, 2008). However, these studies focused solely on the development of PAC within the first academic year. Initial research by Respondek, Seufert, Stupnisky, and Nett (2017) started to fill this gap with a comparison of the level of first and second year undergraduate students' PAC. The results suggested a decline, as PAC levels for second year students were lower (Respondek et al., 2017). Yet little is known about how PAC changes throughout entire undergraduate programs and the implications of such changes for university dropout and university grades (see lower rectangle in Figure 1, objective 1).

Perceived Academic Control (PAC) and University Dropout

Academic retention (persisting versus dropping out) is a key element of university success (Robbins et al., 2004; Robbins, Oh, Le, & Button, 2009). University dropout has negative societal consequences, such as fewer qualified employees in the workforce (e.g., Heublein & Wolter, 2011), as well as personal consequences, such as reduced personal income, lower perceived happiness, higher reported depression and stress (Faas, Benson, Kaestle, & Savla, 2018). Rising dropout rates point to a strong need for action: Among the 23 OECD countries, about a third of students drop out of university (OECD, 2012). In Germany, university dropout rates during the previous 13 years have increased from 25% to 33% (Heublein, 2014). Despite high dropout rates during the first year, some students still drop out in subsequent years (Mabel & Britton, 2018). A recent German study showed that 47% of

dropouts occurred in the first academic year, 29% in the second year, 12% in the third year, and 12% after the third year (Heublein et al., 2017).

It is therefore necessary to identify central factors that affect dropout over entire undergraduate programs. In the psychological model of college student retention (Bean & Eaton, 2001), it is assumed that PAC is one key psychological process within the institutional environment. Bean and Eaton (2001) argue that high PAC is linked to increased academic and social motivation in university achievement settings. This, in turn leads to academic and social integration, which leads to institutional fit, and therefore reduces students' dropout.

Supporting theoretical assumptions concerning the importance of PAC for retention, there is also empirical evidence suggesting that PAC is relevant for university dropout. Preliminary research in this area found that first-year PAC was related to reduced course withdrawal (Hall et al., 2006; Ruthig, Haynes, Perry, & Chipperfield, 2007) and to university dropout (Perry, Hladkyj et al., 2005). However, prior research focused mostly on the first academic year (Willcoxson, Cotter, & Joy, 2011) and did not account for the different times of dropout, such as early vs. late (DesJardins, Ahlburg, & McCall, 1999; Mabel & Britton, 2018), despite the fact that PAC seems to be differentially related to dropout intention across academic years (Respondek et al., 2017). As discussed by Alarcon and Edwards (2013) it is necessary to use multiple measurements and longitudinal data to understand the relevance of motivational variables such as PAC for dropout. Our study thus addressed how PAC influenced dropout over an entire undergraduate program of study, while also testing whether its influence differed for early or late dropout (see dotted lines in Figure 1, objective 2a).

Perceived Academic Control (PAC) and University Grades

University grades are the second key element of university success (Robbins et al., 2004; Robbins et al., 2009). They are strongly predicted by high school grades (e.g., Geiser &

Santelices, 2007) and reflect a combination of students' academic skills and abilities, work habits, and content knowledge (Hamm, Perry, Chipperfield, Parker, & Heckhausen, 2018). Further, early postsecondary grades strongly predict subsequent achievement outcomes (e.g., Richardson, Abraham, & Bond, 2012; Schneider & Preckel, 2017).

Prior research revealed the positive impact of first-year PAC on students' grades within the critical first academic year (e.g., Daniels et al., 2014; Hall et al., 2006). For instance, PAC at the beginning of an introductory course related positively to the test performance throughout the course and to final course grades (Perry et al., 2001). First-year PAC seems to have long-term enhancing effects on university grades within the first academic year, as the impact of high PAC levels on course grades was greater for 6-months compared to 2-week periods (Stupnisky et al., 2012). These findings are consistent with other research that shows the long-term positive influence of first-year PAC on students' grades over a three-year period, which remained significant even when high school grades were controlled (Perry et al., 2001). Besides a high level of PAC, Stupnisky et al. (2012) found that high stability in first-year PAC was also important for freshman grades. Finally, a meta-analysis about university grades underscored the relevance of PAC, as it showed an overall moderate positive relationship to university grades (Richardson et al., 2012).

An important issue that has yet to be systematically addressed in the literature concerns positive reciprocal associations that may emerge between PAC and university grades over time. High school grades are positively associated with PAC at the beginning of first-year at university, which is in turn positively associated with subsequent university grades (Hall et al., 2006; Perry et al., 2001; Perry, Hladkyj et al., 2005). This implies that initial grades may foster positive shifts in PAC, which may lead to better university grades, which may in turn lead to increased PAC and so on. The present study sought to advance this work by analyzing whether positive reciprocal associations emerged throughout an entire

undergraduate program of study. We focus on the influence of university grades on changes in PAC and the influence of those changes in control on subsequent university grades (see dashed line in Figure 1, objective 2b).

Interrelationships between Perceived Academic Control (PAC), University Dropout, and University Grades

Both key elements of university success are related, as university grade point average (GPA) predicts dropout (e.g., Robbins et al., 2004; Robbins et al., 2009), especially in the first year (Allen, Robbins, Casillas, & Oh, 2008; Pascarella & Terenzini, 2005). High school grades also predict dropout (e.g., Stewart, Doo Hun Lim, & JoHyun Kim, 2015), even in later years (Mabel & Britton, 2018). Approximately a third of the variance in dropout can be explained by high school and university grades (Voelkle & Sander, 2008).

Previous research suggests that first-year PAC is also associated with reduced university dropout (Perry, Hladkyj et al., 2005; see section 'Perceived Academic Control (PAC) and University Dropout'; cf. direct effect). However, its influence may be indirect since first-year PAC also predicts increased university grades (Perry et al., 2001; see section 'Perceived Academic Control (PAC) and University Grades') and university grades predict university dropout (Voelkle & Sander, 2008). These findings suggest that the relationship between PAC and university dropout may be mediated by university grades. This would be in line with theoretical propositions forwarded by Bean and Eaton (2001) who proposed that intermediate outcomes (e.g., performance) mediate the effect of psychological processes (e.g., PAC) on student dropouts. However, empirical research has yet to systematically examine this proposition. Our study thus addressed the interrelationships between PAC, university dropout and university grades over students' entire undergraduate program of study (see Figure 1, objective 3).

Study Purpose and Research Objectives

The present study sought to extend prior research by examining the role of perceived academic control (PAC) over an entire undergraduate program of study. Our focus was on its associations with university dropout and university grade point average (GPA) within and beyond the first academic year.

Our first objective was to analyze change in PAC over multiple years of an academic program. As stated above, research has yet to analyze PAC beyond the critical first academic year. We expected PAC to decrease significantly within the first academic year (cf. Respondek et al., 2017). When students first begin university, they may be unaware of how much control they actually have (veridical control) due to entering a novel and unfamiliar learning environment. This could result in overestimates of PAC in the first year that are subsequently recalibrated (lowered) to better match reality. After the first-year, PAC declines may be attenuated and PAC may even remain relatively stable in subsequent years, as students have adjusted to the new demands and are now aware of their actual levels of control (cf. Perry et al., 2001). Alternatively, PAC could increase in students who did not drop out and are thus experiencing success, which might enhance control perceptions (*change focus*, Figure 1).

Our second objective was to analyze how changes in PAC are relevant for university success over an entire academic program of study. We examined the interrelationships between changes in PAC, university dropout, and university grades (GPA). In a first step, we focused on PAC change and university dropout. Preliminary evidence suggests that PAC is associated with decreased probability of dropout (cf. Perry, Hladkyj et al., 2005). The present study built on this research by testing whether the relationship between PAC and dropout differs during a three-year undergraduate program, with a focus on the impact of changes in

PAC. We expected positive changes (increases) in PAC to predict reduced odds of university dropout (*dropout focus*, Figure 1).

In a second step, we also examined relationships between PAC and GPA over multiple academic years, in order to extend prior research that focused on the first year only (e.g., Perry et al., 2001; Stupnisky et al., 2007). This study therefore focused on how changes in PAC influence and are influenced by GPA within all three undergraduate academic years, by considering university dropout. We expected positive changes (increases) in PAC to positively predict GPA, which was in turn expected to predict increases in PAC as part of a positive reciprocal association that emerges over time (*grade focus*, Figure 1).

Our third objective was to test previously unexamined interrelationships between PAC, university dropout, and GPA. We expected GPA to mediate the association between PAC and university dropout. Specifically, we expected that positive changes in PAC would predict increased GPA, which would in turn predict reduced odds of university dropout (*mediation focus*, Figure 1). In sum, first, positive reciprocal associations are assumed between GPA and PAC (grade focus) and, second, GPA is assumed to mediate the impact of PAC on dropout (mediation focus).

Method

Participants and Procedures

The present study followed two cohorts of students over three years. Cohort A consisted of 387 students who first enrolled in Winter 2013 and Cohort B consisted of 620 students who first enrolled in Winter 2014. Altogether, 1007 undergraduate students participated in the study (see Table 1 for demographics)[1]. The students were enrolled in different disciplines offered by a German university (20.9% psychology, 18.3% biology, 16.4% economics, 15.1% mathematics, 8.4% chemistry, 7.9% computer science, 6.8%

physics, and 6.2% engineering). Participation was voluntary, all participants gave written informed consent in accordance with the Declaration of Helsinki, and participants had the chance to withdraw their consent at any point of the study.

This longitudinal study consisted of multiple measurements throughout entire three-year bachelor programs, which are the most common undergraduate programs in Germany (Figure 2). Questionnaires that assessed PAC were administered at the beginning of the first, second, and third academic year (in November). They were distributed to the students during an important lecture of each discipline. We were able to match the questionnaires over time via a participation code. However, missing data occurred as not all students took part in all three measurements[2]. Those missing data occurred in two ways: either systematically via university dropout, which this study accounts for via discrete time survival analysis. Alternatively, it occurred unsystematically as some students were missing in those lectures where we conducted the survey. This could be due to various reasons such as not wishing to participate or absences due to illness, personal time constraints, premature completion of this study module, etc. Due to conducting our study during highly relevant lectures, attrition rates were acceptable and resulted in an overall attrition rate of 41.8%, which is comparable to other longitudinal field studies in higher education (e.g., 49%; Perry et al., 2001).

In addition to the survey, students consented to release their current enrolment status (dropout) and grade point averages (GPA) by signing a data privacy statement and providing their participation code in combination with their matriculation number. We used this matriculation number to request students' enrollment status from institutional records at the end of the undergraduate study program of both cohorts (September 2017). We were able to record if and when the students did or did not remain enrolled in their freshman major. Therefore, this study also includes late dropout data. Dropout contains no missing data (Figure 2). Further, we used the matriculation number to obtain students' cumulative GPA

from institutional records at the midpoint of the first, second, and third year (beginning of April; at this time the students received the first comprehensive performance feedbacks). Due to technical and formal issues in the institutional records, we could not access the current GPA for all students (up to 11.7% missing; Figure 2).

Measures

Perceived Academic Control (PAC). PAC was measured using the German translation of the Academic Control Scale (Perry, 1991; Perry et al., 2001; in its German version of Pekrun et al., 2004). Students rated six items on a five-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*; $N_1 = 990$[3], $M_1 = 4.02$, $SD_1 = 0.52$; $N_2 = 462$, $M_2 = 3.84$, $SD_2 = 0.71$; $N_3 = 171$, $M_3 = 3.70$, $SD_3 = 0.74$). An example item was, "I have a great deal of control over my academic performance" (see supplemental materials for details). In order to obtain an interpretable and informative zero-point for the discrete time survival analysis model, PAC items from the first measurement occasion were mean centered. In order to create interpretable scores for the latent change score model, the PAC items from the second and third measurement occasion were centered by the same value as the respective item from the first measurement occasion. We confirmed the measurement model for PAC (see supplemental materials for details): All McDonalds Omega scores were higher than .70, supporting the internal reliability of our measure of PAC. The confirmatory factor analysis for PAC showed acceptable fit for each academic year. Sixteen of eighteen standardized factor loadings for the latent PAC variable were higher than the acceptable cut-off of 0.50 (Hair, Black W. C., Babin, & Anderson, 2010). Thereby, nine of them were higher than the recommended ideal cut-off of 0.70 (Hair et al., 2010). Two standardized factor loadings were close to 0.50 but did not meet the cut-off criterion. Still they did meet the more liberal cut-offs as recommended by 0.40 (Stevens, 2009).

Dropout. Dropout was assessed using institutional records and reflected whether or not students remained enrolled in their freshman major (for an overview of common operationalization see Bahr, 2009; for specific dropout types see Bernardo et al., 2017). In detail, we considered different perspectives in our dropout operationalization. The total observed dropout (n = 271) included the perspective of the faculty dean by students leaving this specific faculty (major transition, n = 52), the perspective of the university by students leaving this specific university (university transition, n = 66), and the perspective of the German government by students withdrawing from university (complete dropout, n = 153). Dropout was coded as a dichotomous variable (0 = *did not drop*, 1 = *dropped out*).

University Grades. Consistent with prior research, university grades were operationalized as students' cumulative grade point average (GPA), measured at the midpoint of each academic year. They were obtained from institutional records and contained students' average grades achieved in all completed courses up until that point. Additionally, we obtained participant high school GPAs via self-report (N_0 = 991). Each GPA was cohort-centered (M_{GPA0} = 0, SD_{GPA0} = .58, M_{GPA1} = 0, SD_{GPA1} = .74; M_{GPA2} = 0, SD_{GPA2} = .66; M_{GPA3} = 0, SD_{GPA3} = .61). Further, due to the German grading system (originally from 1.0 = excellent to 5.0 = failed), we transformed each GPA by multiplying -1 so that higher grades reflect higher performance.

Rationale for Analyses

Regarding our first objective, we estimated a Latent Change Score model to assess change in PAC over time (*change focus;* Figure 3; also called true change model or latent difference model, cf. McArdle, 2001; Steyer, Eid, & Schwenkmezger, 1997; Steyer, Partchev, & Shanahan, 2000). Via this structural equation model, we took the measurement error into account and described the change between two measurement occasions as

unobserved latent variables (Δ). Significant mean change (μ_Δ) indicated reliable mean differences in PAC over all participants. Significant change variance (σ_Δ^2) indicated individual variability of these overall mean differences (McArdle, 2001). We estimated a Neighbor-Change model (Steyer et al., 2000), capturing the change of PAC within the first (eq. $PAC_{\Delta 12}$) and the second academic year (eq. $PAC_{\Delta 23}$). Further, factor loadings and intercepts were constrained to be equal across measurement (strong measurement invariance; cf. Steyer et al., 2000, see supplemental materials for details). Auto-correlated error variables were accounted for via correlations between residual variances of the same indicators across time (e.g., Christ & Schlüter, 2012; Geiser, 2011).

