Students' emotions during homework: Structures, self-concept antecedents, and achievement outcomes

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ABSTRACT

In the present study ($N = 553$; 8th and 11th grade students; 52% female) we investigated students' enjoyment, pride, anxiety, anger, and boredom while completing homework (homework emotions), and contrasted these emotions with those experienced during class (classroom emotions). Both homework emotions and classroom emotions were assessed separately for the domains of mathematics, physics, German, and English. Our hypotheses were based on propositions of the control-value theory of achievement emotions (Pekrun, 2006), Marsh and Ayotte's (2003) differential distinctiveness hypothesis, and previous empirical findings. In line with our assumptions, observed correlations between homework emotions and classroom emotions suggested that the emotions experienced in the two settings should be assessed separately. Within domains, both homework emotions and classroom emotions showed clear linkages with students' academic self-concept and achievement outcomes, with self-concept being slightly more strongly related to classroom emotions. Between-domain relations of emotions were significantly stronger for homework emotions as compared to classroom emotions, likely due to the relative situational homogeneity of homework settings across domains. Further, between-domain relations for emotions in both settings were weaker in 11th grade students, whereas within-domain relations did not differ as a function of age. Implications for research and educational practice are discussed.

1. Introduction

> *"The chief motive of human actions lies in feelings and emotions. If education is to secure certain actions, the safest way will be by developing certain likes and dislikes, pleasures and displeasures, enthusiasms and aversions"* (Muensterberg, 1910, p. 196).

Despite early recognition of the importance of emotions in the psychology of learning and achievement, educational research has largely neglected students' emotional experiences with the exceptions of extensive research on test anxiety since the 1950s (Sarason & Mandler, 1952; Zeidner, 1998, 2007) and on emotions in achievement settings based on attribution theory (see Weiner, 1985, 2001). Over the past decade, however, theoretical and empirical contributions on academic emotions, defined as "emotions that are directly linked to academic learning, classroom instruction and achievement" (Pekrun, Goetz, Titz, & Perry, 2002, p. 92), have increased significantly as reflected in a number of recent special issues and edited volumes (Efklides & Volet, 2005; Linnenbrink, 2006; Linnenbrink-Garcia & Pekrun, 2011; Lipnevich & Roberts, 2011; Schutz & Lanehart, 2002; Schutz & Pekrun, 2007). Academic emotions have been investigated with respect to specific contexts (e.g., school, class; see Goetz, Hall, Frenzel, & Pekrun, 2006), age groups (e.g., middle and high-school students), and subject domains (e.g., mathematics, languages; see Goetz, Frenzel, Pekrun, Hall, & Lüdtke, 2007). However, while the majority of this research has focused on emotions in the classroom (i.e., classroom emotions as a subgroup of academic emotions), few studies have investigated students' discrete emotional experiences in *homework situations* (Knollmann & Wild, 2007; Mayring & von Rhoeneck, 2003).

Despite a lack of research exploring homework-related academic emotions as defined in the present study, there exist a number of studies exploring emotion-related psychosocial constructs in the context of homework completion (e.g., interest, Xu, 2008; regulation

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of emotions, Xu, 2005a; Xu & Corno, 2006; affective components of attitudes, Cooper, Lindsay, Nye, & Greathouse, 1998). Further, in the few studies evaluating both homework and classroom emotions, mean level differences in affective experiences between these academic settings are primarily assessed (e.g., Leone & Richards, 1989; Verma, Sharma, & Larson, 2002). As such, the structural relationships between homework and classroom emotions, and between emotions within the homework domain, have yet to be explored. In other words, there exists little research to date providing empirical support for the conceptual differentiation between students' emotions experienced in class as compared to homework settings (for work on learning-related versus classroom emotions in university students, see Pekrun, Goetz, Frenzel, & Perry, 2011). Existing research on homework emotions also does little to account for domain-related differences in relations among homework emotions (e.g., mathematics vs. language courses), in spite of studies showing academic emotions to be largely domain specific in nature (Goetz et al., 2007). These research gaps are particularly intriguing considering the substantial proportion of study time accounted for by homework assignments (Cooper, 1989, 2007; Cooper et al., 1998; Xu, 2005b) and the significant impact of quality of homework assignments on achievement outcomes (Dettmers et al., 2011; Dettmers, Trautwein, Lüdtke, Kunter, & Baumert, 2010).

The present study aims to redress these research deficits by exploring students' academic emotions in both homework and classroom settings while accounting for the largely domain-specific organization of students' emotional experiences. The study hypotheses were derived from theories of both academic emotions and homework (e.g., Pekrun, 2006; Trautwein, Lüdtke, Schnyder, & Niggli, 2006) and evaluated in a high-school student sample. The specific academic emotions assessed included enjoyment, pride, anxiety, anger, and boredom as experienced in the subject domains of mathematics, physics, German, and English. The study analyses evaluated the strength of relations between homework and classroom emotions, and the relations between these emotions and two important variables functioning as antecedents and outcomes, respectively (self-concept of ability and academic achievement). Finally, we also investigated the differences between homework and class-related emotions with respect to structural relations between emotions across subject domains (e.g., enjoyment in mathematics vs. English) and within subject domains (e.g., enjoyment and anxiety in mathematics).

