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The role of study engagement in university students' daily experiences: A multilevel test of moderation

Elina E. Ketonen[a,c,*], Lars-Erik Malmberg[b], Katariina Salmela-Aro[a,c], Hanni Muukkonen[d], Heta Tuominen[a], Kirsti Lonka[a,e]

[a] Faculty of Educational Sciences, University of Helsinki, Finland
[b] Department of Education, University of Oxford, UK
[c] Department of Psychology, University of Jyväskylä, Finland
[d] Department of Educational Sciences and Teacher Education, University of Oulu, Finland
[e] Optentia Research Focus Area, North-West University, South Africa

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ABSTRACT

The present study investigated the dynamic nature of students' daily experiences and general study engagement using intra-individual assessment. More specifically, we examined individual differences in the relationship between university students' task-specific value and situational emotions and, further, whether first-year study engagement would moderate this association during the first two years of studies. Intra-individual state assessments were conducted via mobile phone-based experience sampling method (ESM) during participants' first ($N = 72$) and second ($N = 56$) academic years, resulting in 3089 and 2912 fully completed state questionnaires. In both years, students were asked five times a day over two weeks how important they perceived their current activity and their positive and negative emotions. Using multilevel structural equation modeling, we found that, on average, a higher perception of task-specific value was associated with higher positive emotions and lower negative emotions within individuals. However, individual differences were detected in the value-emotion relations especially during the second academic year. Finally, the findings indicated that overall study engagement, measured at the beginning of the first academic year, predicted between-person differences in these within-person relationships both years.

1. Introduction

Students in higher education vary in terms of how they value different tasks and may also vary regarding their emotional experiences related to these value appraisals. Is this variation due to the fact that some students are generally more engaged than others? Or instead, is it related to the particular situations of just having a good or a bad day? Our urge to understand such questions better is part of a larger movement to investigate university students' engagement (e.g., Ketonen et al., 2016; Salmela-Aro & Read, 2017; Schaufeli, Martínez, Pinto, Salanova, & Bakker, 2002; Shernoff et al., 2017), as well as students' emotional experiences within university settings (e.g., Barker, Howard, Galambos, & Wrosch, 2016; Ketonen, 2017; Robinson et al., 2017). On the basis of previous research, we already know that more general approaches to learning, such as the deep approach (Postareff, Mattson, Lindblom-Ylänne, & Hailikari, 2017), the mastery approach (Tanaka & Murayama, 2014) and autonomous goal motivation (Ketonen, Dietrich, Moeller, Salmela-Aro, & Lonka, 2018), are all related to positive academic emotions among university students. Although much of the research has focused on variations in emotions between students, recent studies have also started to examine the extent to which these findings can be generalized to the level of situations and within-person functioning by measuring university students' emotions as they occur (e.g., Goetz, Frenzel, Stoeger, & Hall, 2010; Tanaka & Murayama, 2014). We wanted to examine the role of more general study engagement in such situational experiences.

Situational academic emotions pertaining to ongoing academic tasks (e.g., enjoyment during learning) can be characterized according to their positive or negative valence (i.e., whether the emotional state is pleasant or unpleasant) and activating or deactivating nature (e.g., Pekrun, 2006; Yik, Russell, & Barrett, 1999). *Positive activating emotions*, in particular, have been shown to enhance students' performance. For instance, the enjoyment of learning has been related to increased interest, effort, self-regulation, and elaboration of the learning material,

* Corresponding author.
E-mail address: elina.e.ketonen@helsinki.fi (E.E. Ketonen).

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thus it is likely to facilitate overall performance (Pekrun & Linnenbrink-Garcia, 2014). The underlying patterns of *negative activating emotions* may be more complex. For example, anxiety has been shown to produce task-irrelevant thinking in some situations, which reduces the cognitive resources available for task purposes. However, it may also induce the motivation to study harder and facilitate overall learning among those who are more resilient (Pekrun, Goetz, Titz, & Perry, 2002). Besides the effects on performance, the overall balance of people's positive to negative emotions has been shown to contribute to their subjective well-being, such as life satisfaction (Diener, Sandvik, & Pavot, 1991). Thus, understanding the antecedents of these emotions represents an important area of research with potential implications for university students' learning and adaptive academic functioning.

1.1. Perceived value as an antecedent of students' emotions

The control-value theory of achievement emotions (CVTAE; Pekrun, 2006) introduces different types of emotions experienced in situations involving learning and achievement, and the contextual and individual factors that influence these. The theory suggests that individuals' subjective valuing of a particular task or activity and their self-evaluated controllability in this activity are the key predictors of achievement-related emotions. While in empirical studies the perception of control has constantly been found to be positively associated with positive emotions and negatively related to negative emotions (e.g., Pekrun, 2000), the effect of value on emotions seems to be more ambiguous. CVTAE suggests that a high level of personal relevance is related not only to greater positive emotions, but that negative emotions should also be intensified if a task is found to be subjectively valuable. However, the predictive role of the perceived value of the activity on negative emotions has been empirically demonstrated to be either positive (e.g., Pekrun, 2000), negative (e.g., Goetz, Pekrun, Hall, & Haag, 2006), or the constructs have been unrelated at a group level (e.g., Ahmed, Werf, Minnaert, & Kuyper, 2010; Bieg, Goetz, & Hubbard, 2013). Due to these controversial findings, we aimed specifically to shed more light on the relationship between perceived value and emotions in the context of higher education.

Although CVTAE and many of the empirical studies applying the theory identified patterns of behaviour *between* individuals, the interpretations of these studies often suggest that relationships between perceived values and emotional experiences occur *within* individuals. However, the between-person approach does not provide information about situational factors that occur within individuals and may influence emotional experiences at a specific time point (Nesselroade & Molenaar, 2016). Furthermore, the patterns of behaviour within a given individual may differ from the findings regarding patterns of behaviour between individuals (Molenaar, 2004; Voelkle, Brose, Schmiedek, & Lindenberger, 2014).

In research applying the situational or within-person approach, the empirical evidence on momentary task-specific value as an antecedent of students' emotions indicates that high value appraisals during tasks are related to students' positive and negative emotions both in a school context (Ahmed et al., 2010; Bieg et al., 2013) and regarding university students (Goetz et al., 2010; Tanaka & Murayama, 2014). In line with CVTAE, subjectively important activities were found to lead to stronger positive emotions within individuals and this result has consistently been found across studies using intra-individual assessment (Ahmed et al., 2010; Bieg et al., 2013; Goetz et al., 2010; Tanaka & Murayama, 2014). However, the intra-individual correlation between perceived value and negative emotions has been found to be both positive (Bieg et al., 2013) and negative (Ahmed et al., 2010).