Regarding our second objective, we estimated a Discrete Time Survival Analysis model for dropout (DTSA, cf. Masyn, 2003, 2014; Muthén & Masyn, 2005; Voelkle & Sander, 2008). Generally, DTSA accounts for the timing of the event 'university dropout', which is one of the main advantages over logistic regression (Voelkle & Sander, 2008). The DTSA modeled whether and when students dropped out (cf. latent hazard function): The dropout probability or dropout risk is estimated by hazard rates (h(t) = 1/(1+eThreshold)) for every undergraduate academic year.

In a first step, we examined whether latent changes in PAC predicted subsequent dropout (*dropout focus*, Figure 4; cf. McArdle, 2001). Thereby, the conditional dropout risk (i.e., under consideration of the study predictors) were indicated by odd ratios ($OR = e^{estimate}$): It represents the ratio between the odds after a unit change in the predictor and the original odds. For instance, an OR value of 0.60 for $PAC_{\Delta 12}$ would indicate that each unit increase in the change of PAC within the first year was associated with a 60% reduction in odds of university dropout in the second year.

In a second step, we added GPA to the DTSA model, with high school GPA as a time-invariant predictor and university GPA in Years 1-3 as a time-varying predictor (*grade*

focus, Figure 5). Via this structural equation model we could test the hypothesized positive reciprocal longitudinal associations between PAC and GPA.

Regarding our third objective, we tested whether GPA mediated the influence of PAC on dropout by testing the significance of indirect effects for each undergraduate year (*mediation focus*, Figure 5, cf. Fairchild, Abara, Gottschall, Tein, & Prinz, 2015). Note that temporal sequencing of the model was preserved as each variable in the longitudinal mediation model was measured at separate (non-overlapping) time points (Figure 2).

All analyses were conducted using *Mplus* 8 (Muthén & Muthén, 1998-2017). Missing data were accounted for by using the full information maximum likelihood estimator (FIML) with standard errors that are robust to non-normality and non-independence of observations (MLR). We considered various fit indices based on Hu and Bentler (1999). Acceptable model fit was indicated through chi-square (χ^2), root-mean-square error of approximation (RMSEA ≤ 0.05), comparative fit index (CFI ≥ 0.95), and standardized root mean square residual (SRMR ≤ 0.08). The syntax was based on previous research (Fairchild et al., 2015; Gottschall, Fairchild, Masyn, & Prinz, 2013; Muthén & Muthén, 1998-2017) and is provided as supplemental material.

Results

Preliminary Results

Table 2 provides correlations among all study variables. Perceived academic control (PAC) showed relatively high stability, indicated by strong correlations over the three academic years. PAC only related meaningfully to dropout in the second academic year. The university grade point average (GPA) measures also exhibited strong, positive relations over time. The strong positive association between PAC and GPA seemed to increase over time. Finally, GPA showed a robust negative relationship with dropout.

Change Focus

In order to address our first research objective, we examined change in PAC over an entire program of study using a latent neighbor-change model (Figure 3). Results of models with strong measurement invariance and indicator-specific effects showed acceptable model fit (χ^2 (134) = 271.51, $p < .001$, RMSEA = 0.03, CFI = 0.94, SRMR = 0.07). On average over all students, PAC declined foremost the first academic year. However, high standard deviations for latent change score intercepts indicated that for some participants, PAC decreased, whereas for others it increased from their beginning to the end of the first academic year (Table 3).

University Dropout

In order to address our second research objective, we conducted an unconditional discrete time survival analysis (DTSA) to model university dropout. We first tested if the hazard rates for dropout were different across academic years by comparing a DTSA model with no constrained hazard rates against a DTSA model with equally constrained hazard rates (Table 4). Chi-square difference tests using the log likelihood function (Satorra & Bentler, 2010) indicated fit was significantly worse in the constrained models ($_{\Delta}\chi^2$ ($_{\Delta}df$) = 64.46 (2), $p < .001$). Therefore, we proceeded with DTSA models that did not constrain the hazard rates over time. Based on the observed university dropout of our sample, the DTSA estimated an unconditional hazard rate of 14.9% risk to drop out in the first academic year, of 10.5% risk to drop out in the second academic year, and of 4.0% risk to drop out in the third academic year (Table 4, Figure 2). This results in an overall dropout rate of 26.8% for the entire bachelor degree within this study, which is in line with other relevant assessments at German universities, for instance 33% for bachelor graduates 2012 (Heublein, 2014). Moreover, we

found varying unconditional hazard rates over the three academic years, with the highest probability to drop out of university during the first academic year.

Dropout Focus

In a second step, we combined the PAC latent change score model with the DTSA dropout model (Figure 4, Table 4). Students with average PAC at the beginning of the first year showed a dropout risk of 14.8% for the first year. Students with stable PAC within the first year showed a dropout risk of 7.8% for the second year. Students with a stable PAC within the second year showed a dropout risk of 1.9% for the third year.

Further, the results of the conditional DTSA model showed only a meaningful impact of PAC changes from the first to second academic year on dropout (Table 5). The probability of dropping out decreased from 7.8% to 3.1% for students whose PAC increased by one unit, whereas it increased to 12.5% for students whose PAC decreased by one unit. Yet, the effect of PAC changes from the second to the third academic year on dropout was not significant, it had a meaningful effect size. The probability of dropping out decreased from 1.9% to 0.2% for students whose PAC increased by one unit, whereas it increased to 3.6% for students whose PAC decreased by one unit.

In sum, the results partially confirmed the assumed positive relation of PAC on university dropout, as an increase in the PAC during the first academic year was related to reduced dropout risk in the second academic year.

Grade Focus

In a third step, we added GPA to the model (Figure 5, Table 4 and Table 5). Consistent with the hypotheses, the model showed PAC positively predicted GPA and vice versa when simultaneously controlling for autoregressive effects. Specifically, high school grades[4] had a small, but positive impact on PAC at the beginning of the first year. In turn,

PAC at the beginning of university positively predicted grades in the first year, which predicted positive change in PAC. Positive changes in PAC over the first academic year had a small, but positive influence on grades within the second academic year. However, second year GPA had no meaningful impact on the change of PAC within the second year. Finally, positive change in PAC over the second year had a small, but positive impact on third year grades. In sum, the results provide support for the predicted positive reciprocal longitudinal associations between PAC and GPA when autoregressive effects were controlled.

Mediation Focus

In the final model, we tested if the association between PAC and dropout was mediated by GPA (Figure 5, Table 5). First, the direct relation of PAC on dropout was no longer significantly different from zero when controlling for GPA. Second, PAC showed positive reciprocal associations with GPA over time. Third, results showed GPA had strong and negative associations with dropout when controlling for PAC. Therefore, we tested whether GPA mediated the relationship between PAC change and dropout (Fairchild et al., 2015; Voelkle & Sander, 2008). We found the predicted significant indirect relation of PAC on university dropout. Positive changes in PAC in Year 2 were associated with increased Year 2 grades, which were in turn associated with reduced odds of Year 2 dropout [5]. This result confirmed that the influence of $PAC_{\Delta 12}$ on D_2 was mediated by GPA_2.[6]

Overall, our results showed a dropout risk of 12.1% for students with average PAC and grades in the first year (Table 4). This first-year dropout risk was negatively influenced by first-year grades. In detail, the probability of dropping out for students who performed one grade point better than the average was reduced to 5.7%. Vice versa, the probability of dropping out for students who performed one grade point worse than average rose to 18.4% (Table 5).

Further, our results showed a dropout risk of 5.5% for the second year for students with stable PAC within the first year and average grades in the second year. This second year dropout risk was negatively predicted by second-year grades. This means, the probability of dropping out decreased to 1.7% for students, who performed one grade point better than average in the second year and increased to 9.4% for students who performed one grade point worse than average. Further, this second year dropout risk was negatively predicted by the mediated relation of PAC change within the first year and GPA in the second year. This means, the initial dropout rate of 5.6% was reduced to 4.8% for students whose increases in PAC resulted in better GPA, which in turn reduced the risk of dropout. The reverse relation led to an increased dropout risk of 6.4%.

Finally, our results showed a dropout risk of 1.8% for the third year for students with stable PAC within the second year and average grades in the third year. This third year dropout risk was negatively influenced by third-year grades. This means, the probability of dropping out decreased to 0.6% for students, who performed one grade point better than average in the third year and increased to 3.0% for students, who performed one grade point worse than average.

In sum, the model explained up to 32% of the academic year specific dropout variance (Table 5). These results support the hypothesized relationships between PAC, dropout, and GPA. Additionally, they revealed PACs' impact on dropout and confirmed its expected positive reciprocal longitudinal associations with GPA.

Discussion

The present study sought to advance the literature on perceived academic control (PAC) by examining its interrelations and reciprocal longitudinal associations involving university dropout and university grades over three years of an academic program. Study results showed that (a) most students experienced decreased levels of PAC in their first year

(*change focus*), (b) changes in PAC predicted university dropout (*dropout focus*), (c) positive reciprocal longitudinal associations operated between positive PAC changes and university grades (*grade focus*), and (d) the associations between PAC change and dropout were mediated by university grades (*mediation focus*).

Change Focus – Perceived Academic Control of University Students

The observed negative changes in PAC within the first year were in line with the existing literature (Niculescu et al., 2016; Respondek et al., 2017; Stupnisky et al., 2012). PAC decreased to a much greater extent in the first year relative to the second year, which extends previous research (e.g., Hall, 2008; Perry et al., 2001). This suggests the initial transition to university has negative implications for changes in students' PAC (cf. e.g., Perry, 1991; Perry et al., 2001; Perry, 2003; Perry, Hladkyj et al., 2005).

An explanation for the relatively strong decrease in first-year PAC could be that the baseline measurement was prior to any performance feedback. As stated by the Attribution Theory of Motivation and Emotion (Weiner, 1985) and shown by Hall (2008), students may be prone to changes in perceived control after failure. This could imply a correction process while adjusting to university, whereby students enter university with inflated levels of PAC that change (decrease) to better reflect reality over time. Freshman students may be unaware of how much control they actually have, due to the novel and unfamiliar learning environment. Students may have initially overestimated their academic control (cf. e.g., Ruthig et al., 2007; Ruthig, Perry, Hall, & Hladkyj, 2004) and subsequently adjusted it after receiving their first performance feedback at university.

On the other hand, students experienced on average small negative changes within the second academic year and PAC showed strong autocorrelations over the three academic years. Those results indicate a relative stability after students adjusted to university (cf.

Ruthig et al., 2009), which is in line with assumptions about the disposition-like nature of PAC (Perry, Hall et al., 2005).

However, high variance of the overall decrease indicated that for some students the decrease was even greater, or for others there was no change or even an increase. This variability indicated all three possibilities of change (declines, stability, and increases), which underscores the relevance of multiple PAC assessments over time.

Dropout Focus – Perceived Academic Control and University Dropout

After we analyzed the change in PAC over an entire undergraduate program of study, we focused on its relevance for university dropout and university grades, and tested whether university grades mediated the relation of PAC on university dropout.

Our study participants showed in general an expected overall dropout rate of nearly one third (cf. Heublein, 2014). Contrary to Voelkle and Sander (2008), we found university dropout to be different for each undergraduate year, with the highest dropout for the first academic year (cf. Alarcon & Edwards, 2013; Heublein et al., 2017). These findings support prior research that focuses on the first-year experience being especially important. Nevertheless, about half of the overall dropout occurred after the first academic year. This late dropout (Mabel & Britton, 2018; Willcoxson et al., 2011) points to the importance of the present study's examination of an entire academic program.

By following students over several years, we found that for students with average baseline control perceptions that remained stable over time the dropout risk was already lower than the overall average dropout risk. This finding highlights the academic risks that accompany low PAC and extends previous research by showing the impact of levels and changes in PAC on university dropout beyond dropout intention or voluntary course withdrawal (e.g., Hall et al., 2006; Perry, Hladkyj et al., 2005; Respondek et al., 2017).

In detail, it seems as if initial changes in PAC that accompany the adaption to university are mostly relevant for dropout (as opposed to baseline PAC perceptions). This results stand in contrast to Perry, Hladkyj et al. (2005), who found PAC to be relevant for students' departures especially in the third year. One explanation of that diverse relevance for dropout could be that the present study obtained baseline control perception data prior to students' first performance feedback and therefore prior to the occurrence of a potential correction process as mentioned earlier (Weiner, 1985). Another explanation could be that overly optimistic expectations during this transition period could reflect an academic risk factor, as the adjustment to university can consist of frequent failure experiences that may contradict the initially high PAC perceptions of some students (Ruthig et al., 2004). Finally, the impact of the positive PAC changes in Year 2 showed, however, close to meaningful associations with reduced dropout risk in the subsequent year. Non-significant associations could be a consequence of various reasons (e.g., reduced third-year dropout rates or third-year sample size). In sum, PAC changes were shown to have important implications for university dropout, especially in Year 2, which expands on prior research examining course withdrawals (e.g., Hall et al., 2006; Ruthig et al., 2007) or dropout intentions (e.g., Respondek et al., 2017).

Grade Focus – Perceived Academic Control and University Grades

This study is the first to examine the interplay of PAC and performance over an entire undergraduate program of study, thereby extending prior research (Perry et al., 2001; Perry, Hladkyj et al., 2005). Our results showed prior university grades to strongly predict subsequent university grades at each time point (cf., Geiser & Santelices, 2007; Richardson et al., 2012; Schneider & Preckel, 2017). However, PAC still exhibited significant positive relationships with university grades. The study therefore highlights the relevance of high and

increasing levels of PAC for students over an entire academic program of study, broadening previous work (Stupnisky et al., 2007, 2012).

The study findings highlight positive reciprocal longitudinal associations between PAC change and university grades. In other words, students' high school grades predicted higher PAC at the beginning of their studies, which enhanced their grades within the first year, which produced a strong increase in PAC, and which subsequently enhanced their second-year grades. Besides the non-significant effect of the second-year grades on second-year PAC change, the study provides strong support for the hypothesized positive reciprocal longitudinal associations.

One explanation why the positive reciprocal longitudinal associations occurred mainly in the first year could be the importance of the causal search after failure experiences (Weiner, 1985, 2018). In our study, the first performance feedback was highly relevant for changes in students' control perceptions. As students adjust to university, their control perceptions may become more accurate via performance feedback, resulting in positive reciprocal longitudinal associations especially in the first year. Later on in the study, PAC became more stable, resulting in weaker positive reciprocal longitudinal associations.

Further, the relationship between the first-year baseline PAC and university grades was lower than expected from prior research (e.g., Perry et al., 2001; Perry, Hladkyj et al., 2005). One explanation could be the prior mentioned students' overestimation of PAC at the beginning of the first year, especially since they had yet to receive performance feedback. Thus, the study points to the potential role of veridicality or accuracy of high PAC. Presumably, PAC is adjusted to better reflect reality after the first performance feedback. These subsequent perceptions of control that may be more accurate may better predict university grades later on.

However, baseline PAC perceptions that may have been overestimated still had a weak positive effect on first-year university grades. Further, high levels of baseline PAC and subsequent positive changes in PAC appear to be adaptive for future university grades, even if those perceptions are inaccurate. This implies that, even if their perceptions are becoming more accurate, it is maladaptive that most students experienced declines in PAC.