1.1. Homework and classroom emotions: similarities and differences

Homework assignments are largely completed on an independent basis and typically defined as “tasks assigned to students by school teachers . . . to be carried out during non-school hours” (Cooper, 1989, p. 7). In contrast, classroom activities involve instruction, group work, individual work, and testing conducted in a school setting in the presence of classmates and teachers (e.g., Brophy & Good, 1986; Butler, 1989). Further, whereas homework activities are often self-regulated, classroom learning is generally more structured in nature and externally as well as professionally regulated (Zeidner, Boekaerts, & Pintrich, 2005).

In Pekrun's (2006) control-value theory of achievement emotions, it is posited that cognitive appraisals of control and value (proximal antecedents) mediate the impact of the environment (distal antecedents) on academic emotions. Consistent with the situational generality of Pekrun's (2006) theoretical propositions, it can be assumed that the impact of perceived control and value on emotions is equivalent across homework and classroom situations (see Goetz, Frenzel, Stoeger, & Hall, 2010, for empirical evidence). In other words, a basic assumption of this theory is that the *structural relationships* between these psychosocial constructs should be similar across situational contexts despite possible differences in mean levels. For example, although *mean levels* of control and enjoyment may differ between homework and classroom situations, the *strength of* control/enjoyment *relations* is assumed to be similar in both situational contexts (cf., universality assumption as outlined in Frenzel, Pekrun, & Goetz, 2007; Pekrun, 2009). However, according to this theory it is also possible that differences in distal antecedents (i.e., social environment; see Trautwein, Lüdtke, Kastens, & Köller, 2006) between these settings could lead to different emotional experiences. In this regard, Pekrun (2006) outlines five critical antecedents of students' emotions that may indeed differ as a function of homework versus classroom settings including (a) quality of instruction, (b) induction of values, (c) autonomy support, (d) goal structures and expectancies of others, as well as (e) achievement feedback and consequences.

Nevertheless, it is possible that more similarities than differences exist in these categories with respect to homework vs. classroom situations. More specifically, the quality of homework assignments often reflects the quality of classroom instruction (cf., Cooper, 1989; Dettmers et al., 2010), values that teachers wish to convey, degree of autonomy afforded to students, as well as goal structures and expectancies that are outlined either implicitly or explicitly in the classroom setting. This assumption is consistent with the findings of Trautwein, Niggli, Schnyder, and Lüdtke (2009) demonstrating the impact of teacher characteristics as reflected in homework assignments on students' emotions concerning homework activities. In this study, the findings showed students to report more negative homework emotions in classes with greater teacher control over homework assignments. Conversely, factors such as achievement feedback are likely to be less salient in homework as compared to classroom settings.

Given the assumed preponderance of similarities as opposed to differences with respect to the antecedents of students' emotional experiences in homework versus classroom settings, it can be assumed that the relations between homework and classroom emotions are moderate to strong in magnitude. This assumption is consistent with studies by Pekrun et al. (2011) and Pekrun et al. (2002) in which the mean correlations between university students' class-related and learning-related emotions (outside of class) were in the magnitude of $r = .65$. However, it is important to note that the relations observed in a higher education setting may differ for secondary school students for whom homework assignments are more externally structured.

1.2. Homework and classroom emotions: self-concept and achievement relations

In their classic and highly influential review, Shavelson, Hubner, and Stanton (1976) broadly defined *self-concept* as self-perceptions formed through experience and interpretations of one's environment (see also Marsh & O'Mara, 2008). These self-perceptions are further assumed to be especially influenced by evaluations of significant others, reinforcements, as well as attributions for one's own behavior. Self-concept represents a critical indicator of control appraisals (Pekrun, 2006) and has been found to have a moderate to strong impact on academic emotions (Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010; Goetz, Frenzel, et al., 2010; Goetz, Frenzel, Hall, & Pekrun, 2008). Numerous studies also provide empirical support for the effects of academic emotions on *achievement outcomes* (e.g., Goetz et al., 2007 for classroom emotions; Trautwein, Schnyder, Niggli, Neumann, & Lüdtke, 2009 for homework emotions), likely due to their demonstrated effects on cognitive, motivational, and regulatory processes (Pekrun, in press).