The ambiguous effect of perceived value on negative emotions could potentially be explained by *individual differences*, but to the best of our knowledge, only few studies have investigated individual differences in the value-emotion relations using an intra-individual approach (see Ahmed et al., 2010; Tanaka & Murayama, 2014). The within-person approach can capture dynamic variations within individuals across situations, thus allowing us to examine whether particular individuals, on average, feel certain emotions in response to certain situational factors (i.e., within-person effects). For instance, Tanaka and Murayama (2014) showed that individual differences in university students' achievement goals moderated the relationship between their task-specific utility value and academic emotions. Especially the relationship between task-specific utility value and boredom significantly differed between students: although utility value on average predicted lower boredom within situations, among those students with high mastery-approach goals, the constructs were actually unrelated. Based on these findings, Tanaka and Murayama (2014) suggested that perceived value does not always reduce boredom within situations, particularly when students are mastery-oriented. Furthermore, Ahmed et al. (2010) found that the effect of value appraisals on anxiety, enjoyment, and hope varied substantially across secondary school students. However, they did not provide any suggestions as to why students reacted differently during academic activities. We suggest that variation in *study engagement* may moderate the association between university students' daily situational value appraisals and emotions (see also, Tanaka & Murayama, 2014, for a similar perspective).

1.2. Study engagement as a general disposition explaining situational experiences

One of the factors that has been suggested as having an influence on daily experiences is study engagement (Salmela-Aro, Moeller, Schneider, Spicer, & Lavonen, 2016). Although in some circumstances study engagement is referred to as a multidimensional construct with its emotional, cognitive, and behavioural aspects being the most-researched (e.g., Fredricks, Blumenfeld, & Paris, 2004), in the present study, the focus is on the individual's emotional engagement (see Salmela-Aro & Upadyaya, 2012). In this framework, study engagement is defined as a positive, fulfilling, study-related state of mind characterized by energy, dedication, and absorption (Salmela-Aro & Read, 2017; Salmela-Aro & Upadyaya, 2012; Schaufeli et al., 2002). Rather than a momentary and specific state (such as flow), study engagement refers to a more persistent and pervasive affective state that is positively related to academic performance and can be relatively stable over time (Salanova, Schaufeli, Martínez, & Bresó, 2010; Schaufeli et al., 2002; Tuominen-Soini & Salmela-Aro, 2014).

Study engagement predicts various long-term positive outcomes, such as higher educational aspirations, persistence in educational pathways, better job possibilities, positive self-perceptions and well-being, and less depressive symptoms (e.g., Li & Lerner, 2011; Salmela-Aro & Upadyaya, 2012, 2014; Tuominen-Soini & Salmela-Aro, 2014; Wang & Peck, 2013). Thus, engagement may have positive, far-reaching effects even beyond the educational context. Furthermore, study engagement has found to be associated in meaningful ways with academic motivation and functioning: engaged students value studying, receive better grades, and report lower levels of academic withdrawal and work avoidance (Tuominen-Soini & Salmela-Aro, 2014). Although the daily short-term effects are less often examined, situational in-school experiences of demands, resources and emotional engagement have been found to be related to more stable measures of study engagement among high school students (Salmela-Aro et al., 2016). For instance, those students with higher study engagement experienced fewer demands (i.e., stress, anxiety, confusion, and challenge) and more emotional engagement (i.e., activity, interest, enjoyment, and importance) within daily situations at school. Although not labelled as emotions, the similarity of the situational measures let us assume that university students' first-year study engagement might also be related to their situational experiences of value and emotions, and possibly, the association between these two.

1.3. The present study

In the present study, we aimed to provide insight on the relationship between perceived value and students' emotions, focusing on within-person variation and the situational nature of this interaction. The main aim was to investigate the possible individual differences in the within-person relations between task-specific value and emotions and whether more general study engagement would affect these daily experiences. Since existing literature has consistently shown that the first year of university is the most critical in terms of forthcoming academic years (e.g., Reason, Terenzini, & Domingo, 2006; Tinto, 1996), we wanted to investigate whether the level of engagement in the beginning of studies would affect students' daily experiences not only during the first but also the second academic year.

The perceived value of the activity and the related emotions were assessed with situation-specific measures following the traditions of the experience sampling methodology (ESM; Hektner, Schmidt, & Csikszentmihalyi, 2007). During their first and second academic years, the participating university students attended a two-week intensive data collection resulting in multiple self-reports in both years. In addition, students' study engagement and control variables of life satisfaction and depressive symptoms were assessed once at the beginning of the first academic year.

First, consistent with CVTAE, perceived value was assumed to precede emotions (Pekrun, 2006). Second, general level study engagement was assumed to be related to everyday situational experiences (Salmela-Aro et al., 2016). Finally, we wanted to control for the more general affective dispositions of students in our analyses, namely, life satisfaction and depressive symptoms, since they might potentially shape emotional experiences in addition to the task characteristics (e.g., Lane, Whyte, Terry, & Nevill, 2005). The research questions (RQ) were as follows:

RQ1. What is the relationship between university students' perceived value of the activity and emotions (i.e., averaged interindividual and intra-individual association, fixed effects)?

Consistent with CVTAE, we expected (Hypothesis 1a) inter-individual value to be related to students' emotions at the between-student level (Pekrun, 2006). Moreover, based on previous intra-individual research on the subjective value of activities as an antecedent of students' emotions, we assumed (Hypothesis 1b) that subjectively important tasks would lead to stronger positive emotions at the within-level, compared to tasks that are perceived as less valuable and important (Ahmed et al., 2010; Bieg et al., 2013; Goetz et al., 2010; Tanaka & Murayama, 2014). However, since the empirical evidence for negative emotions in conjunction with intra-individual value is inconsistent (see e.g., Ahmed et al., 2010; Bieg et al., 2013), we did not propose a hypothesis regarding negative emotions, but posed the next research question:

RQ2. Are there individual differences in the relationship between perceived value of the activity and emotions (i.e., random slopes)?