Mediation Focus – Interrelationships between Perceived Academic Control, University Dropout, and University Grades

Finally the present study sought to advance the literature by focusing on whether university grades mediated the association between PAC and university dropout. The data supported our hypothesis and showed that university grades accounted for PAC relations on second-year dropout risk. In general, university grades were a very strong predictor for dropout (cf. e.g., Voelkle & Sander, 2008). However, PAC still remained relevant, with its indirect relation via university grades underscoring its influence. This suggests a low PAC level does not 'only' have negative consequences for university grades, but also indirectly leads to university dropout. Therefore, our results point to PAC as an important psychosocial predictor of university success. In order to enhance retention and performance, students require high levels of initial PAC and/or increasing PAC levels, especially in the first academic year. Then again, PAC represents one facet of expectancy of success. Thus, referring to expectancy value models (for an overview see e.g., Eccles & Wigfield, 2002) students' perceived value and the interaction of expectancy and value should also be considered as predictor of university success (e.g., for secondary school settings, see Trautwein et al., 2012). However, within the higher education setting of the present study, value is presumably relatively high with limited heterogeneity between the students (e.g., Dresel & Grassinger, 2013), which is in contrast to PAC.

Overall, the results support the assumptions in the psychological model of college student retention (Bean & Eaton, 2001) that proposes PAC as a key predictor of freshman dropout, as it influences university grades which later effects dropout. Moreover, our results indirectly support the Attributional Theory of Achievement Motivation and Emotion (Weiner, 1985, 2018) concerning the interrelationship between (negative) achievement outcomes as an initiator of causal search. Finally, the study extends prior research on the relation of PAC on dropout (e.g., Perry, Hladkyj et al., 2005) and university grades (e.g., Perry et al., 2001) by simultaneously analyzing longitudinal PAC effects on both key elements of university success.

Limitations and Implications for Future Research

We used a latent change score model to address our first research objective regarding how annually assessed PAC changes over three undergraduate years. Future research should broaden our results by measuring control perceptions at more frequent time intervals using latent growth models to test assumptions about the functional form of the change. Moreover, future research should consider heterogeneity by examining the three patterns of decreasing, stable, and increasing control perception, as we found high variability in students' PAC changes (cf. e.g., Niculescu et al., 2016; Voelkle & Sander, 2008). Additionally, we sought to extend prior research through multiple measurements of PAC within an entire undergraduate program of study. As mentioned before, our first year measurement occurred prior to any performance feedback and may have influenced our results. In order to better understand the influence of level and change in perceived control, this early measurement was important. However, future research should examine whether our three-year findings are consistent when baseline measures of self-reported PAC occur after early achievement tests, such as mock exams, partial tests, or scored exercises (Perry & Hamm, 2017).

We used discrete time survival analysis models to address our second research objective that focused on how PAC is relevant for university success. We modeled the actual undergraduate dropout accounting for the specific time when dropout occurred. However, we used a broad operationalization of dropout (Bernardo et al., 2017) and had no information about the reasons for student dropout (cf. Alarcon & Edwards, 2013). Future research should address this issue by conducting follow-up sessions with students who withdrew.

In our final estimated DTSA model, we did not account for all possible effects, such as the possible effect of first year grades on second or even third year dropout (Figure 5). In this study, we wanted to estimate the most parsimonious models that would adequately test our complex research objectives. Future research could test those alternative models that account for all possible paths. However, testing such complex models would probably require even more participants or cohorts (cf. Little, 2013).

We focused on PAC and found about a third variance of university dropout was explained by PAC and university grades. Yet, other factors could also influence dropout, for instance, Heublein et al. (2017) surveyed German university dropout and described the following main motives: educational demands that were too high, lack of motivation, and lack of practical tasks at university. These were followed by financial reasons and personal reasons such as sickness. Additionally, dropout can possibly result from an intentional decision that the study program does not fit personal expectations and needs, for instance due to lack of information (Aymans & Kauffeld, 2015). Another important predictor of university success is value. As described previously, the interaction of expectancy and value may be relevant in predicting achievement (e.g., Trautwein et al., 2012). Therefore, it seems reasonable that an interaction of value and PAC should influence university dropout over time and future research should additionally consider academic value. Therefore, future studies should consider more factors that may simultaneously influence university dropout.

This field study was conducted within the university environment to ensure high ecological validity. Due to this design expected levels of attrition were observed, especially by the third year (Moerbeek, 2014). Our design also enabled us to confirm that university grades mediated the association between PAC and dropout risk. Future research should consider additional possible mediators, such as the students' achievement emotions (Respondek et al., 2017; Ruthig et al., 2008). For instance, Pekrun and colleagues (2017) found positive developmental feedback loops between emotions and achievement. As posited by Pekrun (2006), PAC may serve as an antecedent of emotions in a PAC-emotion-achievement sequence. As the current study highlighted the relevance of not only level of PAC but also change in first-year PAC for university dropout and grades, it supports the reciprocal assumption of the control-value theory (Pekrun, 2006) and even broadens it by pointing to the relevance of change in first-year PAC. Therefore, future research on the control-value theory (Pekrun, 2006) may benefit from a more in depth examination of the role of changes in PAC.

We used the common operationalization of university grades: grade point average, which is not a fixed metric. Future research should include an actual performance test with a metric that is stable over time and thus permits the measurement of students' actual gains in achievement. However, we note that such a measure would need to be subject-specific.

Finally, specific methods of instruction could have implications for PAC levels, depending on the learning environment. For example, some instructors or methods of instruction may support students' PAC more than others (cf. Implications for Educational Practice). Future studies should focus on the effects of learning environments (e.g. due to various majors, programs, instructors, etc.) and systematically assess different aspects of the instruction, perhaps starting with a few specific study majors for more homogeneity. It would

be interesting to understand how different methods of instruction affect students perceptions of control.

Implications for Educational Practice

This study points to the relevance of PAC for university success, especially for freshman students. However, this study revealed an overall negative trend of students' control perceptions, especially in the first year. Therefore, it is relevant for institutions and instructors to consider supporting strategies in order to enhance retention and performance. Students' PAC can be supported, either directly via established Attributional Retraining or indirectly via instructional design (Clifton, Hamm, & Parker, 2015). Our results also show that PAC changes after performance feedback, which may reflect an optimal time to support it. This implies that first year experience enhancing programs should not start too early from an attributional perspective. Similarly, Attributional Retraining treatments that are typically administered after initial performance feedback have been shown to enhance students' PAC and even their general sense of control (Perry, Hall et al., 2005; Perry & Hamm, 2017). Instructors can also support students' control perception through increasing predictability and controllability for students, for instance, via well-structured courses, timely and constructive failure feedback, and clearly articulated task expectations (cf. Perry, Hall et al., 2005; Stupnisky et al., 2007). Additionally, early identification of students' level of academic control may help to assists especially low-control students who are 'at risk' of dropout (Haynes, Perry, Stupnisky, & Daniels, 2009; Perry, Hladkyj et al., 2005).

In order to improve retention and university grades, the present study suggests that institutions and instructors should provide early supports to help maintain and enhance students' perceptions of control over their academic outcomes. Nevertheless, the present longitudinal study also points to the relevance of monitoring students' perceived control over

the entire program of study. Results highlight the development of PAC throughout university and reveal its importance beyond the first year experience by showing that it predicts subsequent university dropout and university grades. Taken together, our study suggests the need for institutional programs designed to enhance students' perceptions of control in order to foster their long-term university success.

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Tables

Table 1

Demographics of Participants

Sample	*n*	Sex	Language	Nationality	Age		
					M_{age}	SD_{age}	range
Cohort A	387	49.1% female	87.6% German	93.8% German	19.92	1.95	16 - 30
Cohort B	620	47.9% female	83.1% German	92.1% German	20.18	3.34	17 - 52
Total sample	1007	48.4% female	84.8% German	92.8% German	20.08	2.88	16 - 52

Note. Cohort A enrolled Winter 2013, Cohort B enrolled Winter 2014; language indicates mother tongue, age measured in years at the beginning of their study.

Table 2

Zero-Order Correlations of All Latent Study Variables

Variable	1	2	3	4	5	6	7	8	9	10
Perceived Academic Control (PAC)										
1 PAC first year	-									
2 PAC second year	.52***	-								
3 PAC third year	.62***	.76***	-							
Dropout of University										
4 Dropout within bachelor study	-.07 (.163)	-.22**	-.26 (.120)	-						
5 Dropout within first year	-.08 (.132)	-	-	-	-					
6 Dropout within second year	.01 (.934)	-.28**	-	-	-	-				
7 Dropout within third year	-.11 (.323)	.01 (.979)	-.30 (.113)	-	-	-	-			
University Grades										
8 High school GPA	.13**	.23***	.40***	-.33***	-.18***	-.24***	-.18***	-		
9 GPA first year	.17***	.47***	.46***	-.34***	-.19***	-.27***	-.14**	.59***	-	
10 GPA second year	.14***	.52***	.52***	-.41***	-	-.36***	-.14**	.63***	.90***	-
11 GPA third year	.14**	.48***	.55***	-.30**	-	-	-.08 (.123)	.65***	.87***	.97***

Note. The numbers refer to standardized MLR maximum likelihood parameter estimates for bivariate correlations, point-biserial correlation for successful conclusion bachelor degree and dropout. PAC = perceived academic control. Dropout of university is operationalized as major transfer, university transfer, and complete dropout. University grades are operationalized as cohort-centered grade point average (GPA; high GPA reflects high performance). $N = 1007$
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Non-significant p-values are reported in parentheses.

Table 3

Results of the Latent Neighbor-Change Model (see Figure 3)

Latent Change Score	*M*	p_{M}	*S.E.*	*M* 95% CI	*SD*	p_{SD}	*SD* 95% CI
$PAC_{\Delta 12}$	-0.20	<.001	0.03	-0.27 / -0.14	0.62	<.001	0.53 / 0.70
$PAC_{\Delta 23}$	-0.11	.030	0.05	-0.21 / -0.01	0.54	<.001	0.36 / 0.67

Note. $PAC_{\Delta 12}$ = change of perceived academic control in the first academic year, $PAC_{\Delta 23}$ = changes of perceived academic control in the second academic year, χ^2 (134) = 271.51, $p < .001$, RMSEA = 0.03, CFI = 0.94, SRMR = 0.07, N = 1007

Table 4

Overview of various Dropout DTSA Models (Model fits and Thresholds)

Dropout Model	AIC	$_{adj.}$BIC	τ_{D_1}	$h(t)_{D\_1}$	τ_{D_2}	$h(t)_{D\_2}$	τ_{D_3}	$h(t)_{D\_3}$	R^2
unconditional, equally constrained	1747.04	1748.78	2.16	10.3%	2.16	10.3%	2.16	10.3%	
unconditional, not constrained	1689.19	1694.41	1.74	14.9%	2.14	10.5%	3.17	4.0%	
conditional, not constrained, Figure 4	23001.06	23107.12	1.75	14.8%	2.47	7.8%	3.92	1.9%	
conditional, not constrained, Figure 5	25824.72	25967.29	1.99	12.1%	2.84	5.5%	3.98	1.8%	$R^2_{D\_1} = .15^{***}$ $R^2_{D\_2} = .30^{***}$ $R^2_{D\_3} = .32^{**}$

Note. All Discrete Time Survival Analysis (DTSA) were computed with the MLR estimator using expectation maximization (EM) algorithm optimization method and the numerical integration algorithm with 5000 random integration points. AIC = Akaike information criterion, $_{adj.}$BIC = sample-size adjusted Bayesian information criterion, τ = threshold, h(t) = hazard rate = $1/(1+e^{\tau}) \triangleq$ dropout risk, D_1 = dropout in first year, D_2 = dropout in second year, D_3 = dropout in third year. $N = 1007$
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 5

Overview of various Dropout DTSA Models (Parameter Estimates of Predictors and Corresponding Odds Ratios)

Model	Parameter estimates	β	p_β	β 95% CI	OR	OR 95% CI	$\%_{OR}$
Figure 4	PAC_1 - D_1	-0.34	.131	[-0.78, 0.10]	0.71	[0.46, 1.11]	28.8%
	$PAC_{\Delta 12}$ - D_2	-0.92	.006	[-1.57, -0.27]	0.40	[0.21, 0.76]	60.1%
	$PAC_{\Delta 23}$ - D_3	-2.07	.058	[-4.21, 0.07]	0.13	[0.02, 1.07]	87.4%
Figure 5	PAC_1 - D_1	-0.08	.735	[-0.54, 0.40]	0.92	[0.58, 1.47]	7.7%
	$PAC_{\Delta 12}$ - D_2	-0.55	.141	[-1.26, 0.20]	0.58	[0.28, 1.20]	42.3%
	$PAC_{\Delta 23}$ - D_3	-1.60	.072	[-3.30, 0.10]	0.20	[0.04, 1.16]	79.8%
	GPA_0 - Dropout	-0.41	.011	[-0.71, -0.07]	0.66	[0.48, 0.91]	33.6%
	GPA_1 - D_1	-0.75	<.001	[-1.12, -0.40]	0.47	[0.33, 0.68]	52.8%
	GPA_2 - D_2	-1.20	<.001	[-1.97 -0.50]	0.30	[0.14, 0.63]	69.9%
	GPA_3 - D_3	-1.06	.021	[-1.98, -0.16]	0.35	[0.14, 0.85]	65.4%
	GPA_0 - PAC_1	0.11	.003	[0.03, 0.16]	-	-	-
	PAC_1 - GPA_1	0.10	.004	[0.03, 0.16]	-	-	-
	GPA_1 - $PAC_{\Delta 12}$	0.44	<.001	[0.35, 0.54]	-	-	-
	$PAC_{\Delta 12}$ - GPA_2	0.12	<.001	[0.06, 0.17]	-	-	-
	GPA_2 - $PAC_{\Delta 23}$	0.05	.654	[-0.17, 0.29]	-	-	-
	$PAC_{\Delta 23}$ - GPA_3	0.09	.001	[0.04, 0.15]	-	-	-
	$PAC_{\Delta 12}$ - GPA_2 - D_2 (mediation ab_2)	-0.16	.012	[-0.29, -0.04]	0.85	[0.75, 0.96]	14.8%

Note. All Discrete Time Survival Analysis (DTSA) were computed with the MLR estimator using expectation maximization (EM) algorithm optimization method and the numerical integration algorithm with 5000 random integration points. C.I. = Confidence Interval, OR = Odds Ratio = e^{β}, $\%_{OR}$ = amount of change in dropout probability for each one unit change in the predictor variable = ((1-OR)*100), N = 1007.