Concerning differences in self-concept/emotion and emotion/achievement relations with respect to homework vs. classroom settings, stronger relations for classroom emotions are assumed for academic self-concept as social comparisons might be assumed to be more salient in competitive classroom settings (cf., Goetz, 2004; for homework settings see Knollmann & Wild, 2007; Shavelson et al., 1976). In contrast, the relations between emotions and achievement are anticipated to be more similar between the two settings due to similar effects of emotions on learning behavior and cognitive performance in each achievement situation. However, there exists to date no published empirical research evaluating the relative strength of self-concept/emotion and emotion/achievement relations across homework versus classroom settings.

1.3. Within-domain relations of homework emotions

Theoretical considerations and empirical findings indicate relatively strong within-domain relations between academic emotions (Goetz et al., 2007). Previous research further demonstrates that relations between constructs are stronger in narrowly defined situational contexts that are relatively homogeneous in nature (e.g. mathematics as compared to English classes; Goetz, Cronjaeger, et al., 2010; Goetz, Frenzel, et al., 2010; see also Stodolsky & Grossman, 1995, 2000). Goetz et al. (2007) found significantly stronger within-domain emotion relations in the domain of mathematics that is assumed to be rather homogeneous with regard to subject matter, as compared to a language domain (German) in which the content is considerably more varied. More specifically, whereas German classes may include study materials ranging from poems and biographies to technical or news reports on controversial topics, the topics covered in mathematics classes are predominantly numerical (see also Dweck, 1986).

Therefore, it follows that students' emotions related to more topically heterogeneous domains should also demonstrate less consistent relations than emotions that are related to more narrowly defined domains. For example, German classes may be both enjoyable and anxiety provoking to a student who enjoys poems but is upset by controversy, however a student who enjoys mathematics classes is not likely to also experience anxiety in that subject domain (and vice versa). Similarly, it is to be expected that stronger within-domain relations should be observed for emotions in narrowly defined (homogeneous) *situational contexts*, and that weaker relationships between emotions should be found within more varied (heterogeneous) academic settings. As homework situations for a given academic subject are generally less structured and thus less homogeneous than classroom situations (e.g., math classes vs. math homework; see Zeidner et al., 2005), it can also be assumed that within-domain relations between emotions are likely weaker with respect to homework as compared to classroom settings.

Concerning age differences in within-domain relations of academic emotions, the differential-distinctiveness hypothesis (Marsh & Ayotte, 2003) states that relations between highly correlated constructs do not differ for younger versus older students, or become stronger with age (for very highly correlated constructs). Although this assumption originally referred to self-concept constructs, it has been corroborated with respect to motivation and emotion variables (Bong, 2001; Goetz et al., 2007). Despite anticipated lower within-domain relations for homework as compared to classroom situations, these emotion relations are nonetheless assumed to be rather strong in magnitude in both situation types. As such, within-domain relations in each academic setting are not expected to differ as a function of age.

1.4. Between-domain relations of homework emotions

Recent empirical findings suggest that academic emotions are largely domain-specific in nature (Goetz et al., 2007). In the classroom setting, such domain-related variability may be due to differences in domain content, yet may also reflect differences of classroom composition and teachers across domains (Goetz, Frenzel, Lüdtke, & Hall, 2011). In contrast, in homework settings, differences in domain content are assumed to be largely responsible for any domain-related differences in emotions. Given the absence of classroom environment confounds in homework settings, it is expected that between-domain relations will be stronger for homework emotions than for classroom emotions.

Despite the hypothesis that between-domain relations should be stronger for homework as compared to classroom situations, they are nevertheless assumed to be rather weak in both settings. Furthermore, consistent with Marsh and Ayotte's (2003) differential distinctiveness hypothesis which states that constructs having weak between-domain relations become more differentiated with age, it is also assumed that between-domain relations for both homework and classroom emotions should be weaker in older students (cf., empirical support for differential distinctiveness in classroom emotions; Goetz et al., 2007).

2. Research hypotheses

The four primary hypotheses evaluated in the present research are outlined below.

Hypothesis 1. Relations between homework emotions and classroom emotions.

Homework emotions and classroom emotions are moderately to strongly positively correlated. The magnitude of latent correlations are below .90 for all emotions and domains (cf., Bong, 2001), corroborating the need to distinguish between discrete academic emotions in both homework and classroom settings.

Hypothesis 2. Relations with self-concept and achievement.

Homework emotions and classroom emotions are significantly related to academic self-concept and academic achievement. Self-concept is more strongly related to class-related emotions than to homework emotions. Emotion/achievement relations are expected to be similar for class-related and homework emotions.

Hypothesis 3. Within-domain emotion relations.

Within-domain relations are weaker for homework emotions as compared with classroom emotions, and there are no differences in within-domain relations due to students' age.

Hypothesis 4. Between-domain emotion relations.

Between-domain relations are stronger for homework emotions as compared to classroom emotions, and these relations are weaker for older students.