Since few previous studies suggested that the effect of value on emotions may vary substantially between students (Ahmed et al., 2010; Tanaka & Murayama, 2014), we hypothesized (Hypothesis 2) that individual differences in the value-emotions relation would exist regarding both positive and negative emotions, in line with Ahmed et al. (2010). If this is the case, by including individual characteristics as moderators (i.e., cross-level interaction terms) we can investigate whether the discrepant within-person couplings are related to such individual characteristics (Hamaker, 2012). The third research question was:

RQ3. Does the level of first-year study engagement predict individual differences in the relationship between (within-student) perceived value and emotions (i.e., cross-level interaction)?

Given that previous research has indicated that general motivational orientation can function as moderator for the link between situational emotions and task-specific perceptions (Tanaka & Murayama, 2014), we expected that the between-person variability in study engagement would moderate the within-person relationships between perceived value and emotions. Specifically, we predicted that high study engagement would strengthen the positive relationship between value and positive emotions (and correspondingly reduce negative emotions), such that individuals highly engaged in their studies would enjoy important tasks more than less engaged students (Hypothesis 3a). Furthermore, we proposed that low study engagement would weaken the negative relationship between value and negative emotions (or even increase negative emotions), since students who are not that intrinsically engaged may react with less positive emotions and more anxiety in tasks that are still perceived as important (Hypothesis 3b). If this is the case, we also wanted to investigate how far-reaching are the effects of first-year study engagement on students' daily experiences by pursuing the final research question:

RQ4. Does the level of first-year study engagement predict daily experiences during the second academic year?

Since the first-year experience in academia is known to be essential (e.g., Reason et al., 2006) and since study engagement has shown to have long-term effects on various outcomes (e.g., Li & Lerner, 2011), we expected that the effects of study engagement on students' daily experiences would outreach the first academic year (Hypothesis 4).

2. Method

2.1. Participants

The participants were 72 Finnish first-year university students (76.4% female; mean age = 21.9 years; SD = 3.0). They studied at the University of Jyväskylä (37 psychology majors), the University of Helsinki (15 student teachers majoring in either education or educational psychology), and Helsinki Metropolitan University of Applied Sciences (20 media engineering majors). Of the participants, 56 (77.8%) continued in the study during their second academic year. Male (χ^2 (1) = 4.63, p = .031, adjusted residual = 2.2) and media engineering students (χ^2 (2) = 17.32, p < .001, adjusted residual = 4.1) were more likely to drop out from the second-year follow-up, whereas psychology students were more likely to continue in the present study (adjusted residual = 2.4). No other differences between those who dropped out and those who continued in the study were found regarding other background or study variables (i.e., age of the participants, life satisfaction, depressive symptoms, and study engagement).

2.2. Procedure

To collect the in-the-moment data, we used the contextual activity sampling system (CASS), which is a smartphone-based experience sampling instrument (see Inkinen et al., 2014Inkinen et al., 2014). During the spring semester of their first and second academic years, university students participated in a two-week intensive data collection and were provided with smartphones as data-collecting devices. During the 14 days of data collection in each year, the participants' phones beeped five times a day as a signal to complete a short questionnaire (during the first year, only four of the beeps were used owing to different questionnaires delivered in the mornings). There was a fixed sampling schedule (three-hour predefined intervals), with participants being able to choose their first sampling time in the morning between 7 a.m. and 10 a.m. (i.e., interval-contingent sampling, see Hektner et al., 2007). For more information about the CASS procedure, see Inkinen et al., (2014).

The assessment procedure resulted in a maximum of 56 and 70

completed state questionnaires for each participant (four/five beeps over 14 days), or 4032 questionnaires overall in the first year (56 questionnaires per person from 72 participants) and 3920 questionnaires in the second year (70 questionnaires from 56 participants). The final totals included 3089 (76.6%) and 2912 (74.3%) fully completed questionnaires, respectively. Of those, the average number of completed questionnaires per person was 42.9 (ranging from 32 to 56) in the first year and 52.0 (ranging from 26 to 70) in the second year. Before the two-week state assessment period in the first academic year, all participants (100.0%) responded to a pre-questionnaire measuring their depressive symptoms and life satisfaction. In addition, 50 of the participants representing all majors (69.4%) responded to items of study engagement (initially assessed only from 55 participants due to the small differences in data collection between different cohorts). All assessments within the study were approved by the ethics committee of the University of Helsinki. In addition, the study was carried out in accordance with the guidelines of the Finnish Advisory Board on Research Integrity (2009), and included written informed consents from the participants. Participation in the study was voluntary.

2.3. Measurements

2.3.1. State measures of perceived value and emotions

In the state questionnaires, the participants were asked to report their experiences related to their current ongoing activity. Following CVTAE (Pekrun, 2006), perceived value was defined as the importance of the activity in general, assessed with a single-item measure ("How important is this activity for you?"). In addition, the state questionnaires asked participants about their current emotions (i.e., emotional states). All activities were rated in terms of eight emotions by using a modified version of the Positive and Negative Affect Schedule (PANAS; based on Watson, Clark, & Tellegen, 1988; see Ketonen et al., 2018). Participants rated "The extent you feel at the moment: …": interested, enthusiastic, determined, and active (four emotions measuring *a positive activating state*), and anxious, nervous, irritable, and stressed (four emotions measuring *a negative activating state*). All ratings were given on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). Level-specific Cronbach's α for positive emotions was 0.80 at the within level and 0.91 at the between level. Cronbach's α for negative emotions was 0.77 at the within level and 0.93 at the between level.

2.3.2. Study engagement, life satisfaction, and depressive symptoms

Study engagement was assessed by using an abbreviated student version of the short Utrecht Work Engagement Scale (UWES-9) originally developed by Schaufeli, Bakker, and Salanova (2006) (Salmela-Aro & Reid, 2017; Salmela-Aro & Upadyaya, 2012). The scale consists of nine items related to studying in higher education measuring energy (e.g., "When I study, I feel I'm bursting with energy"), dedication (e.g., "I'm enthusiastic about my studies"), and absorption (e.g., "Time flies when I'm studying"). All items were rated on a six-point scale ranging from 1 (*I totally disagree*) to 6 (*I totally agree*). A composite scale was calculated from all nine items to indicate the overall level of study engagement (α = 0.85, N = 50).