Figures

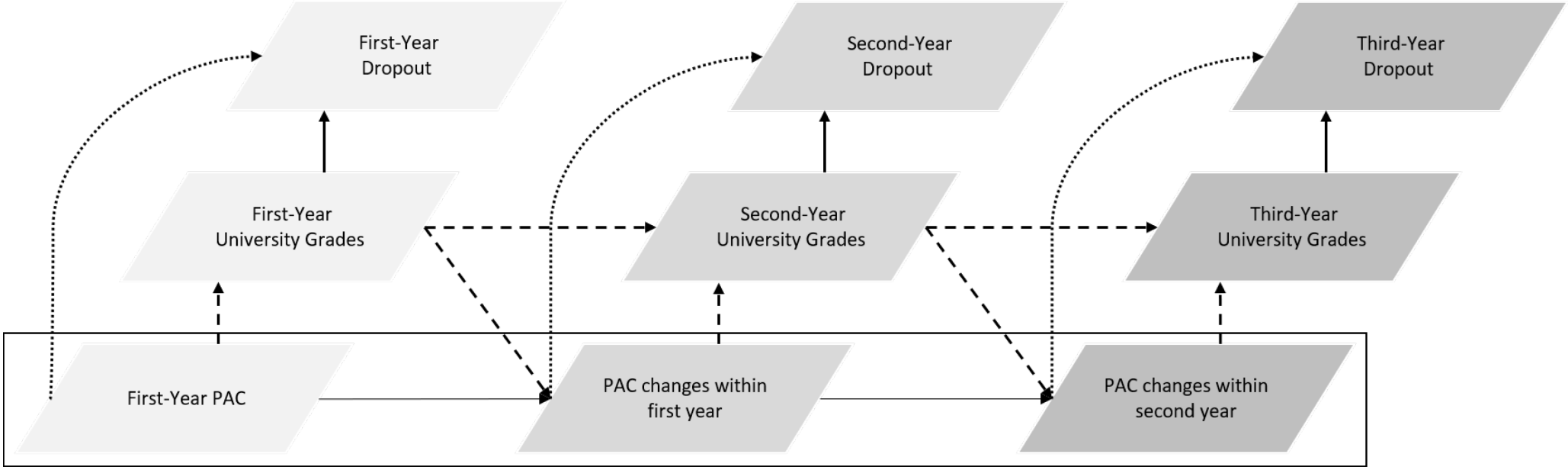

Figure 1. Overview of the study purpose and research objectives which focus on change in perceived academic control (PAC) over time and its impact on university dropout, mediated by university grades. The lower rectangle indicates the change focus (Objective 1), the dotted lines indicates the dropout focus (Objective 2a), the dashed lines indicate the grade focus (Objective 2b), and the full model indicates the mediation focus (Objective 3).

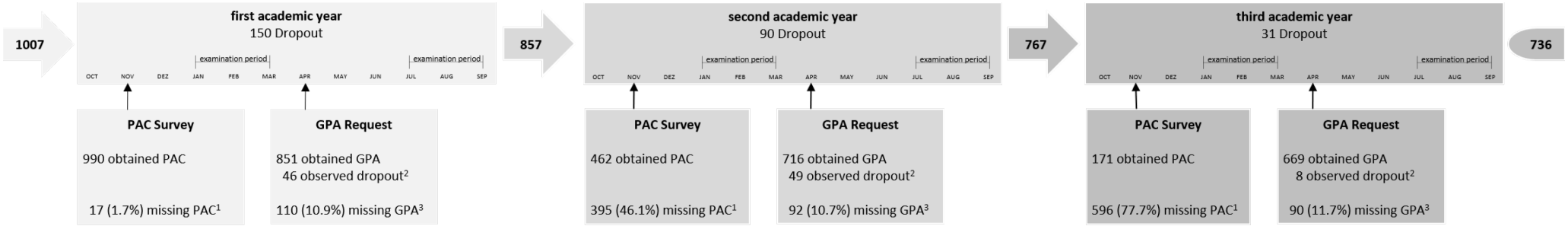

Figure 2. Overview of the obtained data for every measurement point over all three undergraduate academic years. Arrows indicate number of students starting each specific year. Perceived academic control (PAC) was obtained via self-report in November of each year (*PAC Survey*). *Obtained PAC* indicates number of completed PAC questionnaire at that specific point in time. [1]*Missing PAC* indicates missing due to non-valid item response. University grades were requested from the office of institutional records in April of each year (*GPA Request*). *Obtained GPA* indicates number of successfully received GPAs. [2]*Observed dropout* indicates students' dropout before GPA request. [3]*Missing GPA* indicates missing due to technical issues and unsuccessfully obtained GPA. Percentage in parentheses indicates portion of missing on starting sample of each specific year (attrition rate).

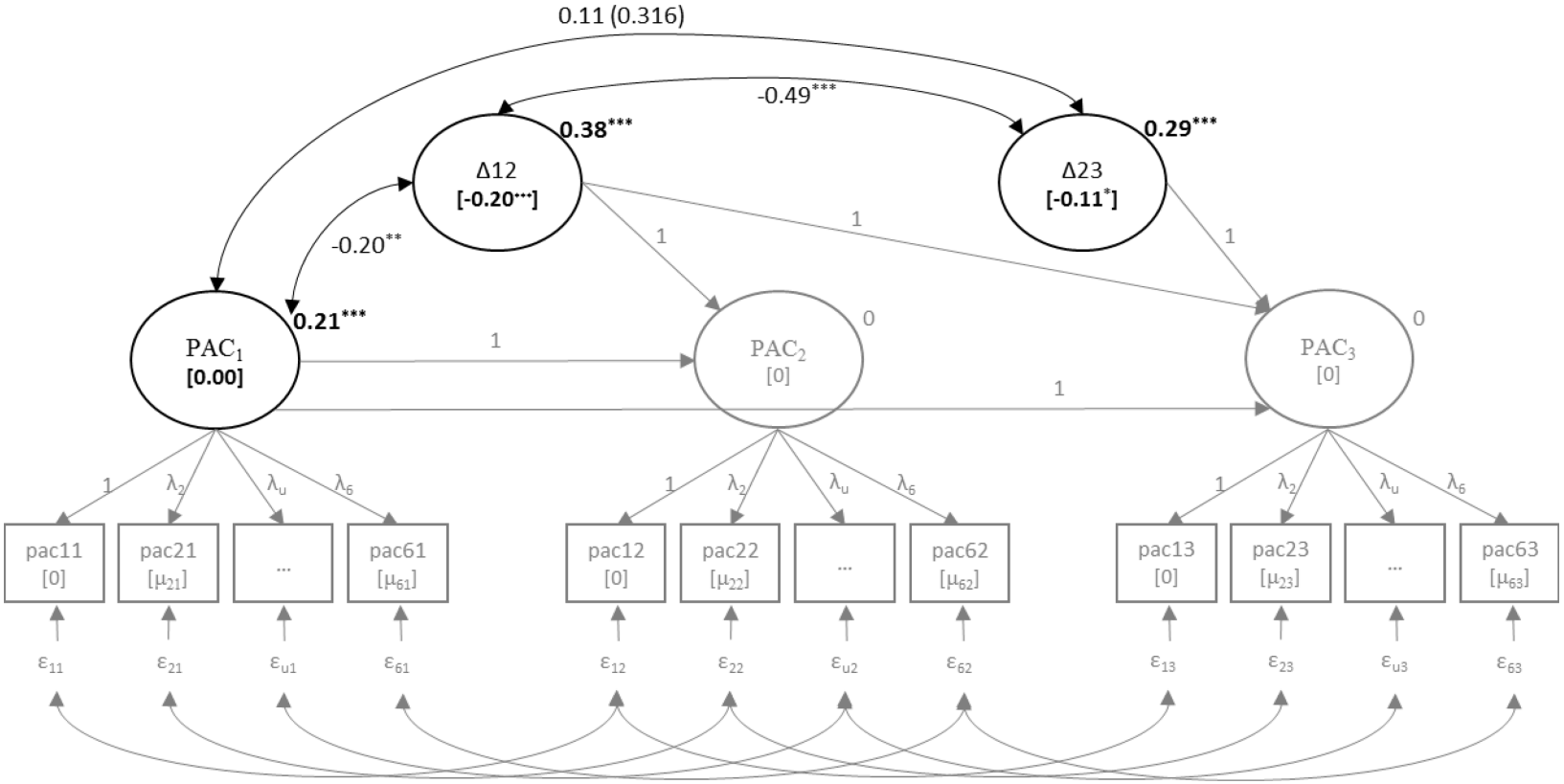

Figure 3. Change in Perceived Academic Control (PAC) over time modeled as Latent-Change Score model, specifically as a Neighbor-Change model. MLR maximum likelihood standardized parameter estimates. The latent variable PAC had six indicators (pac1-pac6). PAC was measured three times (each academic year). PAC_1 is perceived academic control in the first academic year. PAC_2 is perceived academic control in the second year. PAC_3 is perceived academic control in the third year. Δ12 is PAC change from the first to second academic year and Δ23 is PAC change from the second to third academic year. Indicator-specific effects are estimated via autocorrelation. χ^2 (134) = 271.51, $p < .001$, RMSEA = 0.03, CFI = 0.94, SRMR = 0.07, $N = 1007$.

* $p < .05$, ** $p < .01$, *** $p < .001$. Non-significant p-values are reported in parentheses.

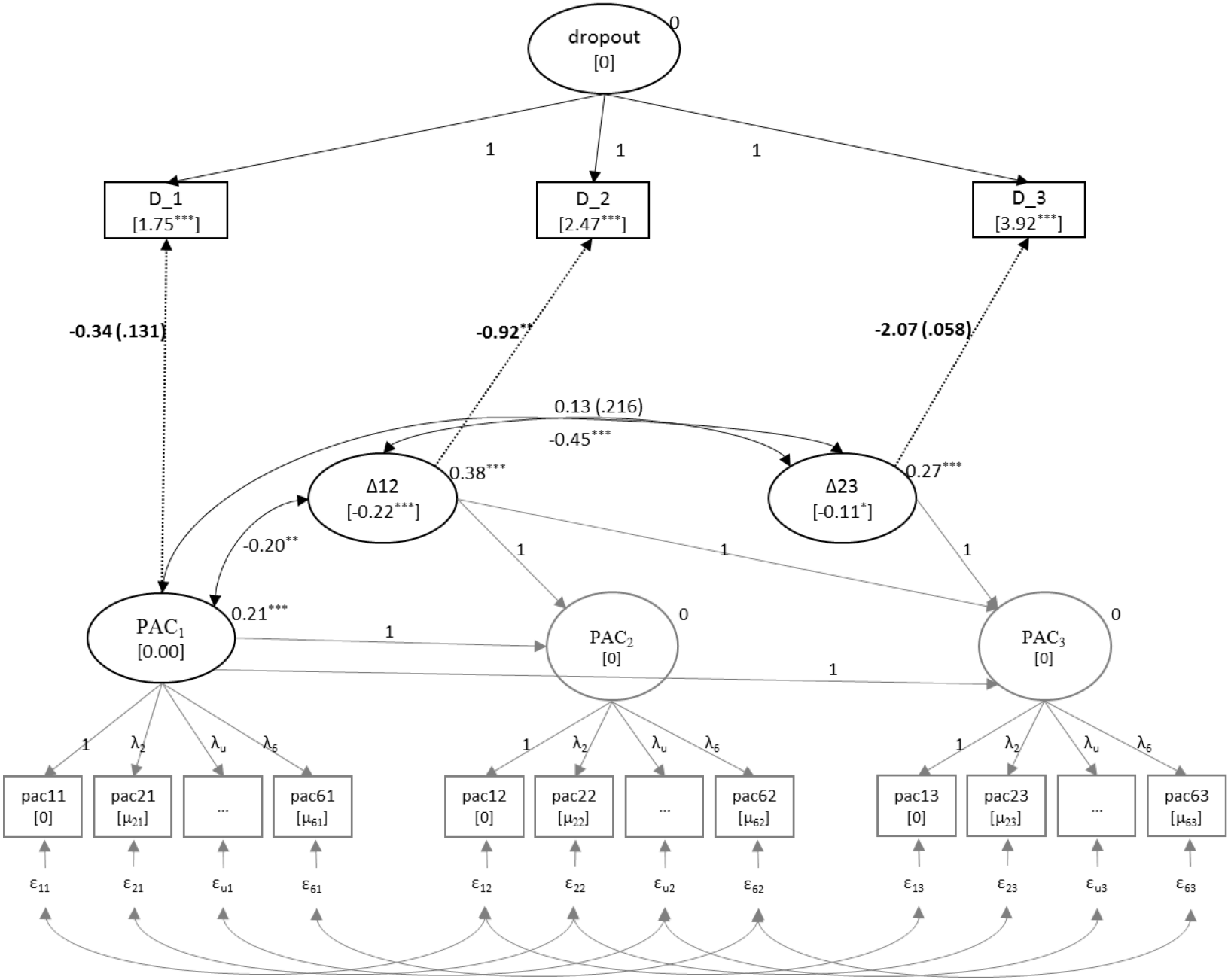
dropout
[0]
0
1
1
1
D_1
[1.75***]
D_2
[2.47***]
D_3
[3.92***]
-0.34 (.131)
-0.92**
-2.07 (.058)
0.13 (.216)
-0.45***
Δ12
[-0.22***]
0.38***
Δ23
[-0.11*]
0.27***
-0.20**
1
1
1
PAC1
[0.00]
0.21***
1
PAC2
[0]
0
PAC3
[0]
0
1
1
λ2
λu
λ6
pac11
[0]
pac21
[μ21]
...
pac61
[μ61]
pac12
[0]
pac22
[μ22]
...
pac62
[μ62]
pac13
[0]
pac23
[μ23]
...
pac63
[μ63]
ε11
ε21
εu1
ε61
ε12
ε22
εu2
ε62
ε13
ε23
εu3
ε63

Figure 4. Change in Perceived Academic Control (PAC) over time, modeled as latent-change model, and its impact on dropout of university, modeled as a discrete time survival model. PAC_1 is perceived academic control in the first academic year. PAC_2 is perceived academic control in the second year. PAC_3 is perceived academic control in the third year. Δ12 is PAC change from the first to second academic year and Δ23 is PAC change from the second to third academic year. MLR maximum likelihood model parameter estimates. Dropout is operationalized as any kind of university dropout, starting from major change, to university change, to complete dropout. D_1 is dropout in the first year. D_2 is dropout in the second year. D_3 is dropout in the third year. Dropout is the overall dropout within the three-year undergraduate program. $N = 1007$.

* $p < .05$, ** $p < .01$, *** $p < .001$. Non-significant p-values are reported in parentheses.