3. Method

3.1. Sample and data collection

The sample consisted of 553 German high-school students attending Gymnasium (top track of the German school system; 52% female) with a mean age of 15.55 years ($SD = 1.62$). Two grade levels were assessed, including 289 students from grade 8 (56% female; M_{age} 14.09 years, $SD = .46$; range = [12.58; 15.92]), and 264 students from grade 11 (47% female; M_{age} 17.16 years, $SD = .56$; range = [15.33; 19.33]). In the German secondary school system, students typically stay with the same classmates across all subjects and have different teachers for each subject. Data collection was conducted in the second half of the academic year by trained personnel using fully standardized questionnaires. Missing data due to student nonresponse was negligible (0.8% missing at the item level).

3.2. Study measures

3.2.1. Homework emotions and classroom emotions

Based on previous research showing emotions in test situations to strongly differ from those in other classroom situations (see Pekrun et al., 2002, 2004, 2011), test-related emotion items were excluded from our classroom emotions scales. *Class-related emotions* of enjoyment, pride, anxiety, anger, and boredom in the domains of mathematics, physics, German, and English were assessed using measures adapted from the mathematics version of the Achievement Emotions Questionnaire (AEQ-M; trait-oriented emotions; Pekrun, Goetz, & Frenzel, 2005). Parallel item wordings were used to assess the five emotions in four subject domains (four items per scale; e.g.,

"I am looking forward to [DOMAIN] classes" for enjoyment; see Goetz, Cronjaeger, et al., 2010; Goetz, Frenzel, et al., 2010 for detailed scale information). To assess *homework-related emotions*, parallel versions of the class-related emotion scales with very similar wordings were developed for this study (e.g., replacing "class" with "homework"; see Appendix A). Thus, the total questionnaire comprised 160 emotion items (4 items per emotion × 5 emotions × 4 domains × 2 situation types — class vs. homework). All emotion items utilized a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Means, standard deviations, and Cronbach's alphas for all 40 emotion scales (5 emotions × 4 domains × class vs. homework) are provided in Appendix B and presented separately by grade level. Zero-order correlations by grade level are outlined in Appendixes C and D.

3.2.2. Academic self-concept

To measure students' *academic self-concept* in the domains of mathematics, physics, German, and English, items from the German version of the Self Description Questionnaire were employed (SDQ; Marsh, 1988, 1990; Marsh & O'Neill, 1984; for the German scale items, see Goetz, Cronjaeger, et al., 2010; Kunter et al., 2002). Parallel item wordings were used to assess academic self-concept in four subject domains (four items per scale; e.g., "I have always done well in [DOMAIN] classes"). Thus, the study questionnaire included a total of 16 self-concept items (4 items per scale × 4 domains). The response format consisted of a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

3.2.3. Academic achievement

Achievement outcomes in mathematics, physics, German, and English were assessed using students' self-reported midterm grades. As grades in the German education system range from 1 (very good) to 6 (insufficient), students' grades were inverted to allow for higher numbers to be more intuitively interpreted as better performance. Scale means and standard deviations for the self-concept and achievement measures, as well as Cronbach's alphas for the self-concept measures, are provided in Appendix E by grade level. Zero-order correlations for each grade level are presented in Appendix F.

3.3. Data analysis

3.3.1. H1/H2

To evaluate Hypotheses 1 and 2, latent correlations between constructs were calculated using Mplus 5.2 software (Muthén & Muthén, 1998–2008). Analyses of relations between emotions (H1 for the relations between homework and classroom emotions) were conducted as recommended by Jöreskog (1979) and Marsh and Hau (1996) in including correlated uniqueness between items with parallel wording in all models.[1] To compare the strength of relations between emotions and self-concept/achievement in homework vs. classroom situations (H2), differences between the correlation coefficients for homework versus classroom emotions were calculated. Before calculating the difference scores, all latent correlation coefficients were subjected to Fisher's *z* transformation (Cohen, 1988).

3.3.2. H3/H4

To evaluate Hypotheses 3 and 4 (differences in within- and between-domain relations for emotions across homework versus classroom settings and across age groups), we adopted a data analysis strategy suggested by Goetz et al. (2007), Goetz, Cronjaeger, et al. (2010), and Goetz, Frenzel, et al. (2010) that allows for differences in the magnitude of between- and within-domain structures to be assessed while controlling for differing reliabilities of study measures. More specifically, comprehensive 3-level models (hierarchical linear modeling, HLM; Raudenbush & Bryk, 2002) were conducted using Mplus 5.2 software (Muthén & Muthén, 1998–2008). In our 3-level hierarchical model of homework and classroom situations for students in grades 8 and 11, *Level 1* reflected the *item level* (manifest variables; within-level 1) and included all emotion items for the within-domain analyses (negatively worded items inverted). *Level 2* reflected the *domain level* and consisted of the four subject domains assessed (within-level 2). Finally, *Level 3* reflected the *person level* and was organized according to individual study participants (between-level). Based on the variance components for the three levels, we calculated homogeneity indices representing the strength of within- and between-domain emotion relations for homework vs. classroom emotions and for grade levels 8 vs. 11. These indices range from 0 to 1 (higher values = stronger relations) and can directly be compared across situations and grade levels (for a detailed description see Goetz et al., 2007; Goetz, Cronjaeger, et al., 2010; Goetz, Frenzel, et al., 2010). 95% confidence intervals for these indices were evaluated to test for significant differences in magnitude.[2]