Life satisfaction was assessed with the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), which includes five items (e.g., "I am satisfied with my life") that were rated on a six-point scale ranging from 1 (*I totally disagree*) to 6 (*I totally agree*). Depressive symptoms were measured using a revised version of the short Beck's Depression Inventory (BDI; Beck & Beck, 1972). The participants were asked to rate 13 items (e.g., "I often feel sad") on a five-point scale ranging from 1 (*I totally disagree*) to 5 (*I totally agree*). Internal consistencies of the scales were α = 0.82 and α = 0.85 (N = 72), respectively.

Table 1
Descriptive item statistics.

Item	M		ICC		Variances			
					L1		L2	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
State measures								
Perceived value	4.88	4.87	0.20	0.15	2.30	2.14	0.56	0.37
Positive emotions								
Interest	4.08	4.02	0.25	0.27	1.89	1.62	0.64	0.60
Enthusiasm	3.67	3.69	0.28	0.27	1.75	1.73	0.67	0.63
Determination	3.84	3.73	0.33	0.35	1.68	1.57	0.83	0.85
Activeness	3.67	3.52	0.35	0.31	1.47	1.50	0.78	0.69
Negative emotions								
Anxiety	2.00	2.21	0.43	0.43	1.09	1.19	0.81	0.88
Nervousness	1.81	2.13	0.32	0.39	0.97	1.12	0.46	0.72
Irritation	1.82	1.89	0.24	0.25	1.21	1.19	0.39	0.40
Stress	2.18	2.43	0.43	0.46	1.15	1.13	0.87	0.95
Pre-test measures								
Study engagement	4.09						0.50	
Life satisfaction	4.38						0.69	
Depressive symptoms	1.96						0.40	

Note: All state items were rated on a scale from 1 = *not at all* to 7 = *very much*; study engagement and life satisfaction on a scale from 1 = *I totally disagree* to 6 = *I totally agree*; depressive symptoms on a scale from 1 = *I totally disagree* to 5 = *I totally agree*. For the state measures, mean values are based on manifest variables and person-aggregated scores; N_{1st} = 72 students; N_{1st} = 3089 state assessments within students; N_{2nd} = 56 students; N_{2nd} = 2912 state assessments within students. ICC = intraclass correlation. L1 = situation level. L2 = student level. 1st = first year. 2nd = second year.

2.4. Statistical analyses

The data were structured hierarchically into two levels, with situations (Level 1; $N_{1st\ year}$ = 3089, $N_{2nd\ year}$ = 2912) nested in students (Level 2; $N_{1st\ year}$ = 72, $N_{2nd\ year}$ = 56). Initial variance component models showed that between 24 and 46% of the variance in emotions resided in the between-level (see Table 1), warranting multilevel analysis. Thus, we specified multilevel structural equation models to adjust parameter estimates for item uniqueness, sampling error, and standard errors for clustering (Marsh et al., 2009; Rabe-Hesketh, Skrondal, & Zheng, 2012). Analysing these nested data with a multilevel approach enabled us to 1) investigate intra-individual associations between perceived value and emotions in real time situations (i.e., within students), 2) compare these to interindividual associations (i.e., between students), 3) explore individual differences in associations between perceived value and emotions (i.e., random slopes models), and 4) investigate the associations between more general study engagement) and patterns of within-person situational experiences (see Hamaker, 2012).

First, we examined descriptive statistics for all pre-questionnaire and state variables using unconditional multilevel models. Second, we specified a multilevel structural equation model (MSEM) (e.g., Marsh et al., 2009) to examine the predictive value of perceived value on emotions. We evaluated the effect of perceived value on positive and negative emotions both at the situation level (i.e., intra-individual association) and at the level between individuals (i.e., interindividual association). In order to answer RQ1 and to test Hypotheses 1a (interindividual association) and 1b (intra-individual association), the model was first estimated with directional paths (fixed effects) as presented in Fig. 1. In the next step, we estimated random effects to examine whether there was individual variation in value-emotion relations (Hypothesis 2). Finally, in order to explain the possible individual variation, we included study engagement as a predictor of both between-level value and emotions, as well as the value-on-emotions slopes (i.e., an individual slope for each student), as presented in Fig. 2. We investigated the cross-level moderating effect of study engagement (first-

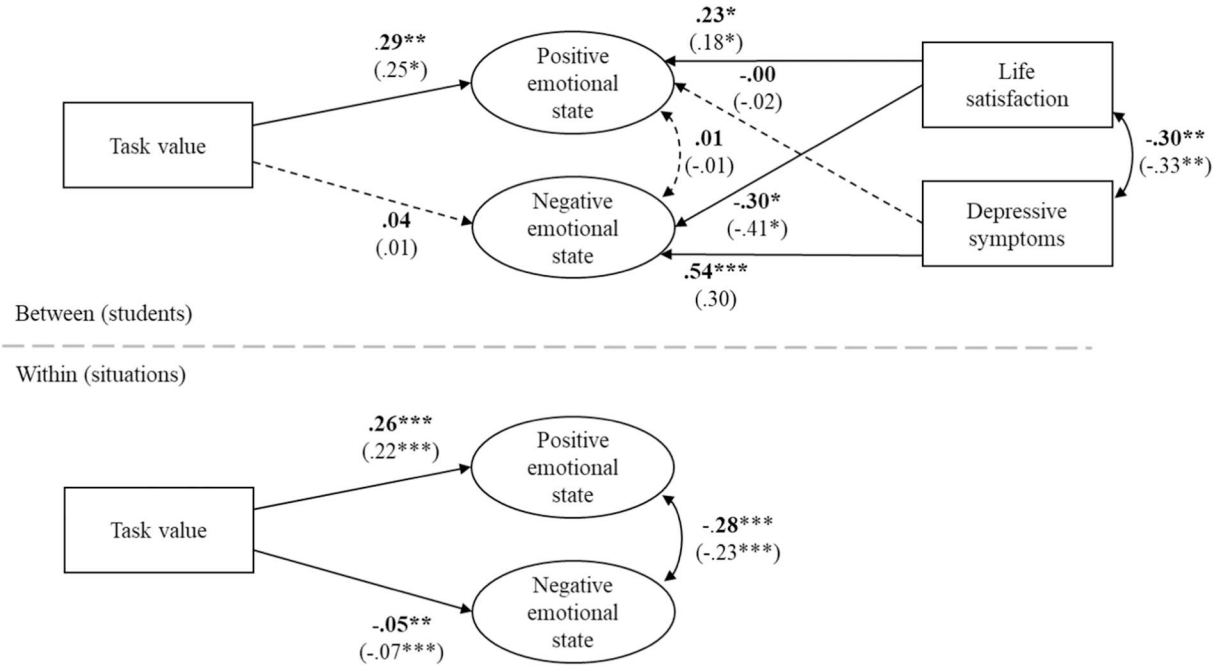

Fig. 1. Students' perceived value predicting positive and negative emotions. *Note*: Unstandardized estimates from Mplus 7.4. presented. Coefficients from the second-year ESM data presented in parentheses. Only latent constructs (regarding positive and negative emotions) presented for clarity. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