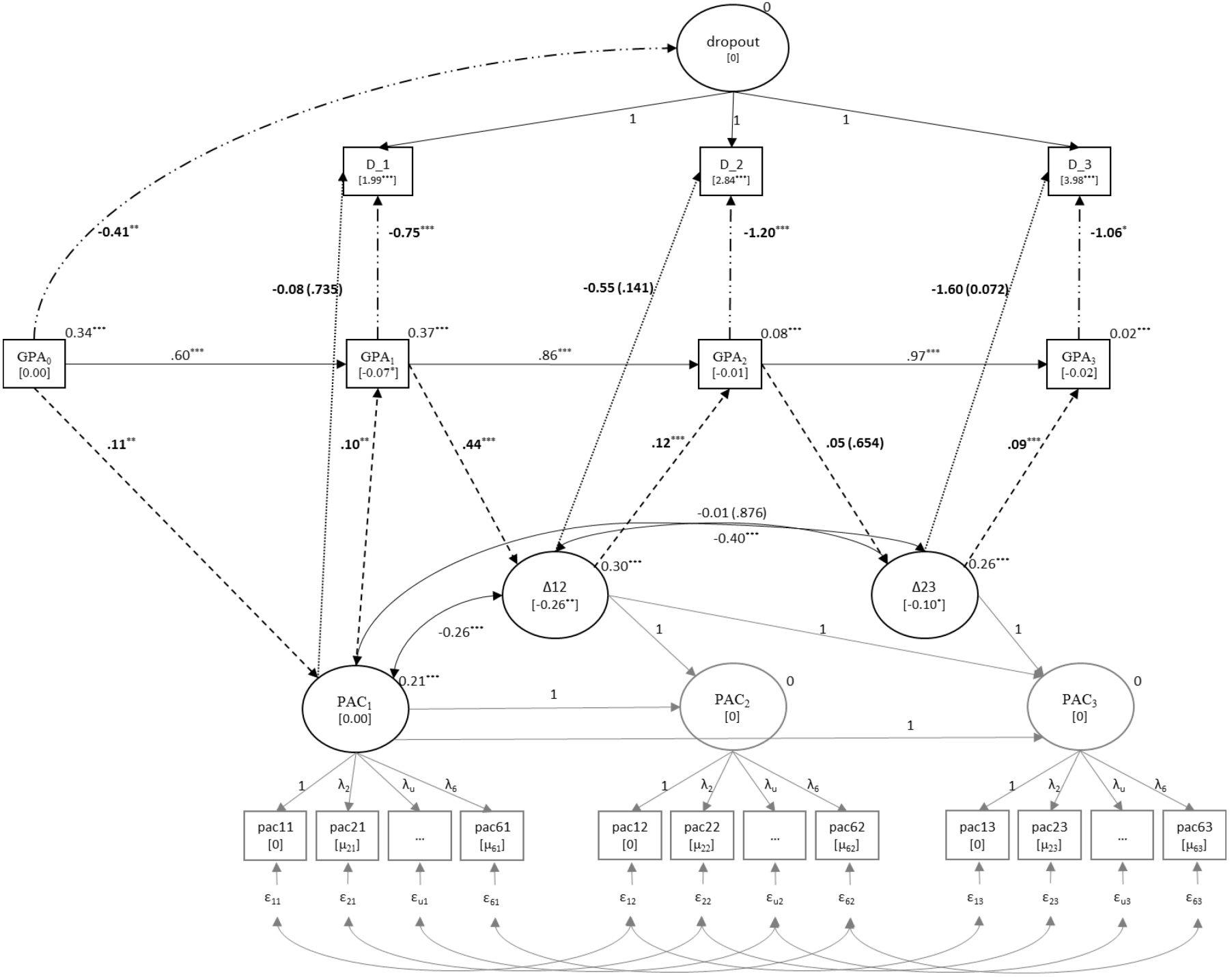
dropout
[0]
D_1
[1.99***]
D_2
[2.84***]
D_3
[3.98***]
GPA0
[0.00]
GPA1
[-0.07*]
GPA2
[-0.01]
GPA3
[-0.02]
Δ12
[-0.26**]
Δ23
[-0.10*]
PAC1
[0.00]
PAC2
[0]
PAC3
[0]
pac11
[0]
pac21
[μ21]
...
pac61
[μ61]
pac12
[0]
pac22
[μ22]
...
pac62
[μ62]
pac13
[0]
pac23
[μ23]
...
pac63
[μ63]
-0.41**
-0.75***
-1.20***
-1.06*
-0.08 (.735)
-0.55 (.141)
-1.60 (0.072)
0.34***
0.37***
0.08***
0.02***
.60***
.86***
.97***
.11**
.10**
.44***
.12***
.05 (.654)
.09***
-0.01 (.876)
-0.40***
0.30***
0.26***
-0.26***
0.21***
1
λ2
λu
λ6
ε11
ε21
εu1
ε61
ε12
ε22
εu2
ε62
ε13
ε23
εu3
ε63

Figure 5. Change in Perceived Academic Control (PAC) over time, modeled as latent-change model, and its impact on dropout of university as mediated by university grades, modeled as a discrete time survival model. PAC_1 is perceived academic control in the first academic year. PAC_2 is perceived academic control in the second year. PAC_3 is perceived academic control in the third year. Δ12 is PAC change from the first to second academic year and Δ23 is PAC change from the second to third academic year. MLR maximum likelihood model parameter estimates. University grades are operationalized as cohort-centered grade point average measured in each year (GPA), controlling for high school grades (GPA_0). GPA_1 = grades mid-term first year, GPA_2 = grades mid-term second year, GPA_3 = grades mid-term third year. Dropout is operationalized as any kind of university dropout, starting from major change, to university change, to complete dropout. D_1 is dropout in the first year. D_2 is dropout in the second year. D_3 is dropout in the third year. Dropout is the overall dropout within the three-year undergraduate program. $N = 1007$.

* $p < .05$, ** $p < .01$, *** $p < .001$. Non-significant p-values are reported in parentheses.

Footnotes

[1] In order to merge the two cohorts into one sample, we compared them on several demographic measures and study variables. *t*-test and chi-squared test for categorical data showed that cohorts did not differ regarding age, sex, nationality, or overall PAC, but differed slightly on overall GPA ($t(878) = 4.98$, $p < .001$, $d = 0.30$) and dropout ($\chi^2(1) = 20.70$, $p < .001$, $OR_{dropout} = 0.50$). The results of the mean comparisons can be found in detail in the supplemental material. We also note that, in two of eight disciplines, minor curriculum changes occurred between the cohorts. In the following results, we therefore cohort-centered GPA. An additional analysis of the final model (Figure 5) with cohort as a covariate (also in supplemental material) yielded consistent results as those reported in the main analyses, despite the expected small impact of cohort on dropout.

[2] We compared students with full data, to those with missing data, and to those who dropped out regarding their self-reported PAC, GPAs, and demographic variables (sex, age, and nationality). We found no significant mean differences concerning PAC, sex, age, and nationality. For the second measurement, we found that students who dropped out had poorer GPAs compared to students with missing data and full data. Further, students with full data had higher GPAs compared to students with missing data. For the third measurement, we found that students who dropped out had poorer GPAs compared to students with missing data and full data, but no difference was observed between students with full data and missing data for GPAs (for details see supplemental material). Based on the relevance of dropout and GPAs for the missingness and to account for the partial MNAR mechanism (Enders, 2010), we recalculated the model considering dropout and GPA as auxiliary variables in our latent change score model of PAC (change focus). The results of the models with and without the auxiliary variables (dropout, GPAs) were largely consistent (see the supplemental materials). Only changes in PAC in the second academic year (delta 23) varied from $M = -0.11$, $p = .030$ without auxiliary variables to $M = -0.16$, $p = .070$ with auxiliary variables. For this reason and due to its very small effect size, we do not interpret this parameter. As both variables (dropout and GPAs) are part of our final model (Figure 5), the MNAR mechanism becomes MAR for this model (Enders, 2010).

[3] At the first point of measurement, 17 of the 1007 students participated in the questionnaire and gave their consent to release their current enrolment status and GPA by signing a data privacy statement, but did not provide data on their PAC.

[4] The applied proportional DTSA model (Figure *4*5; AIC = 25824.72, adj.BIC = 25967.29) fit the data better than a non-proportional model (AIC = 25826.34, adj.BIC = 25972.39) for the time-invariant impact of high school GPA on dropout.

[5] Additionally, the model estimating both, the direct association of $PAC_{\Delta 12}$ on D_2 and the indirect association via GPA_2 (Figure *4*5; AIC = 25824.72, adj.BIC = 25967.29), fit the data worse compared to a model estimating only the indirect association (AIC= 25820.67, $_{adj.}$BIC = 25961.50).

[6] "We additionally tested alternative specifications for our final model shown in Figure 5. On the one hand, we incorporated paths from prior grades to dropout while still including paths from current grades to dropout (see Table G, Model A of the supplemental materials). None of the additional paths from prior grades were significant due to the high stability of achievement across measurement occasions. On the other hand, we tested an alternative model that incorporated paths from prior grades to dropout while omitting paths from current grades to dropout (see Table H, Model B of the supplemental materials). Results were comparable to those observed in the main analyses. However, both alternative models showed weaker fit than the theoretically preferred model Figure 5, as indicated by higher AIC and BIC values."

GENERAL DISCUSSION

In addition to the scientific articles, the following section discusses the findings of the aforementioned studies regarding the three research objectives and overall aim of the dissertation. First, the summarized main results are integrated into the theoretical background, next, a detailed reflection concerning the strength and limitations of this dissertation is presented, third, implications for future research and practice are discussed, and finally, concluding remarks are described which reflect the overall aim of the dissertation.

Summary and Discussion of Findings

Academic success.

In the present dissertation, academic success is defined by absence of dropout along with achievement. Thereby dropout had a decreasing trend over the years of study. Specifically, Study I revealed higher dropout intention for freshman versus sophomores' students, however, altogether low reported tendencies. In addition, Study III showed reducing dropout rates over the three undergraduate academic years, however, revealed about one sixth dropout risk in the first academic year along with meaningful late dropout. Reflecting on previous research, the present dissertation accomplished the challenge to track students (Thomas & Hovdhaugen, 2014), which resulted in dropout rates comparable to dropout rates at other universities (Heublein, 2014; Heublein & Schmelzer, 2018; OECD, 2012) and varying across the years (cf. Alarcon & Edwards, 2013). Regardless of the expected high dropout rates in the first academic year (cf. e.g., Heublein et al., 2017), the present research highlights late dropout (cf. Mabel & Britton, 2018). Finally, the dissertation also indicated that dropout intention is relevant for actual dropout behavior (cf. e.g. Mashburn, 2000), which reveals dropout intention as a possible early-warning sign (cf. e.g. Brandstätter et al., 2006). To this end, the intention to leave was discovered to be most prominent for freshmen (cf. Bean, 1985), similar to actual dropout

behavior. The first-year relevance of dropout intention and dropout behavior is not surprising, considering the students' potential issues adjusting to university, and in line with the reported time of dropout decision (Heublein et al., 2017).

Focusing on achievement, the current research indicated a first rising and later stable achievement, operationalized by university grades. Specifically, Study I showed higher GPA for second-year students compared to first-year students. Study III, however, showed high stability of GPA over time, particularly after the first academic year. In line with previous research, this dissertation therefore emphasizes long-term stability over time of achievements (e.g., Bacon & Bean, 2006). The results underline that high school grades predicts university achievement later on (similar to e.g. S. Geiser & Santelices, 2007). However, this dissertation also acknowledges variability within the first academic year regarding achievement. On one hand, these differences could be due to a selection bias in the sample or occurred dropout. On the other hand, it is possible that achievement becomes more stable over the years of study, as first year achievement showed the lowest relevance for subsequent achievement.

Finally, both academic success components related negatively to one another. Study I depicted a weak negative relation between dropout intention and annual GPA for freshman and sophomores students in sum, however, not separately. In addition, Study III showed that high achievement reduced subsequent dropout. These results are in line with previous research (e.g., Robbins et al., 2004). When comparing all three undergraduate years, second-year achievement was surprisingly the strongest predictor for subsequent dropout. This could be due to the focus on direct effect of achievement on subsequent dropout compared to a focus on long-term effects (Allen et al., 2008). In terms of dropout intention, the present dissertation specified relations to achievement (cf. Bean, 1985): The assumed negative relation occurred only when the sample size was adequate. One explanation for this might be the time-delayed measurement of achievement. In contrast to Bean (1985), both success components were measured with a time delay of about one semester with the intention being close to the beginning and grades close to

the end. Therefore, students appear to intend to drop out independently of their later achievement potential. This results in an early warning sign for dropout not only for potentially low achievers, but also for potentially high achievers. However, overall students in sum we found a meaningful, but weak relation (Study I). To conclude, the current dissertation questions the common belief that potentially poor achievers mostly intend to dropout (based on the results of a time-delayed study design), however, further research is required.

Perceived academic control and academic success.

The first research objective focusses on the relation of PAC and academic success (Figure 8). Thereby, the present dissertation acknowledges a rather long-term and small negative change in undergraduate university PAC. In detail, Study I showed that PAC was lower for students who had just finished their first year compared to those who had just started. Study II revealed no meaningful short-term change of PAC, whereas Study III showed a meaningful mildly negative long-term change of PAC, foremost within the first year. Additionally, high variability between the students indicates a strong PAC decline for some students or a PAC increase. Overall, these findings are the first which consider the research gap regarding PAC over time: The present dissertation additionally focused on PAC after the critical first academic year and thus broadens previous findings, as only meaningful long-term change was found (e.g. Perry et al., 2001; Ruthig et al., 2009). The results of no short-term change (Study II) versus meaningful long-term change (Study III) highlight the assumed relatively stable character of PAC (cf. e.g., Perry, Hall et al., 2005), but also the necessity of achievement feedback for a change in PAC (cf. Hall, 2008; Weiner, 1985). However, both studies used trait measures for PAC. Future research could pursue this further by comparing state and trait PAC measured over time. Additionally, the dissertation results also indicate a decline of PAC over time (cf. Stupnisky et al., 2012) with high variability between the various students (cf. Niculescu et al., 2016). One explanation could be possible overestimations or overoptimistic perceptions of PAC

at the beginning of study, due to the new unknown learning context and prior to the adjustment to university (Ruthig, Haynes, Perry, & Chipperfield, 2007). Another explanation could be inaccurate PAC levels due to lacking causal search (cf. attribution theory Weiner, 1985). Causal search is assumed to take place especially after negative, important, and unexpected achievement feedback. It could be that the first semester does not offer feedback and therefore the students may not apply causal search due to possible not highly valued achievement feedbacks prior to the dissertations' measurement (Weiner, 1985). Independent of this potential reason, the most change occurred within the first year, which highlights this time to be critical for students. It further emphasizes the assumed feeling of being out of control (Perry, 1991, 2003; Perry, Hall et al., 2005).