4. Results

4.1. Relations between homework emotions and classroom emotions (H1)

Correlations between homework and classroom emotions at the latent level are presented separately for the five emotions, four domains,

[1] Before conducting our main analyses, we investigated parallel items referring to homework vs. classroom situations that are empirically separable (e.g., enjoyment of mathematics homework vs. enjoyment of math class). We compared 20 single-factor models (5 emotions × 4 domains; grouping for grade levels 8 vs. 11) in which one global factor loaded on all 8 items (4 homework and 4 classroom items) with each a correlated two-factor model in which a latent homework factor was loaded on each 4 homework item and a latent classroom factor loaded on each 4 classroom item. In all models, we included correlated uniquenesses between items with parallel wordings. For all domain-specific emotions included in this study, the single-factor model in which homework and classroom items loaded on a single, global factor was unacceptable (with 3 exceptions, all TLIs < .90; all CFIs < .95). The fit indices for the two factor models were always clearly better than those for the corresponding single-factor model as indicated by clearly higher TLIs (all TLIs > .90; the smallest TLI was .93) and higher CFIs (with one exception, all CFIs > .95) of the two factor models. Median fit indices for the two-factor/one-factor models are as follows: CFI = .97/.90; TLI = .96/.88; RMSEA = .075/.141; SRMR = .053/.069. These analyses thus suggest that homework and classroom items are best assessed as separate constructs and not collapsed into a single measure.

[2] To obtain standard errors for the homogeneity index, a three-level model (emotions nested within domains nested within individuals) was evaluated in Mplus for each situation (classroom versus homework situation) and grade level (8 versus 11). As it is possible to calculate only two-level models in Mplus, we specified the first level (emotions nested within domains) as a constrained confirmatory factor analysis (see Bauer, 2003; Mehta & Neale, 2005). In detail, the following Mplus syntax was used: Model:

```
%within%
Level_2 by emo_1@1 emo_2@1 … emo_n@1;
emo_1 (a) emo_2 (a) … emo_n (a);
Level_2 (b);
%between%
Level_3 by emo_1@1 emo_2@1 … emo_n@1;
emo_1@0 emo_2@0 … emo_n@0;
[emo_1@0 emo_2@0 … emo_n@0];
Level_3 (c);
[Level_3];
```

By setting nonlinear constraints that could be specified in Mplus, standard errors for derived quantities like the homogeneity index can be obtained. Using these standard errors, 95% confidence intervals were calculated. This procedure is consistent with data analysis of Goetz et al. (2007), Goetz, Cronjaeger, et al. (2010), and Goetz, Frenzel, et al. (2010).

and two grade levels in Appendix D. The range of correlations (same emotion for homework and classroom situations within the same domain) in grades 8/11 was [.73; .86]/[.67; .91] and the means were $r = .80/.79$ (medians: .81/.80). Only one of the total of 40 correlations was above .90 (pride in mathematics, $r = .91$), thus providing support for Hypothesis 1.

4.2. Relations with self-concept and achievement (H2)

The range of correlations (absolute values) between homework emotions and academic self-concept in grades 8/11 was [.34; .71]/[.36; .69], and the range of correlations between classroom emotions and self-concept in grades 8/11 was [.29; .86]/[.41; .83] (see Appendix C). In support of Hypothesis 2, relations were significantly stronger for classroom emotions ($p = .02$; paired-samples t-test across 40 Fisher z-transformed correlations). In terms of effect size, the mean difference between the Fisher z-transformed correlations referring to homework and classroom emotions (5 emotions × 4 domains = 20 coefficients per grade level) was .17 (effect size d) for each grade level. These findings indicate that there were significant, albeit weak effects of the academic setting on the strength of self-concept/emotion relations (Cohen, 1988).

The range of correlations (absolute values) between homework emotions and academic achievement in grades 8/11 was [.03; .41]/[.10/.32], and the range of correlations between classroom emotions and achievement was [.04; .40]/[.10; .39] (see Appendix C). The effect sizes for differences between emotion/achievement correlations between homework and classroom settings in grade levels 8 and 11 were $d = .07$ and .04, respectively, indicating negligible and non-significant effects of the setting ($p = .11$; paired-samples t-test across 40 Fisher z-transformed correlations). This further supports Hypothesis 2.