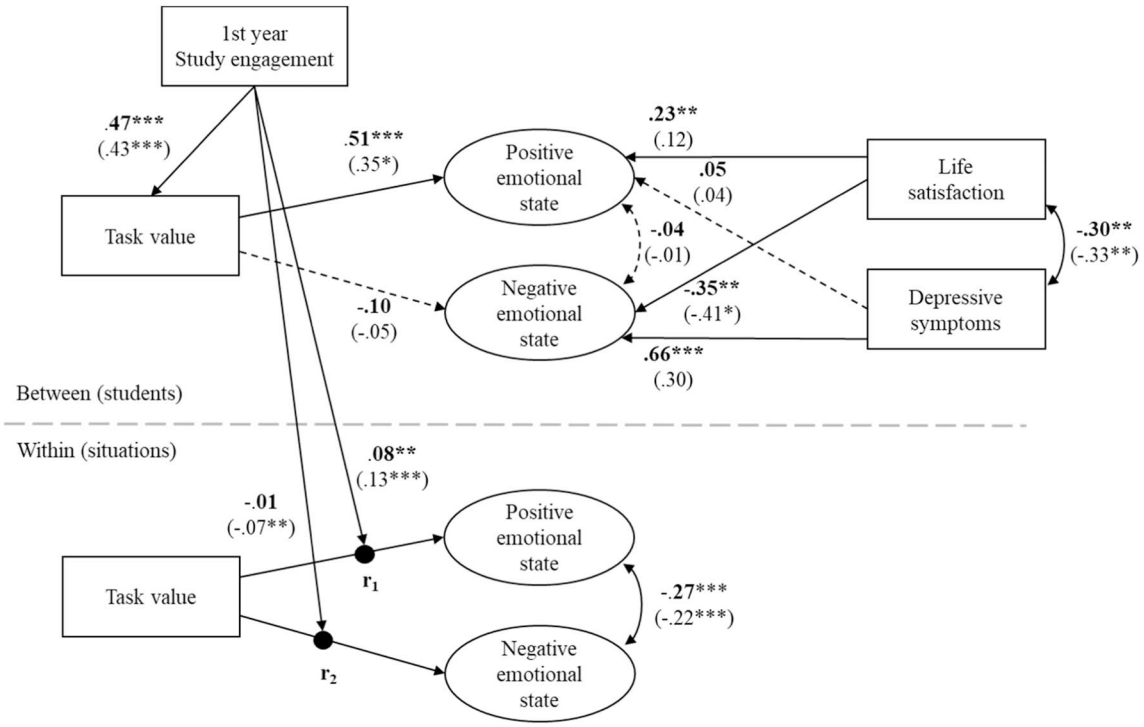

Fig. 2. Students' perceived value predicting positive and negative emotions including random value-on-emotions slope (r_1 and r_2) and the cross-level moderating effect of first-year study engagement. *Note*: Unstandardized estimates from Mplus 7.4. presented. Coefficients from the second-year ESM data presented in parentheses. Only latent constructs (regarding positive and negative emotions) presented for clarity. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

year pre-test measure) on the situation-level value-emotion relations regarding both first- and second-year state assessments.

In all models, positive and negative emotions were modelled as latent factors at both the situation-level (within) and student-level (between) to account for possible measurement error (Marsh et al., 2009). We specified models so that the item loadings were held equal across the two analysis levels. In addition, depressive symptoms and life satisfaction were included as covariates in all the models. The control variables, as well as study engagement, were used as the manifest mean,[1] were grand mean centred, and correlated with each other in the

[1] The number of free parameters would exceed the number of available clusters in MSEMs (leading to nonidentification of the model) if both student level (pre-test) variables and state emotions had been modelled as latent constructs.

models. At the student level, (state-level) perceived value was cluster mean centred. Good model fit was defined as a value below 0.05 on the Root Mean Square Error of Approximation (RMSEA), as a value below 0.08 on the Standardized Root Mean Square Residual ($SRMR_B$ for between student, and $SRMR_W$ for within parts, respectively), and as a value above 0.95 on the Comparative Fit Index (CFI; see e.g., Hu & Bentler, 1999). In all models, a robust maximum likelihood (MLR) estimator was used to adjust standard errors for non-normality in the indicators, and missing data was estimated using the full-information maximum likelihood procedure in Mplus 7.4 (Muthén & Muthén, 1998–2017).

3. Results

3.1. Descriptive statistics

Table 1 presents the means and variances of all items, for state items at both levels. Overall, perceived value was quite high and negative emotions were less pronounced than positive emotions in students' daily activities in both years. However, students reported slightly more negative emotions during the second academic year, while positive emotions and perceived value remained at the same level. Furthermore, participants expressed quite high study engagement and life satisfaction and rather low depressive symptoms at the beginning of their studies. Table 1 also provides the intraclass correlations of state emotions and value. The majority of variance in all emotions and especially in perceived value was due to situational fluctuation within individuals. However, interindividual differences also influenced a students' tendency to experience positive and negative emotions across all situations.

3.2. RQ1: effect of task-specific value on emotions

Fig. 1 presents the regression parameters of the multilevel structural equation model regressing positive and negative emotions on perceived value (model with fixed effects).[2] At the situation level (Level 1) Hypothesis 1b, assuming intra-individual relation between value and emotions, was supported, since higher value predicted more positive emotions ($\beta = 0.26$; $p < .001$) and, additionally, fewer negative emotions ($\beta = -0.05$; $p = .001$) within situations. Hypothesis 1a, proposing such association to be found also between students, was instead only partly supported, since at the student level (Level 2) the similar relation was only found regarding perceived value and positive emotions ($\beta = 0.29$; $p = .003$). Students who reported higher value than their peers across all situations also experienced positive emotions more often. Negative emotions were instead strongly predicted by higher depressive symptoms at the student level ($\beta = 0.54$; $p < .001$). In addition, life satisfaction predicted more positive ($\beta = 0.23$; $p = .013$) and fewer negative emotions ($\beta = -0.30$; $p = .011$) on student level.