Regarding dropout, the current work further addresses the possible decrease in university dropout intentions and behaviours through high or increasing PAC, hinting towards PAC as a protective factor of dropout and a predictor of retention. Study I showed up to a medium negative relation of PAC with dropout intention. Study III revealed the preventive effect of PAC and its change on dropout. Especially an increase in PAC within the first academic year was found to reduce the subsequent dropout risk. In reflection of previous research, the present dissertation contributed to bridging the research gap of few empirical studies concerning the theoretical assumed relevance of PAC for dropout (cf. Bean & Eaton, 2001). High levels of PAC were found to occur simultaneously with low dropout intention (in line with Ruthig, 2002; as cited in Perry, Hall et al., 2005). However, this was found mostly for students after the first year of university. Moreover, high levels of PAC prevented subsequent dropout behavior (in line with Perry, Hladkyj et al., 2005). From a process perspective, an increase of PAC in the first year prevented subsequent dropout, leading to the question of whether or not PAC needs to be high or increasing to aid in retention. An explanation for the importance of the first year change in PAC compared to the beginning level could be an adaption process or correction process for PAC. As previously mentioned, students may have overestimated their PAC at the

beginning of their studies or prior achievement feedback. This overestimation was then likely adjusted or corrected after various learning experiences at university resulting in a more adequate PAC levels in the second year. This adjustment process to university may be especially important when considering retention (cf. Credé & Niehorster, 2012). It could be the case that a too overoptimistic PAC in the first year may result in dropout (broadening. e.g., Ruthig et al., 2007). However, optimism was found to predict students' psychological adaptation to university (Perera & McIlveen, 2014). The level of optimism appears to be important for the change in PAC and students' adaptation and retention. Self-efficacy may be an alternative factor influencing PAC, the adaptation process, and retention, as theoretically assumed in the psychological model of college retention (Bean & Eaton, 2001) and shown in multiple studies (for an overview see Robbins et al., 2004). It is possible that both control concepts interact and influence students' dropout simultaneously, however, further research is necessary. In line with the dual process model (J. Heckhausen & Schulz, 1995), more research is needed regarding the interaction between PAC and secondary control for dropout. Here, secondary control could explain why students with low levels of PAC or decreasing PAC remain in university studies on the basis of research for achievement (Hall et al., 2006; Hall, 2008). Overall, the present dissertation revealed PAC as a predictive factor of dropout.

Regarding achievement, the present dissertation emphasised the positive effect of PAC on achievement and vice versa. Specifically, Study I indicated that high PAC levels enhance later achievement, particularly for sophomore students. In addition, Study III revealed positive reciprocal longitudinal relations between increasing PAC and high achievement within an entire undergraduate study program. With respect to previous research, an additional strength of the present dissertation lies in the focus of the (reciprocal) relation between PAC and achievement beyond the first academic year, as assumed by the attributional theory of motivation and emotion (Weiner, 1985). The findings also highlight the relevance of achievement feedback triggered causal search in that the adaption process of first-year PAC is strongly affected by

first year achievement. High levels of PAC appear to enhance subsequent grades, especially for students with frequent achievement feedback experiences. Still, the relation between PAC and achievement was stronger for students after the first year of study compared to the beginning, perhaps reflecting the completed adjustment to university. These results do not confirm a 'paradox of failure', where high achiever in secondary school perceive low PAC at university (Perry et al., 2001). High school grades showed a weak effect on first year PAC, which then had a weak effect on first-year achievement. An explanation for this could be that students were not separated into groups of high or low levels of PAC. To this end, the 'paradox of failure' might be more relevant for the group of low control students and therefore may not appear in students overall. Alternatively, the relevance of secondary control (cf. J. Heckhausen & Schulz, 1995) may have masked the influence of PAC, as the interaction between secondary control and PAC triggered optimal adjusting processing leading to success (Hall et al., 2006). Nevertheless, this research focused on the relevance of PAC stability for achievement (cf. Stupnisky et al., 2012).

Finally, a small direct effect of PAC on dropout via the mediation of achievement was found. Drawing on this, Study III confirmed that increasing PAC within the first academic year enhanced achievement within the following year, which subsequently reduced the odds of dropout. In sum, these results broaden the empirical evidence regarding the assumed mediation of achievement on the effect of PAC on dropout (e.g., one key psychological process as described by Bean & Eaton, 2001) or persistence (e.g., as a product of all three attributional dimensions proposed by Weiner, 1985). The present dissertation adds actual dropout and the consideration of PAC beyond first year to the formerly researched voluntary course withdrawal literature (Hall et al., 2006; Perry, Hladkyj et al., 2005). Students' PAC influences their achievement and their subsequent dropout risk. This is an important first step towards a better understanding of the relevance of PAC for both academic success components.

Achievement emotions and academic success.

The second research objective centered in on achievement emotions and their relevance for academic success (Figure 8). Thereby the present dissertation broadens the trait-state debate of achievement emotions. In this context, Study II confirms previous experiences as a third variance component of the current emotional experiences of enjoyment, anxiety, and anger. In addition, Study II revealed that previous experiences are more important for the current emotional experience of pride than a person-specific variance component. Overall, this dissertation extends previous research by accounting for both trait and state components of achievement emotions in that stable trait components influence about a half of the variance (cf. Nett et al., 2017) and through adding a third emotional variance component to previous experiences. The current research also indicates how the situation-specific effect becomes a person-specific effect concerning current emotional experiences through previous emotional experiences. Emotional experiences therefore add up over time. Additionally, some achievement emotions, such as pride, depend more on previous experiences than person-specific habitual tendencies, which fits the taxonomy of achievement emotions where pride has a retrospective outcome focus (Pekrun, 2006).

Regarding dropout, this current work acknowledges the relevance of trait achievement emotions for dropout intention as a first step towards dropout. In view of this, Study I showed meaningful relations between enjoyment, boredom, and anxiety with dropout intention at the beginning of the first academic year. Enjoyment showed medium negative, boredom showed medium positive, and anxiety indicated strong positive relations with the intent to dropout. In reflection of the small amount of literature, the present dissertation is an important step towards a better understanding of the relevance of achievement emotions for dropout via intention. Additionally, negative emotions are prominent for dropout intention, comparable to voluntary course withdrawal (Ruthig et al., 2008) or to referred emotion after dropout (Herfter et al., 2015;

Pekrun et al., 2002). However, the present dissertation also indicates a possible preventive effect of enjoyment for dropout via low intention to dropout. Still, future research is needed.

In relation to achievement, the present dissertation emphasizes the relevance of stable variance components of the current negative emotional experience for achievement. In detail, Study I showed a meaningful but small positive influence on achievement of trait enjoyment and a negative influence on trait boredom. Study II, however, revealed the relevance of stable or slowly changing emotional variance components for achievement. Thus, positive emotions enhanced achievement and negative emotions particularly reduced achievement. In respect to the rich body of research confirming the relevance of achievement emotion for achievement, the present dissertation is the first study to reflect the varying influences of the person-specific, previous experience specific, and situation-specific emotional variance components for achievement. The negative valence emotions (cf. e.g., Pekrun & Linnenbrink-Garcia, 2014a) and the stable variance components were relevant (cf. weaker relation for state emotions by Ketonen and Lonka, 2012). Then again, the present dissertation revealed only weak if any long-term relations between trait course-related emotions at the beginning of the semester and achievement at the end of the semester. One explanation for this could be the varying relevance of course-, learning-, or test-related emotions (Pekrun et al., 2011) or a short-term importance of achievement emotions for achievement.

Perceived academic control, achievement emotions, and academic success.

The third research objective involves the triad of PAC, achievement emotions, and academic success (Figure 8). Here, the present research acknowledges the partial reciprocal relations between PAC and achievement emotions. More specifically, Study II revealed reciprocal relations between PAC and the more stable variance components of anger while preparing for an important exam. Moreover, the rather stable components of the emotional experience of pride, anxiety, and anger within this week influenced the PAC reported after the

exam. The present dissertation provides empirical evidence for the assumed reciprocal relation (Pekrun, 2006; Weiner, 1985), at least for anger. Further, it acts as empirical evidence for the assumed influence of emotions on PAC (Pekrun, 2006), as not only trait emotions but also previous emotional experiences were relevant. Nevertheless, the present results are only preliminary. For instance, they do not include value as a potential mediator.

Finally, the current research considered the triad of PAC, achievement emotions, and academic success. Study I showed that the co-occurrence of high PAC and low dropout intention is mediated by anxiety. Further, achievement emotions were not relevant for consequent achievement when simultaneously considering PAC. As shown by the PACES model framework (Figure 1), these results act as first indicators of the triad in that low-control students (particularly in their freshman year) experienced high anxiety and were more likely to dropout. In sum, PAC seems to be more relevant for long-term achievement than achievement emotions, leading to the question of the triads' duration.

Strengths and Limitations

The present dissertation features several strengths that broaden previous research, but it also struggles with some limitations that should be considered when interpreting the results. Starting with *general pros and cons*, this dissertation had to overcome the typical challenges of psychological survey field-based research (e.g., subjective self-reports or sample selection bias). However, the present dissertation used established scales focused on individual subjective perceptions of PAC, which cannot be observed directly. Moreover, emotional self-reports as a state measure were also obtained, which reduce memory bias. Alternative measurements of achievement emotions, such as facial detection, are difficult and expensive to implement into field research. In sum, the present dissertation managed to obtain students' self-report in high valued typical learning settings, resulting in high ecological validity. Regarding a possible sample selection bias, for the Longserv dataset, students had to attend the lectures that resulted in low response rates for senior

students due to various reasons. For the EsMon dataset, students had to attend a learning workshop that could limit the sample to highly engaged or at-risk students. Additionally, due to the protection guidelines of data privacy, achievement release forms had to be signed which limit the generalization of the results to high achievers or students with high self-concepts. However, it was not legal to obtain actual GPA from institutional records. Despite the mentioned attempts to overcome self-selection, both datasets possibly contained mostly highly motivated students. So much the worse that PAC overall declined, when considering this possibly limited generalization of the results to highly motivated and potentially successful students. A question then arises regarding how the results might have looked for a sample of potential less motivated students, low achievers, students with low self-concepts, low self-confidence, and so forth.

Another more general strength of the present dissertation lies within the consideration of time and the dynamics over time via multiple measurements and/or state measurements, as both datasets are longitudinal. For instance, the Longserv dataset considered the critical first academic year, but also broadened prior research by considering an entire undergraduate study program. The results of the present dissertation, however, are limited to the considered time lags and frequencies of measurements. For example, in Study II, even shorter or rather longer time lags between the measurements could be used to understand the emotional variance components in more depth. Additionally, in Study III, more frequent measurements of PAC could provide insights into the functional form of change via latent growth modelling or could enable heterogeneity analyses for various types of change. Still, the present study is the first to consider annual repetitive PAC self-reports. In line with the longitudinal strength of the dissertation datasets, however, comes the limitation of participants' attrition. In order to reduce attrition, the present dissertation used various methods: For EsMon, the participants were paid based on their compliance, resulting in high overall compliance rates (Study II). For Longserv, the participants were recruited within a highly valued lecture on the spot with the support of the

course instructor (after a pilot online study showed low compliance). Unfortunately, no funds were available to pay the participants (Study I & III).

Another more general strength lies within the considered heterogeneity. On the one hand, various disciplines and majors were considered in the Longserv and EsMon samples. To this end, the results of the present dissertation can be generalized to nearly all bachelor majors offered at the Ulm University. On the other hand, various situations over a week of studying were considered in the EsMon sample which widen possibilities for generalization. However, the population of interest in the current dissertation was undergraduate students on average. Future research might additionally consider various groups or profiles of students, such as high versus low control students (cf e.g. Perry, Hladkyj et al., 2005), different profiles of dropout (cf. e.g., Voelkle & Sander, 2008), or social class (cf. e.g., Goldrick-Rab, 2006) and so on.

Besides the general strength and limitations, the present dissertation holds specific pros and cons resulting from its aim and research objectives. Regarding academic success, this research tracked students throughout an entire bachelors' program, obtained actual dropout behavior from institutional records, and used a sample with comparable dropout rates to other universities. Further, dropout intention was measured as a construct indicated by three items (as opposed to a single item with yes or no responses). Still, this research is limited to a rather global understanding of dropout intention and behavior (cf. Bernardo et al., 2017) as transition was not separated from leaving. The operationalization of dropout allowed for the consideration of all perspectives on the relevant higher education stakeholders, but future research should try to separate university transition from a seasonal stop and from actual dropout (cf. e.g., Bäulke & Dresel, 2018). Moreover, the present dissertation cannot attest reasons for dropout (cf. e.g. Alarcon & Edwards, 2013), which would be useful in underlining the relevance of PAC. Regarding the second component of academic success, achievement was not only understood as single exam results, but rather actual GPA from institutional records. This accounts for the relevance of GPA for later job performance and security (e.g. Freire-Seoane et al., 2019). On the

other hand, actual subject-specific performance tests with a fixed metric may have measured actual or decrease in achievement, though this operationalization would have required enormous effort.

Regarding PAC, the present dissertation utilized the established PAC scale (Perry et al., 2001) modified using the translation of Molfenter (1999) for the context of higher education. These item versions were the basis for further development and later, validation of the German PAC scale (Geisler, Hamm, Parker, & Perry, 2018). An overview of the slightly different item wordings of PAC can be found in the appendix (Table A). Another specific limitation results from the strength that the present dissertation considered the relevance of high school grades when analyzing the relevance of PAC for long-term academic success. On the one hand, controlling for prior high school achievement is important for subsequent university achievement. Additionally, PAC was relevant for academic success despite the influence of high school grades. On the other hand, high school grades consists of various components, meaning not only performance, but also motivation, learning strategies, or school characteristics. Future research is needed to understand its relevance on tertiary motivation and achievement. Furthermore, in Study I & III the first PAC measurement was obtained prior to any achievement feedback which may have potentially been too early. Therefore, future research could compare alternative timing of PAC measurements. Finally, while the learning environments were ecologically valid, they were also potentially heterogenous. Therefore, the specific instructors may have influenced PAC differently, for instance, by designing their classes transparently or by using PAC supporting methods. The current research did not account for these differences and the effects of instructors and instructions on PAC in general.

Regarding achievement emotions, this research broadens the understanding of test anxiety and negative emotions by considering various discrete achievement emotions. However, only a limited selection was used which requires further research. This selection originates from the attempt to reduce the participants' workload. All used emotions were selected to account for various dimensions of the taxonomy of achievement emotions (Pekrun, 2006) and by their

occurrence in higher education (Pekrun et al., 2002; Pekrun & Stephens, 2010). Another limitation of the present dissertation lies in the individual level of emotions. As achievement emotions are also a social phenomenon, future research should focus on group level emotions (Pekrun & Schutz, 2007). By focusing on the individual level, the present dissertation added a third component to the current emotional experience literature. Moreover, achievement emotions have a domain-specific component (cf. secondary education research e.g., Collier, 2012). This research considered various study majors in that the Longserv dataset used domain-general operationalization of achievement emotions (Pekrun et al., 2011) and the EsMon dataset used course specific state measurements. Future researchers could vary the situational conditions systematically and analyze the strength of the found emotional variance components in varying courses and domains. Within the tertiary education the course-specificity of achievement emotions remains uncertain.

Finally, the current research placed a focus on PAC, while value was not considered even though it mediates the predictive influence of PAC on academic success (Dong, Stupnisky, Obade, Gerszewski, & Ruthig, 2015). Therefore, the third research objective concerning the triad is only inspired by the control-value theory (Pekrun, 2006) and cannot be understood as empirical evidence. Still, value was not the focus of this dissertation and it is located at the beginning of the study program, where students just choose their major and high value can be assumed.

Implications for Research and Practice

Implications for further research.

The present dissertation answers questions regarding the relevance of PAC and achievement emotions for academic success. By doing so and due to the prior mentioned limitations, further questions arise, which are addressed in the following section.