4.3. Within-domain emotion relations (H3)

Table 1 shows the variance components and the homogeneity indices for levels 1 and 2 representing the strength of within-domain relations between emotions (within-domain homogeneity). In support of Hypothesis 3, our results showed significantly weaker within-domain relations for homework emotions as compared to classroom emotions (non-overlapping 95% confidence intervals), and no significant differences in within-domain relations due to grade level (overlapping 95% confidence intervals; grades 8/11 = .21/.25 for homework emotions; .30/.32 for classroom emotions). Coefficients for within-domain relations of both homework and classroom emotions at the latent level are presented in Appendix C.

4.4. Between-domain emotion relations (H4)

Table 1 also shows the variance components and the homogeneity indices for levels 2 and 3 representing the strength of between-domain relations between specific emotions. Consistent with Hypothesis 4, our results showed significantly stronger between-domain relations for homework emotions as compared to classroom emotions (non-overlapping 95% confidence intervals for the homogeneity indices; grades 8/11 = .43/.26 vs. .24/14) and significantly weaker between-domain relations for older students (grades 8/11 = .43/.26 for homework emotions; .24/.14 for classroom emotions). Between-domain relations for homework and classroom emotions at the latent level are presented in Appendix D.

5. Discussion and conclusion

The present research represents a preliminary examination of differences between students' emotions experienced in homework and classroom settings in terms of their relations across the two settings, their relations with self-concept and achievement, and their within- and between-domain structures in the two settings. This research extends the findings of previous studies by examining the structures of homework and classroom emotions as well as their relations with critical antecedent and outcome variables (self-concept, achievement) and the moderating function of students' age. The study hypotheses were derived from both homework research and theories of academic emotions, and analyzed with respect to both homework and classroom settings for the emotions of enjoyment, pride, anxiety, anger and boredom in the subject domains of mathematics, physics, German, and English.

Consistent with Hypothesis 1, the observed magnitude of correlations indicated that homework and classroom emotions are not synonymous but conceptually distinguishable. Despite strong correlations between homework and classroom emotions, these disattenuated, latent coefficients were statistically corrected for unreliability and thus represent the highest possible coefficients derivable from the study data. Thus, our results suggest that in spite of high correlations, it is nonetheless warranted to conceptually distinguish between homework and class-related emotions (cf., Bong, 2001). Further, while previous research and theories on the domain specificity of psychosocial constructs (Bong, 2001) underscores the domain-specific organization of academic emotions (e.g., "mathematics enjoyment" instead of "school enjoyment"; Bong, 2001; Goetz et al., 2007; Pekrun, 2006), our study highlights the importance of further distinguishing between academic emotions as experienced in classroom as opposed to homework situations (e.g., "homework-related mathematics enjoyment" instead of "mathematics enjoyment"; for

Table 1
Between- and within-domain relations of academic emotions.

	Variances			Within-domain relations		Between-domain relations	
	Level 1	Level 2	Level 3	Homogeneity level 1_2	95% confidence interval level 1_2	Homo-geneity level 2_3	95% confidence interval level 2_3
Grade 8							
Class	1.13	.16	.49	.30	(.29–.31)	.24	(.21–.28)
Homework	1.43	.38	.29	.21	(.20–.23)	.43	(.39–.47)
Grade 11							
Class	1.06	.08	.50	.32	(.30–.34)	.14	(.10–.17)
Homework	1.38	.40	.16	.25	(.23–.27)	.26	(.22–.31)

Note. All negative emotion items (items referring to anxiety, anger, and boredom) were inverted for this analysis. Consequently, all items were indicators of positive emotional experiences.

differences in academic emotions across settings, see also Pekrun et al., 2011).

Our findings expand upon previous research on *mean level differences* in emotions across homework and classroom situations (e.g., Leone & Richards, 1989; Verma et al., 2002) in showing significant *differences in structures and functional relations* between these emotions, their close interrelations notwithstanding. In light of the substantial proportion of study time accounted for by homework activities (Cooper, 1989, 2007; Cooper et al., 1998; Xu, 2005b), the findings of the present study thus contribute to a growing and important research literature highlighting the importance of continued research on the structures, antecedents, and effects of homework emotions.

In line with Hypothesis 2, the relations between emotions and self-concept were slightly weaker for homework emotions as compared with classroom emotions. The relations with achievement outcomes were similar for the two groups of emotions. As such, these results suggest that it may be most efficient in future investigations focusing specifically on achievement/emotion relations to investigate emotions as experienced in either homework or classroom situations, but not necessarily both. Concerning self-concept, although our results do imply that self-concept is less important with respect to students' emotions in homework as compared to classroom settings, this finding is nonetheless notable in suggesting that other factors may contribute more significantly to homework emotions. For example, as homework emotions may be less impacted by perceived competencies, it is possible that efforts to optimize students' emotions during homework should rely more heavily on the characteristics of the homework materials assigned by instructors (e.g., "authentic" tasks with real-world applications; Bergin, 1999; Hiebert, 1994; see Ames, 1992; Fraser & Walker, 2005; for homework quality, see Dettmers et al., 2010).