3.3. RQ2 & RQ3: individual variation in value-emotion relations and cross-level effect of study engagement

Fig. 2 presents the regression parameters of the multilevel structural equation model regressing positive and negative emotions on perceived value but this time, exploring whether there are differences between students in these slopes (model with random effects). In the first-year data, individual variation was found in value-emotion relation only regarding positive emotions, indicating that the relationship between perceived value and positive emotions differed between individuals. Thus, Hypothesis 2 was only partly supported by first-year ESM data. The average value-on-positive-emotions slope was $B = 0.25$ and the slope variance $\sigma^2 = 0.01$ was significant ($p = .001$).

To account for this individual variation, we also investigated the cross-level effects of student-level study engagement on the value-emotion relations in situation level. As shown in Fig. 2, study engagement moderated the random slope of value on positive emotions at the between level ($\beta = 0.08$; $p = .007$).[3] The cross-level interaction effect is presented in Fig. 3. Although perceived value, on average, was significantly and positively related to positive emotions, the association was even stronger and the overall level of positive emotions higher for individuals with higher study engagement at the beginning of first year than for those with lower engagement, supporting Hypothesis 3a. In addition, study engagement predicted higher situational value directly ($\beta = 0.47$; $p < .001$), but was unrelated to emotions when control variables were included.

3.4. RQ4: effect of first-year study engagement on second-year situational experiences

Finally, we repeated the analyses above but now using the second-year ESM data. These coefficients are given in parentheses in Figs. 1 and 2. As in first-year ESM data, higher perceived value predicted more positive emotions ($\beta = 0.22$; $p < .001$) and fewer negative emotions ($\beta = -0.07$; $p < .001$) at the situation level (model with fixed effects).[4] Again, at the student level, the similar relation was only found regarding value and positive emotions ($\beta = 0.25$; $p = .025$). First-year depressive symptoms no longer predicted daily negative emotions in second year, but first-year life satisfaction still predicted more positive ($\beta = 0.18$; $p = .040$) and fewer negative emotions ($\beta = -0.41$; $p = .010$) even during the daily activities of second academic year (see Fig. 1).

As in the first-year ESM data, individual variation was found in the value-emotion relation regarding positive emotions (model with random effects). The average value-on-positive-emotions slope was $B = 0.20$ and the slope variance $\sigma^2 = 0.01$ was significant ($p < .001$). Furthermore, this time Hypothesis 2 was fully supported, since the random effect was also found in the value-on-negative-emotions slope, indicating that the relationship between perceived value and negative emotions differed between individuals during the second academic year. The average slope was $B = -0.06$ with significant ($p = .030$) slope variance $\sigma^2 = 0.01$.

Finally, Hypothesis 4 was supported, since first-year study engagement was related to second-year experiences. As shown in Fig. 2, study engagement again moderated the random slope of value-on-positive emotions ($\beta = 0.13$; $p < .001$) but also the random slope of value-on-negative emotions ($\beta = -0.07$; $p = .003$).[5] The cross-level moderating effects of first-year study engagement on second-year daily experiences are presented in Figs. 4 and 5. Again, higher levels of study engagement at the beginning of studies also strengthened the positive within-person relationship between value and positive emotions in the second academic year in addition to additive effect on the level of positive

[2] The model fits were satisfying ($N_W = 3089$; $N_B = 72$; $\chi^2 = 5237.74$; $df = 91$; $p < .001$; CFI = 0.924; RMSEA = 0.043; $SRMR_W = 0.043$; $SRMR_B = 0.071$) and the factor loadings were statistically significant and the reliabilities (R^2) were substantial on both levels.

[3] In the model we also tested the cross-level moderating effect of control variables on the random slope of value on positive emotions, but the effects were non-significant regarding both life satisfaction ($p = .675$) as well as depressive symptoms ($p = .938$).

[4] The model fits were satisfying ($N_W = 2912$; $N_B = 56$; $\chi^2 = 5733.26$; $df = 91$; $p < .001$; CFI = 0.941; RMSEA = 0.041; $SRMR_W = 0.041$; $SRMR_B = 0.081$) and the factor loadings were statistically significant and the reliabilities (R^2) were substantial on both levels.

[5] In the model we also tested the cross-level moderating effect of control variables on the random slopes of value on both emotions, but the effects were non-significant regarding both life satisfaction ($p = .219$ and .310) as well as depressive symptoms ($p = .887$ and .873).

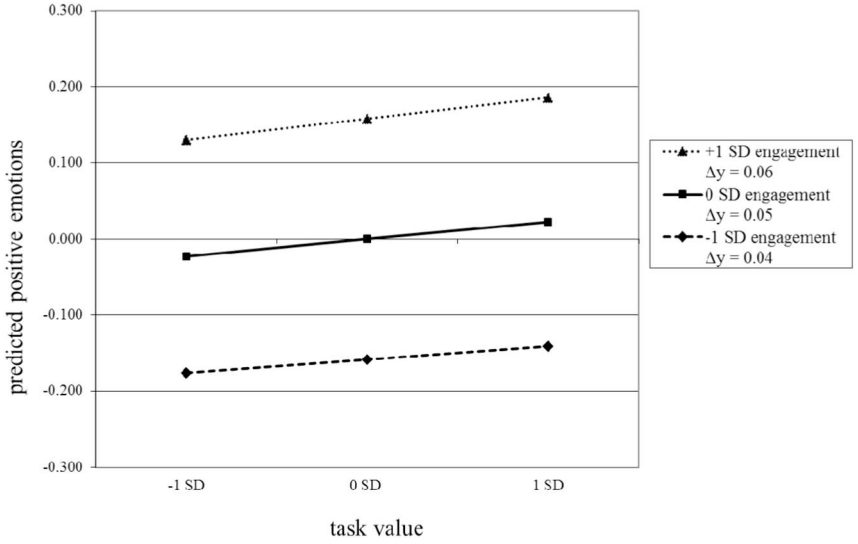

Fig. 3. Study engagement as a moderator of the effect of task-specific value regressed on *positive* emotions on *first* academic year.