Regarding academic success, it is operationalized as retention and achievement, with dropout intention as pre-step towards dropout. Although the present dissertation may indicate that dropout intention affects dropout, future research is required to better understand the process from dropout intention to behavior. Here, the important question arises concerning what underlying cognitive processes and other factors may be more relevant than verbalized intention. For instance, the present dissertation questions the automatism between achievement and dropout. Future research could further analyze if and how dropout intention, possibly measured at multiple time points over the first academic year, relates to future achievement and subsequent retention. Additionally, the final reason for dropout could help to understand the dropout decision process in a more comprehensive way. As such, Ulm University is beginning to request dropout rationale systematically when students exmatriculate themselves voluntary. However, it is most likely that students would name poor achievement or too high demands as product of various cognitive and non-cognitive predictors for dropout (cf. Heublein et al., 2017).

Regarding PAC, it is operationalized as agent-mean-ends relation and specific component of perceived control, which leads to the question of how PAC is related to other agent, means, or ends of perceived control. For example, based on the attributional theory (Weiner, 1985), the three attributional dimensions do not only result in PAC levels but also in self-esteem levels. However, Stupnisky et al. (2013) showed PAC to be a better predictor of first-year achievement than self-esteem. Further, the purpose of engagement, meaning achievement goals, influence academic success (Robbins et al., 2004). Specifically, mastery goals predict retention and performance goals predict achievement (Elliot, McGregor, & Gable, 1999). To this end, the influence of performance goals seems to be mediated by PAC (Daniels et al., 2014). Future research could therefore reanalyze the relevance of PAC for academic success under consideration of achievement goals. Moreover, future research could additionally clarify the complex net of perceived control constructs (cf. Skinner, 1996) and motivational constructs in

general to analyze the best predictor for academic success and identify the specific role of PAC. Thus, the attributional theory (Weiner, 1985), control-value theory (Pekrun, 2006), or PACES model (Figure 1) could guide future research regarding possible mediators for the achievement enhancing effect of PAC. Additionally, a main aim of the present dissertation was to focus mainly on PAC and its relevance for academic success, and thereby disregarding other potential relevant motivational theories (cf. e.g. Eccles & Wigfield, 2002; Ryan & Deci, 2000). Future research therefore could combine common motivational theories regarding tertiary academic success and analyze the role of PAC within. For instance, autonomy and competence could foster PAC, which may subsequently shape expectancies such as self-efficacy, self-concepts, and success. Moreover, the present dissertation revealed PAC as a slowly changing trait. However, it would be interesting to confirm this understanding by an experience sampling approach and state operationalization of PAC and analyze the assumed daily stability of PAC (cf. situational expectancies, Dietrich, Viljaranta, Moeller, & Kracke, 2017) or measure multiple PAC reports prior and post various achievement feedbacks (broadening Hall, 2008). Further research is needed to understand the development of PAC over time. Similarly, the change in PAC could be partially due to the learning environment. Further research could either control for or systematically vary instructions or teacher attitude to better understand why PAC changes. Moreover, inspired by the psychological model of college retention (Bean & Eaton, 2001) the present dissertation showed the relevance of PAC for dropout, however, highlights the question of whether or not overoptimistic PAC leads to dropout. Future research could add multiple PAC measurements throughout the first two academic years and analyze their effect on students' dropout risks to test this hypothesis. Future research is also needed to strengthen the empirical base of the psychological dropout model by Bean and Eaton (2001). Moreover, while the present dissertation showed the relevance of the change in PAC for achievement and vice versa, future research could additionally analyze how PAC changes reciprocally influence fluctuations in achievement. For instance, a study could additionally account for changes in

performance, in addition to the change of PAC, and subsequently analyze the reciprocal influences of those two changes amongst each other—although the present dissertation found achievement to be rather stable, particularly after the first academic year.

Regarding achievement emotions, the present dissertation showed the relevance of person-specific and previous experience specific emotional variance components for the current emotional experience and subsequent achievement. This information results in questions of how both emotional components develop over time. Specifically: Are there predestinated points of time where continuous emotional experience shape trait emotions? Are the shown three variance components only existing for enjoyment, anxiety, or anger? Additionally, the present dissertation revealed the relevance of enjoyment and anxiety for dropout intention. Future research is needed to understand the relevance of emotions for actual dropout behavior. In reflection of the importance of rather stable variance components, a study focusing on trait emotions would be an acceptable first step. Moreover, this present research revealed only short-term emotional influence on achievement versus long-term influence of PAC on achievement, highlighting the question of how long the emotional influence on achievement lasts.

Regarding PAC and achievement emotions, the present dissertation indicated the assumed reciprocal relation for anger. Future research could reanalyze this interrelation for state PAC and state emotions through the experience sampling method or through multiple measured trait PAC and trait emotions in a longitudinal design. Moreover, it is important to acknowledge possible mediation of, for example, value or self-regulated learning (Pekrun, 2006). In line with the expectancy-value interaction (Meyer et al., 2019; Trautwein et al., 2012), future research could look into an interaction of PAC and value as predictors of academic success. In line with the consideration of value, all three scientific articles were within a highly valued tertiary academic context. Important lectures or weeks prior to an important exam are highly relevant for students. They voluntary chose when, where, and what to study. A next step could entail the

analysis of the stability of the present results within other contexts, such as obligatory professional training at work.

Finally, the current research used the PACES model as framework for the three scientific articles (Figure 1). The model outlines a scheme concerning how PAC is relevant for academic success under the consideration of achievement emotions. Future research is needed regarding the assumed triad, particularly longitudinal time-delayed measurements of all three constructs.

Implications for institutions, instructors, and students.

The present dissertation showed that PAC and positive achievement emotions enhance academic success, in line with the overall relevance of motivational and emotional control mediators for academic success (Robbins et al., 2009). This dissertation indicates concrete propositions for educational practice, for instance, regarding possible ways to reduce university dropout or enhance academic achievement.

Most importantly, institutions, instructors and students should draw their attention towards PAC; particularly for the first year (cf. Stupnisky et al., 2011), especially as the present dissertation revealed an overall decline in PAC. Thereby, PAC can be supported directly via established attributional retraining (ART, e.g., Perry & Hamm, 2017). As a result of the present dissertation, an attributional retraining started at Ulm University after conducting Study III. Specifically, in cooperation with the Motivation and Academic Achievement (MAACH) Research Laboratory at the University of Manitoba (e.g., Haynes et al., 2009), a pilot study was initiated, as a first German version of the direct PAC training was applied (so called “HELD – Du hast es in der Hand. Es liegt an Dir!”, Ulm University, 2019). This functions in that after freshman students receive their first high valued achievement feedback, they receive an invitation from their instructor to the HELD training and to research possible reasons for their results (imitating causal search). The participants then receive an online tutorial regarding PAC and the attribution theory (Weiner, 1985) with concrete advice on how to foster their own PAC

(cf. detailed descriptions of ART e.g. Hamm, Perry, Clifton, Chipperfield, & Boese, 2014; Haynes, Ruthig, Perry, Stupnisky, & Hall, 2006; Parker, Perry, Chipperfield, Hamm, & Pekrun, 2018; Perry, Stupnisky, Hall, Chipperfield, & Weiner, 2010). Alternatively or additionally, PAC can be supported in students indirectly via high predictability and controllability in their courses (Clifton et al., 2015). Clear educational objectives, structured course content, or clear task expectations (e.g., Haynes et al., 2009; Perry, 1991) help students to perceive their control opportunities in the high autonomous learning situation at university and to feel rather in than out of control. Further, an adaptive attributional feedback focusing on internal and controllable attributional dimensions supports PAC (e.g., Schunk, 1983). It might be a valuable avenue to induce productive failure experience (cf. Kapur, 2008) at the beginning of the study as unexpected negative achievement feedback to reduce possible overestimations (and subsequent reduced PAC/increased dropout risk). Finally, students could support their own PAC through frequent causal searches after achievement feedback and by reflecting their own control opportunities at university, especially if they know the concept of attributions and PAC. Alternatively, students could make their courses more structured, transparent, and controllable by themselves, for instance, by using metacognitive strategies, practicing with exams from prior cohorts, or by interviewing senior students and so forth.

Besides PAC, the present dissertation also indicated the relevance of achievement emotions. In line with the various important functions of achievement emotions for student's attention, learning strategies, or motivation (Pekrun, 2006); institutions and instructors should support positive emotional experience while studying. On one hand, positive achievement emotions can be enhanced directly via emotion regulation trainings (for an overview of test anxiety interventions see Huntley et al., 2019). For instance, a semester long weekly online course-based intervention design to increase students' PAC to enhance their achievement emotions (Howard, 2016) or an online treatment focusing on students' PAC and reappraisal usage to reduce negative emotions in mathematics (Kim & Hodges, 2012). Here, the specific context

needs to be considered, as for instance suppression instead of reappraisal can be effective for anxiety in academic context (Rottweiler, Taxer, & Nett, 2018). On the other hand, Frenzel and Stephens (2013) advise teachers to design emotionally 'healthy' courses by promotion of enjoyment while learning to support emotion regulation and performance-enhancing emotions. Achievement emotions can also be supported indirectly through the teaching skills of the instructors, such as their attitudes or methods, which would increase positive emotions, reduce stress and negative emotions, and consequently enhance PAC (Muntaner-Mas, Vidal-Conti, Sesé, & Palou, 2017). Moreover, reduced direct instructions and increased working in small groups could individually help provide emotional support (Bieg et al., 2017). Based on the control-value theory (Pekrun, 2006), adaptive task demands or increased autonomy can increase positive emotions. Also, the prior mentioned supporting mechanism for PAC subsequently supports achievement emotions. Finally, students could use adequate learning strategies to enhance positive emotional experiences (Villavicencio & Bernardo, 2013). They could also learn together in learning groups as a potential strategy for emotion regulation (Järvenoja & Järvelä, 2009) or might enhance their control perception in order to experience positive achievement emotions (Parker et al., 2018).

Concluding Remarks

Overall, it can be summarized that the present dissertation sheds light into new insights regarding the relevance of PAC for both academic success components together over time. The results close the former research gap regarding the relevance of PAC for dropout and broadens its known influence on achievement by reciprocal relations. Moreover, dropout and achievement depend on the adaption or correction process of students' PAC in the first year. This and the overall decline of PAC indicated institutions, instructors, and students to make a change. Students need to receive early achievement feedback and to reflect their causal search in order to obtain adequate PAC levels and/or reduce possible overoptimistic levels at the

beginning of their studies, and subsequently stay enrolled. Moreover, the present dissertation broadens the state trait debate of achievement emotions by adding previous experiences as a third variance component, which could explain how state becomes trait. Thereby, the results indicate no relevance of the most variable state component for perceived academic control or achievement. In addition, the effect of trait emotions on achievement seems rather short-term. Further, despite focusing on more than anxiety, the present dissertation underlined its relevance within the tertiary educational context. Finally, the present dissertation provides new insights into the interaction of PAC and achievement emotions by accounting for previous emotional experiences, leading up to the PACES model as a framework of this dissertation (Figure 1) which suggests future research directions. Methodologically, the present dissertation managed to obtain longitudinal field-based studies resulting in high ecological validity. Further, it used strong statistical analyses and obtained both academic success components from institutional records. The present dissertation found dropout intention to be an early warning for dropout independently of subsequent achievement, whereas achievement influences actual dropout (particularly late dropout). In sum, the present dissertation achieved its aim by highlighting the relevance of PAC for academic success at university and thereby accounting for achievement emotions. Thus, the present dissertation lends important information regarding the reduction of university dropout intention and behavior. As final remark, PAC contributes to the known relevance of motivation for academic success (Bean & Eaton, 2001; Fong et al., 2017; Heublein et al., 2017; Richardson et al., 2012; Robbins et al., 2004; Schneider & Preckel, 2017).

SUMMARY

High dropout rates within tertiary education worldwide document challenges students have to overcome in order to succeed (e.g., OECD, 2012). For instance, they have to uphold motivation for the long term (e.g., Robbins et al., 2004). Thereby, one relevant motivational aspect is the subjective perception of control over one's own academic outcomes, or in other words, perceived academic control (e.g., Perry, 1991). Particularly freshman students who are required to adjust to a new learning setting of university may 'feel out of control' (e.g., Perry et al., 2001). Unfortunately, the long-term relevance of perceived academic control remains unknown. Besides motivational aspects, the tertiary educational challenges trigger various achievement emotions (e.g., Pekrun & Stephens, 2010), which have impact themselves on students' grades (e.g., Pekrun et al., 2017) and interact with perceived academic control (e.g., Pekrun, 2006). Thereby, experiences of achievement emotions depend on the habitual tendency (trait) and the situational impact (state, e.g., Nett et al., 2017). Overall, the aim of the present dissertation was to provide insight into the relevance of perceived academic control for undergraduate academic success, under the consideration of achievement emotions. In order to accomplish this aim, three scientific studies were conducted. Methodically, those studies used two field-based longitudinal datasets to achieve high external validity. They were obtained within the everyday student life of various study majors at Ulm University. The tow field-based datasets were an experience sampling study with 98 participants and an annual questionnaire with 1009 participants. Here, established scales were used (Pekrun et al., 2011; Perry et al., 2001). Overall from a statistical perspective, this dissertation used structural equation modelling approaches including moderated mediations (Study I), stable trait autoregressive trait state models (Study II), and a latent change score model combined with a discrete time survival analysis (Study III). The first research objective focused on the relation of PAC and academic

success. Thereby Study III acknowledged a rather long-term and small negative change in undergraduate university PAC. Further, the reduction of university dropout intention (Study I) and dropout behaviour (Study III) through high or increasing PAC were addressed and Study III emphasized the positive effect of PAC on grades and vice versa. The second research objective focused on achievement emotions and their relevance for academic success. Thereby Study II broadened the trait-state debate of achievement emotions. Study I acknowledged the relevance of trait achievement emotions for dropout intention and Study II emphasized the relevance of rather stable variance components of the current negative emotional experience on grades. The third research objective focused on the triad of PAC, achievement emotions, and academic success. Study I acknowledged the partial reciprocal relations between PAC and achievement emotions, particularly for negative emotions such as anxiety or anger. Study II showed partially how PAC influences achievement emotions, which subsequently influences PAC and grades. In sum, the long-term decrease of perceived academic control broadens prior research by showing its relevance for late dropout, mediated by grades, and long-term reciprocal relations with achievement (Weiner, 1985, 2018). However, the results reveal the need for action regarding supporting at-risk students who may dropout or potential poor achievers mostly for freshman students, particularly as the present study indicates a possible over-estimation (e.g., Ruthig et al., 2007) or missing causal search (e.g., Stupnisky et al., 2011). Further, the present dissertation adds previous experiences as a third emotional variance component which is relevant for students' grades and possibly for explaining how state becomes trait through new statistical analysis for experience sampling data. Additionally, the present dissertation questions the long-term impact of emotions on achievement and takes a first step to analyze their impact on dropout. Overall, this dissertation highlights the contribution of perceived academic control to the known relevance of motivation for academic success (e.g., Bean & Eaton, 2001; Heublein et al., 2017; Robbins et al., 2004) and provides a framework for future research, namely the PACES model.