Self-concept is most commonly presented in prominent theoretical models as a proximal *antecedent* of students' emotional experiences (Goetz et al., 2008; Goetz, Cronjaeger, et al., 2010; Goetz, Frenzel, et al., 2010; see also Lefcourt, 1983; Levenson, 1973; Rotter, 1966; Weiner, 1985). However, it is important to note that concerning the direction of self-concept/emotion relations, reciprocal causation, in which emotions predict self-concept, can also be assumed (cf., Marsh & Ayotte, 2003). For example, it is plausible that a student may experience initial feelings of pride in a given domain and only later attributes this emotion to perceptions of competence (see Bandura, 1977, 1989, 1997; for a theoretical perspective on reciprocal relations between perceived competence and emotions, see Pekrun, 2006). Future studies investigating the effects of changes in cognitive appraisals on emotional experiences (e.g., interventions fostering self-concept or control appraisals; Perry & Hall, 2009), as well as the effects of changes in emotions on judgments of self-concept (e.g., by adopting an enthusiastic teaching style; Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009) are warranted.

Our findings are also consistent with Hypothesis 3 and previous results (Bong, 2001; Goetz et al., 2007) in showing within-domain relations for both homework and classroom emotions to not significantly vary as a function of age. In other words, students' emotional experiences within specific subject areas do not appear to become increasingly multidimensional after Grade 8. Moreover, our findings support Hypothesis 3 in showing within-domain relations between specific emotions to be weaker, or more multidimensional, in homework situations as compared to the classroom. These results are thus in line with our assumption that homework situations are less structured in a given subject domain, and thus more heterogeneous than more narrowly defined and closely monitored classroom activities. These findings are also consistent with empirical findings on differences in within-domain relations due to heterogeneity in domain content (e.g., mathematics vs. English classes; see Stodolsky & Grossman, 1995, 2000).

Moreover, our analyses of within-domain relations showed that discrete academic emotions can be empirically distinguished in homework situations, even more so than in the classroom. This finding should encourage educators to avoid conceptualizing students' homework emotions as global positive versus negative affect, and instead acknowledge the variety of distinct emotions experienced by students while learning outside of the classroom.

Finally, our study findings support Hypothesis 4 in showing students' homework emotions to be less domain-specific than their classroom emotions. It is important to note, however, that a high level of domain-specificity was observed in emotion relations for both homework and classroom situations. Furthermore, as predicted by Marsh and Ayotte's (2003) differential distinctiveness hypothesis, weaker between-domain relations (i.e., greater domain-specificity) were also found for older students for both homework and classroom emotions. In contrast to teachers' tendency to view students' attributes as habitual and domain-general in nature (Marsh, 1993; Marsh, Smith, & Barnes, 1983; Pohlmann, Moeller, & Streblow, 2004), these results thus suggest that it is more appropriate for educators to view students' academic emotions, especially those of older students, as linked to specific subjects in both the classroom setting (e.g., enjoyment of math classes) as well as homework situations (e.g., enjoyment of math homework).

Appendix A. Homework emotion scale items

	Enjoyment
Ej_1	I am looking forward to [DOMAIN] homework.
Ej_2	I enjoy my [DOMAIN] homework.
Ej_3	I enjoy my [DOMAIN] homework so much that I am strongly motivated to continue studying.
Ej_4	The material we deal with in [DOMAIN] is so exciting that I really enjoy my homework.
	Pride
Pr_1	When doing [DOMAIN] homework, I think I can be proud of my knowledge.
Pr_2	When doing [DOMAIN] homework I am proud of my accomplishments.
Pr_3	I take am proud of being able to do the homework in [DOMAIN].
Pr_4	When doing [DOMAIN] homework I am proud of myself.
	Anxiety
Ax_1	I feel tense and nervous when doing [DOMAIN] homework.
Ax_2	I worry if the homework material in [DOMAIN] is much too difficult for me.
Ax_3	When thinking of my [DOMAIN] homework, I get queasy.
Ax_4	[DOMAIN] homework makes me so nervous that I don't even want to begin it.
	Anger
Ag_1	When doing my [DOMAIN] homework I am angry.
Ag_2	I am so angry while doing my [DOMAIN] homework that I would like to stop.
Ag_3	I get angry because the material in [DOMAIN] is so difficult.
Ag_4	Because I'm angry I get restless when doing my [DOMAIN] homework.
	Boredom
Bo_1	When doing my [DOMAIN] homework I get bored.
Bo_2	When doing my [DOMAIN] homework I can't concentrate because I am so bored.
Bo_3	I am so bored while doing my [DOMAIN] homework that I can't stay awake.
Bo_4	Just thinking of my [DOMAIN] homework makes me feel bored.

Note. DOMAIN: Items each referred to the domains of mathematics, physics, German, and English.