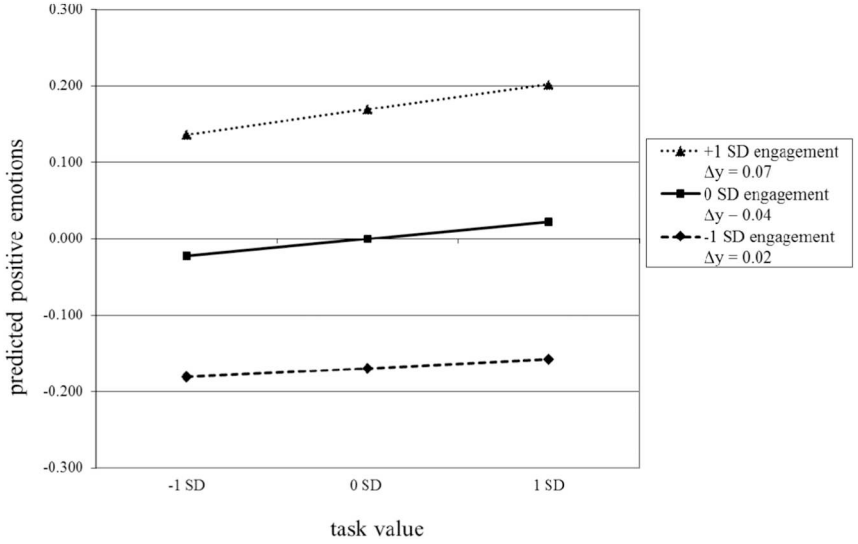

Fig. 4. Study engagement as a moderator of the effect of task-specific value regressed on *positive* emotions on *second* academic year.

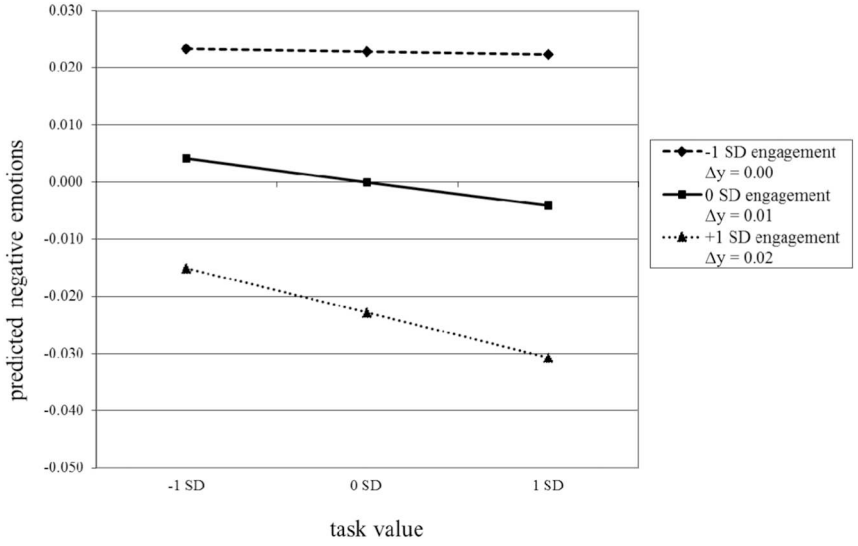

Fig. 5. Study engagement as a moderator of the effect of task-specific value regressed on *negative* emotions on *second* academic year.

emotions (see Fig. 4). Regarding negative emotions, although task-specific value significantly reduced negative emotions within situations on average ($\beta = -0.07; p < .001$), the association was only present in individuals with high study engagement at the beginning of first academic year. In line with Hypothesis 3b, for those with low study engagement, value was unrelated to negative emotions in the second academic year (see Fig. 5). Finally, first-year study engagement also predicted higher situational value directly during the second study year ($\beta = 0.43$; $p < .001$).

4. Discussion

The present study investigated the dynamic interaction between university students' value appraisals, situational emotions, and more general engagement in university studies. More specifically, we examined how the momentary value of the activity and first-year study engagement related to students' emotional experiences during the first and second academic years, and how these relations differ between individuals. Indicators of students' general affective well-being, that is, life satisfaction and depressive symptoms, were included as control variables in analyses. With few minor exceptions, our findings provided support for our hypotheses.

First, it was found that on average, a higher perception of task-specific value was associated with higher positive and lower negative emotions within individuals (in situations). However, at the group level, the association was only found between perceived value and positive emotions. Second, consistent with our expectations, individual differences were detected in the value-emotion relations especially during the second academic year. On the one hand, it was found that higher levels of study engagement at the beginning of studies strengthened the positive within-person relationship between value and positive emotions during the first and second academic years. On the other hand, lower levels of first-year study engagement weakened the negative within-person relationship between value and negative emotions during the second academic year. In other words, perceived value of the activity was a source of high positive emotions, particularly when initial levels of study engagement were high. Furthermore, while in second year, perceived value predicted lower negative emotions for students with high first-year study engagement, this relationship was absent for those with lower engagement at the beginning of their studies. In summary, the findings indicated that overall engagement towards studying predicted between-person differences in the within-person relationships not only in the short-term but also had more far-reaching effects on university students' daily experiences. Besides strengthening or weakening the value-emotion relations, first-year study engagement also directly predicted higher task-specific value in both years.

A few remarks and important implications can be made regarding these findings. First, in contrast with the assumptions of CVTAE (Pekrun, 2006), but consistent with some findings from other empirical studies (e.g., Ahmed et al., 2010; Goetz et al., 2006), negative emotions were not intensified, but were actually weakened if a task was found to be subjectively valuable. One possible explanation for this contradictory result may be the analytical method used. For instance, between-person approaches sometimes result in positive relations whereas intra-individual approaches result in negative relations regarding the corresponding constructs (see Molenaar, 2004). Furthermore, the significant negative correlation between positive and negative activating states at the situation level (see Figs. 1 and 2) suggests that these are somewhat exclusive experiences. In other words, if a student is experiencing positive activating emotions he or she is not likely to experience negative activating emotions simultaneously, and this may also partly explain why perceived value was not related in a similar way to both higher positive and negative emotions. However, since at the student level, perceived value and negative emotions were unrelated (instead of negatively related), future research is still needed to investigate this discrepancy between different levels of analysis regarding these constructs although the moderating role of study engagement partly clarified these inconsistent findings.