ZUSAMMENFASSUNG

Hohe Studienabbruchraten markieren die Herausforderungen, welche Studierende für ein erfolgreiches Studium meistern müssen (OECD, 2012), beispielsweise die Aufrechterhaltung der Lernmotivation über einen langen Zeitraum (Robbins et al., 2004). Ein relevanter Aspekt der Motivation ist dabei ihre subjektive akademische Kontrollwahrnehmung, d.h. wie stark sie ihren Einfluss auf die eigenen akademischen Resultate wahrnehmen (Perry, 1991). Besonders Studierende zu Studienbeginn können sich ‚außer Kontrolle' fühlen, da sie sich an die neue Lernumgebung anpassen müssen (Perry et al., 2001). Leider ist die langfristige Bedeutung von Kontrollwahrnehmung unbekannt. Neben dem motivationalen Aspekt gehen mit den universitären Herausforderungen ebenso verschiedenste Leistungsemotionen einher (Pekrun & Stephens, 2010), welche ebenso die Noten beeinflussen (Pekrun et al., 2017) und mit Kontrollwahrnehmung interagieren (Pekrun, 2006). Dabei hängen die emotionalen Erfahrungen von grundsätzlichen Handlungstendenzen (Trait) und der Situation ab (State, Nett et al., 2017). Das Ziel dieser Dissertation war daher mehr über die Bedeutung von akademischer Kontrollwahrnehmung für den studentischen Erfolg zu erfahren, unter Beachtung der Leistungsemotionen. Um dies zu erreichen wurden drei wissenschaftlichen Studien durchgeführt. Für deren hohe externe Validität wurden zwei Längsschnittdatensätze verwendet, welche im Alltag von Studierenden verschiedenster Ulmer Fachgebiete situiert waren. Diese Datensätze waren zum einen Experience Sampling mit 98 Studierenden und zum anderen jährliche Fragebögen mit 1009 Studierenden. Dabei wurden etablierte Skalen verwendet (Pekrun et al., 2001; Perry et al., 2001). Die Datenauswertung erfolgte mittels Strukturgleichungsmodellen, konkret eine moderierte Mediation (Studie I), ein Trait State Modell mit Autoregression (Studie II) und ein latentes Veränderungsmodell mit diskreter Survival-Analyse (Studie III). Das erste Teilziel fokussierte auf die Interaktion von Kontrollwahrnehmung und akademischen Erfolg. Dabei wurde eine eher langfristige und

geringe Abnahme der Kontrollwahrnehmung aufgezeigt (Studie III), sowie eine Reduktion von Abbruchtendenz (Studie I) und Studienabbruch (Studie III) durch eine hohe oder steigende Kontrollwahrnehmung. Zudem zeigte Studie III einen gegenseitigen positiven Einfluss von Kontrollwahrnehmung und Noten. Das zweite Teilziel fokussierte auf Leistungsemotionen sowie deren Bedeutung für den akademischen Erfolg. Studie II erweiterte die Trait State Debatte um Vorerfahrungen und untermauerte die Noten Relevanz der eher stabilen Varianzkomponenten. Zudem deutete Studie I die Bedeutung von Trait-Emotionen auf die Studienabbruchtendenz an. Das dritte Teilziel fokussierte auf die Triade von Kontrollwahrnehmung, Leistungsemotionen und akademischen Erfolg. Dabei zeigte sich eine teilweise reziproke Beziehung zwischen Kontrollwahrnehmung und speziell negativen Emotionen (Studie I). Studie II zeigte teilweise den gegenseitigen Einfluss von Kontrollwahrnehmung und Emotionen sowie deren Bedeutung für Noten. Insgesamt erweitern diese Ergebnisse bisherige Forschung (Pekrun, 2006; Weiner, 1985, 2018). Die langfristige Abnahme der Kontrollwahrnehmung beeinflusst Studienabbruch, in Abhängigkeit der Noten sowie es besteht eine reziproke Beziehung zwischen Kontrollwahrnehmung und Noten. Allerdings zeigen sie auch den Handlungs- und Unterstützungsbedarf für Studienabbruch gefährdete oder potenziell schlechte Studierende auf. Besonders zu Studienbeginn deuten sich Überschätzungen (Ruthig et al., 2007) und fehlende Ursachenzuschreibung an (Stupnisky et al., 2001). Zudem ergänzen die Ergebnisse emotionale Vorerfahrungen als dritte Varianzkomponente unter Verwendung neuer Analysemethoden für Experience Sampling. Dabei beeinflussen Vorerfahrungen Noten und erklären möglicherweise wie State zu Trait wird. Zudem stellen die Ergebnisse den langfristigen Einfluss von Emotionen auf Noten in Frage, aber zeigen deren Einfluss auf Studienabbruchtendenz. In Summe ergänzt diese Arbeit Kontrollwahrnehmung als relevanten motivationalen Aspekt für den akademischen Erfolg (Bean & Eaton, 2001; Heublein et al., 2017; Robbins et al., 2004). Schließlich bietet diese Dissertation ein Rahmenmodell für künftige Forschung, das PACES Modell.

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INDEX OF ABBREVIATIONS

ART	Attributional Retraining
AEQ	Academic Emotions Questionnaire
DTSA	Discrete Time Survival Analysis
GPA	General Point Average
PAC	Perceived Academic Control
SEM	Structural Equation Modeling
STARTS	Stable Trait Autoregressive Trait State model

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APPENDIX

Additional Tables

Table A. Overview Operationalization of Perceived Academic Control

Molfenter, 1999	Study I	Study II*	Study III	Geisler et al., 2018
Ich habe ziemlich viel Kontrolle über meine Studienleistungen.		Ich habe ziemlich viel Kontrolle über meine Studienleistungen.	Ich habe ziemlich viel Kontrolle über meine Studienleistungen.	In Veranstaltungen habe ich sehr viel Kontrolle über meine akademische Leistung.
Je mehr ich mich in meinem Studium anstrenge, umso besser schneide ich ab.	Je mehr ich mich in meinem Studium anstrenge, umso besser schneide ich ab.	Je mehr ich mich in meinem Studium anstrenge, umso besser schneide ich ab.	Je mehr ich mich in meinem Studium anstrenge, umso besser schneide ich ab.	Je mehr ich mich in Veranstaltungen anstrenge, desto bessere Leistungen erbringe ich.
Wie sehr ich mich auch anstrenge, es scheint mir nicht zu gelingen, mein Studium zu bewältigen (R).	Was auch immer ich tue, ich scheine immer schlecht in meinen Lehrveranstaltungen zu sein. (R)	Was auch immer ich tue, ich scheine immer schlecht in meinen Leistungen zu sein. (R)	Was auch immer ich tue, ich scheine immer schlecht in meinen Leistungen zu sein. (R)	Was ich auch tue, ich scheine in Veranstaltungen nicht voran zu kommen. (R)
Ich sehe mich selber als hauptverantwortlich für meine Leistungen im Studium.	Ich sehe mich selber als hauptverantwortlich für meine Leistungen im Studium.	Ich sehe mich selber als hauptverantwortlich für meine Leistungen im Studium.	Ich sehe mich selber als hauptverantwortlich für meine Leistungen im Studium.	Ich bin der Ansicht, dass ich größtenteils selbst für meine Leistungen in meinem gesamten Studium verantwortlich bin.
Wie gut ich bei Prüfungen in meinem Studium abschneide, ist oftmals Glückssache(R).	Wie gut ich bei Prüfungen in meinem Studium abschneide, ist oftmals Glückssache. (R)		Wie gut ich bei Prüfungen in meinem Studium abschneide, ist oftmals Glückssache. (R)	Wie gut ich in Veranstaltungen abschneide, ist häufig Glückssache. (R)

Meine Leistungen an der Universität kann ich kaum beeinflussen(R).	Meine Leistungen an der Universität kann ich kaum beeinflussen. (R)	Meine Leistungen an der Universität kann ich kaum beeinflussen (R)	Ich habe nur wenig Einfluss auf meine Leistungen im Studium. (R)
Wenn ich in einer Prüfung schlecht abschneide, liegt es meistens daran, dass ich mich nicht genug angestrengt habe.			Wenn ich eine schlechte Leistung in einer Veranstaltung erbringe, liegt es für gewöhnlich daran, dass ich mich nicht hundertprozentig angestrengt habe.
Meine Noten werden im Wesentlichen von Dingen bestimmt, die außerhalb meiner Kontrolle liegen, und daran kann ich wenig ändern(R).	Meine Noten werden im Wesentlichen von Dingen bestimmt, die außerhalb meiner Kontrolle liegen, und daran kann ich wenig ändern. (R)		Meine Noten sind im Wesentlichen von Dingen abhängig, die außerhalb meiner Kontrolle liegen und es gibt wenig, was ich tun kann, um das zu ändern. (R)
Ob man sich im Studium anstrengt oder nicht, macht im Großen und Ganzen wenig aus (R).			

Note.
*recommendations for a short version oft he PAC scale (Perry et al., 2001) by Robert Stupnisky

Complete List of Publications

Scientific Articles

Respondek, L., Seufert, T., Stupnisky, R., & Nett, U. E. (2017). Perceived Academic Control and Academic Emotions Predict Undergraduate University Student Success: Examining Effects on Dropout Intention and Achievement. *Frontiers in Psychology, 8,* 243. https://doi.org/10.3389/fpsyg.2017.00243

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

Respondek, L., Seufert, T., Hamm, J. M., & Nett, U. E. (2019). Linking Changes in Perceived Academic Control to University Dropout and University Grades: A Longitudinal Approach. *Journal of Educational Psychology.* DOI: 10.1037/edu0000388 (accepted 05/25/2019)

Conference Paper

Respondek, L., Seufert, T., & Nett, U. E. (2019, August) Growing Perceptions of Control reduce Dropout Risk and enhance Achievement - A Longitudinal Study. Paper session presented at the 18th Biennial EARLI Conference, Aachen, Germany.

Respondek, L., Seufert, T., & Nett, U. E. (2019, Februar) Alles unter Kontrolle? Die Relevanz von „Perceived Academic Control“ für Studienabbruch und Studienleistung. Eine Längsschnittstudie. [All under control? The relevance of Perceived Academic Control for University Success. A longitudinal study.] Paper session presented at the 7th annual meeting 2019, Cologne, Germany.

Respondek, L., Seufert, T., & Nett, U. E. (2018, September) Aus 2 mach 3? Komponenten von Leistungsemotionen und ihre Bedeutung für akademische Kontrollwahrnehmung und Prüfungserfolg. [2 become 3? Components of Achievement Emotions and their Importance for Perceived Academic Control and Achievement]. Symposia session submitted at the 51th Conference of the German Society for Psychology, Frankfurt a.M., Germany.

Müller, Braun, Respondek, & Seufert (2018, September). Was bringen Prompts längerfristig? Eine semesterbegleitende Studie zu den Effekten eines Lerntagebuchs auf Lernstrategieeinsatz und Prüfungsleistung. [Long-Term Effects of Prompts. Effects of Learning Diaries over a whole Semester on the Use of Learning Strategies and Achievement.] Paper session presented at the 51th Conference of the German Society for Psychology (DGPS), Frankfurt a.M., Germany.

Müller, N., Respondek, L., Braun, H., & Seufert, T., (2018, August). Longitudinal effects of learning journals including prompts on learning strategy development and performance. Paper session presented at the EARLI SIG 6 + 7 Meeting, Instructional Design + Technology-Enhanced Learning and Instruction, in Bonn, Germany.

Respondek, L., Seufert, T., & Nett, U. E. (2018, April) Achievement Emotions from a Trait State Perspective and their Relationships with Perceived Academic Control and Achievement. Poster presented at the AERA Annual Meeting 2018, New York City, USA.

Respondek, L. & Nett, U. E. (2017, September) Es kommt darauf an. Die differenzielle Wirkung von Metakognition auf Prüfungsleistung und akademische Kontrollüberzeugung. [It depends. Differential effect of metacognition strategies on exam achievement and academic perceived control]. Symposia session presented at the Annual Meeting of the Educational Psychology Section of the German Psychological Society, Münster, Germany.

Respondek, L. & Nett, U. E. (2017, June) University students' real-life emotions: Applying STARTS models to analyse the experience of achievement emotions and their interaction with perceived control. Poster presented at the 5th Biennial Conference of the Society for Ambulatory Assessment, Luxembourg.

Respondek, L., Nett, U. E.,& Seufert, T. (2016, September) Herausforderung Studienbeginn – Das Zusammenspiel von Kognitionen und Lern- und Leistungsemotionen [Challenging begin of studies – The Interrelation of Cognition and Academic Emotions]. Paper session presented at the 50th Conference of the German Society for Psychology, Leipzig, Germany.

Respondek, L., & Nett, U. E. (2016, July) The importance of self-beliefs and achievement emotions for academic success of university freshmen. A structural equation approach

to support freshmen. Paper session presented at The Higher Education Conference, Amsterdam, Nederland.

Respondek, L., & Nett, U. E. (2015, September) *Monitoring, Selbstwirksamkeit, Lernemotionen – Bedeutsame Zusammenhänge in realen Lernsituationen* [Monitoring, Self-Efficacy, Academic Emotion – Essential Relations in Real-life Learning Situations]. Symposia session presented at the 15th annual meeting of the Educational Psychology Section of the German Psychological Society, Kassel, Germany.

Respondek, L., Nett, U. E., & Seufert, T. (2015, August) *Beyond marks: Perceived academic control and achievement emotions influence dropout and achievement*. Poster presented at the 16th Biennial EARLI Conference for Research on Learning and Instruction, Limassol, Cyprus.

Respondek, L., Taxis, S.-S., Seufert, T., & Nett, U. E. (2014, September) *Studienabbruch verhindern = Kontrollüberzeugungen + Selbstwirksamkeit fördern?* [Stop University Dropout = Enhance Control Appraisals + Self-Efficacy] Paper session presented at the 49th Conference of the German Society for Psychology, Bochum, Germany.

Respondek, L., Gutmann, C.,& Nett, U. (2014). Fit für die Psychologie - Mit Co-Piloten den Studieneinstieg bewältigen. Paper presented at the Psychologie Didaktik, Witten, Germany.

Respondek, L., Westhauser, C. (2014). Gemeinsam stark für dich und dein Studium. Fachtagung Studieneingangsphase. Paper presented at the Qualitätspakt Lehre, Köln, Germany.

Invited Talks

Respondek, L., Seufert, T., Hamm, J.M., & Nett, U.E. (2018, Oktober) Kontrollerleben, Studienabbruch und Studienleistungen? Zusammenhänge und Veränderungen im Verlauf eines Studiums [Perceived Academic Control, University Dropout, and Achievement. Relations and Change within the entire undergraduate study]. Invited presentation at the Research Colloquium Psychology, Department of Psychology University of Augsburg, Germany.

Respondek, L., Schropp, D., & Seufert, T. (2017, September) Zweifel am Studium. Was nun? Ergebnisse einer vierjährigen Studierendenbefragung. [In doupt about studying. What now? Results of a four-year long student survey.]. Executed workshop at the GIBET

annual conference (Gesellschaft für Information, Beratung und Therapie an Hochschulen), Ulm, Germany.

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