The higher initial levels of study engagement the students displayed, the more intensively their positive emotions were related to high perceived value of the activity both years. Interestingly, during the second academic year, higher task-specific value seemed to lead to lower negative emotions only for those students with high first-year study engagement, whereas those who had reported to be less engaged did not seem to have this 'protective' effect. Previous research on university students' emotions has indicated that intrinsic motives for an activity (e.g., personal relevance) predict more positive emotions (Gillet, Vallerand, Lafreniere, & Bureau, 2013; Ketonen et al., 2018). On the other hand, valued activity may also increase negative emotions if the motives are perceived as extrinsic or controlled, such as instrumental importance or feelings of compulsion (Gillet et al., 2013; Ketonen et al., 2018). Thus, one possible mechanism explaining the moderating effects could be that highly engaged students perceive task value more likely as intrinsic (e.g., reading is important since I *enjoy* learning new things) and consequently, positive emotions are intensified. On the other hand, students with low study engagement may perceive important tasks more likely as externally motivated or even pressured (e.g., reading is important since I *need to pass* the exam). Consequently, these students may experience less positive emotions or even anxiety, even when the value of the task is clear. Thus, based on the findings, we suggest that the perceived value of a task is clearly an incentive for students' emotions, but general study engagement may have a decisive moderating effect on this dynamic. Finally, interesting finding was that, in first year, the moderating effect of study engagement was only found regarding positive emotions. This may indicate that the differences between students and their level of engagement may start to show more in the long-run, concerning especially more maladaptive patterns of academic functioning, while the first-year 'honeymoon effect' may mask some of these patterns at the beginning of university studies.

To summarise, these findings suggest that intervention efforts should first of all be targeted at the characteristics of situations, that is, facilitating university students' experience of subjective value of the activity in order to foster positive emotions and reduce negative ones. This refers to educators helping students in finding personal value and meaning in what they are doing in everyday learning situations, for example. However, findings also indicate a more diverse reality, since the patterns of situational value and emotions differ as a function of individual differences in students' more general approaches to studying. Valued activities may inspire students and decrease students' negative emotions, but the findings also showed that this is not necessarily the case for all students. Although higher task value tends to decrease negative emotions, the results indicated that this negative link can be mitigated, particularly for students who enter the university less engaged. For instance, students with low engagement may perceive important tasks as externally motivated and pressured; thus, they do not necessarily feel positive emotions, even when the value of the task is clear. Accordingly, educators should not assume that increasing value is related to more positive and less negative emotions across all students; to more fully understand various kinds of students' daily academic functioning, attention should be simultaneously paid to the more general student characteristics along with situational factors. Since the overall engagement towards studying at the beginning of university seem to boost later positive experiences even beyond the first academic year, fostering students' general engagement and perceived meaning of studies right at the beginning of university seem to be essential. Bolstering such positive disposition may even spill over and influence activities beyond the academic context (Li & Lerner, 2011; Wang & Peck, 2013).

The present study has several strengths, in particular, the assessment of students' experiences at the moment at which they occur (resulting in intensive longitudinal data) and the follow-up of these

experiences during students' second academic year (resulting in measurement-burst design, that is, a faster time-scale nested within a slower time-scale). Nevertheless, some limitations and open questions warrant further attention. First, concerning the research design, the sample consisted mainly of women, and only three academic fields were included. Furthermore, not all the participants (69.4%) were asked about their study engagement, but those who responded were nevertheless representing all majors equally. Regarding the second-year follow-up data, there had been some attrition of participants, and compared to the 56 students (77.8%) that continued in the study, male and media engineering students were more likely to drop-out. However, since no other significant differences between those who dropped out and those who continued in the study were found regarding the age, depressive symptoms, life satisfaction or first-year study engagement of the participants, attrition should not have affected our results much.

Second, there are some issues regarding the measures that should be acknowledged. In the present study, we relied on self-report measures. However, our approach allowed the capturing of students' experiences in natural settings as they occurred and on multiple occasions, thereby enhancing the quality of the self-report data obtained. Furthermore, the operationalization of perceived value as an *importance* of the activity leaves some ambiguity in the conceptualization of task-specific value. First, the measure did not specify the target of value or importance (i.e., important *for what*, for my future career/for myself in general etc.) and second, it did not encompass qualitatively different aspects of task-specific value by measuring, for instance, more intrinsic/extrinsic values of the activity. Taking into account how the nuances in the conceptualization of perceived value may have led to other kinds of results, future studies should distinguish between different types of task-specific values.

Finally, the in-the-moment/ESM part of the data does not allow us to make inferences about the causality between perceived value and students' emotions and reverse or bidirectional explanations are possible. In addition, relations between value and emotions may be affected by tertiary variables, such as individual's *control beliefs* (Pekrun, 2006), not included in the present study. Students' additive ratings of their abilities and expectancies for success could have potentially differentiated between emotional reactions towards value (Pekrun, 2006; see also, Bieg et al., 2013). Furthermore, the influence of the *context* or the *content* of the activity was not examined. There might be variation in relations between values and emotions based on the type of situation. The fact that Level 1 situations included all kinds of situations from students' everyday lives during the two weeks (also non-academic) needs to be considered when drawing conclusions from the results. However, the fact that the moderating effect of study engagement was still found, even when averaging the academic and non-academic situations, suggests that study engagement indeed seem to have a moderating effect on students' daily experiences and this effect may even reach beyond academic tasks. These limitations and suggestions should be addressed in future research.

5. Conclusions

Overall, the findings from the present study provide support for the idea that the theoretical assumptions of CVTAE (Pekrun, 2006) also hold for the level of situations and within-person functioning, emphasizing the role of subjective value as an antecedent of students' positive emotions. Furthermore, our findings shed light on the more ambiguous association between value and negative emotions, found between previous studies using a within-person approach (see Ahmed et al., 2010; Bieg et al., 2013). Furthermore, while the underlying motivational processes leading to emotions are suggested to be analogous across individuals (e.g., Pekrun & Perry, 2014), our analyses gave preliminary support for the view that students may differ in terms of their emotional reactions to value appraisals. Finally, expanding upon prior evidence, we also showed that the more general approach to study at university, specifically study engagement, has the potential to contribute to students' daily situational experiences (see also, Tanaka & Murayama, 2014). Due to our follow-up data from the second academic year, we were able to show that this interaction also holds in the long term. The present study aimed to grasp the dynamic nature of university students' more general engagement and situational experiences and showed that the motivation formed at the beginning of studies may interact with students' daily experiences, even after a year. The next step would be to investigate how educators could support students in transferring the repeated positive situational experiences into developing a more enduring disposition of study engagement beyond the first academic year.

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