Appendix B. Descriptive statistics for emotion scales

Scale	Classroom						Homework					
	Grade 8			Grade 11			Grade 8			Grade 11		
	M	*SD*	α	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α
Enjoyment												
Mathematics	2.80	1.09	.90	2.79	1.09	.92	2.16	0.94	.84	2.22	1.03	.89
Physics	2.56	1.16	.92	2.96	1.07	.92	1.99	0.94	.85	2.15	0.92	.86
German	2.83	0.92	.88	2.78	1.03	.90	2.01	0.78	.77	2.02	0.83	.82
English	2.86	1.02	.88	3.04	0.96	.90	2.17	0.87	.80	2.35	0.87	.82
Pride												
Mathematics	2.95	1.05	.91	2.93	1.10	.92	2.86	1.07	.90	2.95	1.12	.92
Physics	2.78	1.07	.91	3.01	1.05	.93	2.66	1.05	.89	2.91	1.03	.91
German	3.05	0.84	.80	3.01	0.87	.85	2.92	0.96	.85	2.97	1.02	.87
English	3.11	0.96	.87	3.21	0.95	.90	2.98	1.01	.88	3.16	1.01	.89
Anxiety												
Mathematics	1.98	0.98	.85	2.03	0.98	.87	2.17	1.08	.83	2.26	1.13	.89
Physics	1.91	0.97	.84	1.67	0.72	.79	2.15	1.15	.87	1.91	0.93	.87
German	1.69	0.50	.77	1.62	0.67	.72	2.08	1.10	.86	1.99	1.03	.86
English	1.71	0.80	.81	1.56	0.67	.77	1.90	0.99	.84	1.70	0.81	.82
Anger												
Mathematics	2.20	1.03	.82	2.22	0.99	.83	2.55	1.14	.84	2.57	1.10	.83
Physics	2.28	1.10	.83	1.95	0.86	.80	2.59	1.21	.86	2.30	1.00	.83
German	2.15	0.95	.81	2.15	0.85	.71	2.55	1.07	.81	2.61	1.04	.80
English	2.08	0.95	.81	1.85	0.78	.76	2.41	1.06	.80	2.16	0.91	.77
Boredom												
Mathematics	2.29	1.01	.86	2.37	1.04	.89	2.75	1.18	.87	2.77	1.16	.89
Physics	2.69	1.24	.90	2.39	1.11	.91	2.99	1.22	.88	2.74	1.12	.88
German	2.47	1.00	.87	2.64	1.10	.90	3.18	1.06	.83	3.31	1.14	.87
English	2.42	1.07	.87	2.34	1.02	.90	2.91	1.16	.88	2.75	1.07	.87

Note. Means (*M*) and standard deviations (*SD*) refer to sum scores divided by the number of scale items; 4 items were used for each scale; response format consisted of a 5-point Likert scale ranging from (1) *strongly disagree* to (5) *strongly agree*. $N = 288/261$ for grade levels 8/11 (56/47% female).

Appendix C. Within-domain relations of academic emotions, self-concept factors, and achievement scores (latent correlations, achievement assessed as manifest variable)

	Mathematics							Physics							German							English						
	Ej	Pr	Ax	Ag	Bo	SC	AA	Ej	Pr	Ax	Ag	Bo	SC	AA	Ej	Pr	Ax	Ag	Bo	SC	AA	Ej	Pr	Ax	Ag	Bo	SC	AA
Classroom																												
Ej	–	.85	−.68	−.81	−.76	.79	.18	–	.86	−.57	−.75	−.88	.75	.25	–	.64	−.48	−.85	−.92	.59	.39	–	.64	−.59	−.74	−.83	.73	.27
Pr	.88	–	−.63	−.63	−.48	.83	.24	.78	–	−.46	−.51	−.63	.80	.23	.69	–	−.42	−.44	−.45	.68	.32	.82	–	−.37	−.34	−.35	.81	.25
Ax	−.59	−.62	–	.91	.57	−.75	−.30	−.55	−.50	–	.83	.65	−.59	−.26	−.56	−.33	–	.61	.40	−.61	−.37	−.46	−.51	–	.84	.55	−.61	−.26
Ag	−.76	−.64	.94	–	.84	−.69	−.25	−.77	−.56	.86	–	.90	−.60	−.22	−.80	−.39	.71	–	.92	−.46	−.38	−.77	−.59	.77	–	.82	−.51	−.25
Bo	−.74	−.53	.59	.86	–	−.42	−.10	−.85	−.58	.67	.93	–	−.62	−.22	−.85	−.44	.55	.92	–	−.44	−.32	−.81	−.59	.48	.90	–	−.41	−.18
SC	.75	.86	−.68	−.63	−.48	–	.41	.76	.82	−.63	−.67	−.64	–	.32	.49	.53	−.45	−.29	−.34	–	.57	.57	.81	−.51	−.40	−.30	–	.37
AA	.23	.30	−.28	−.26	−.26	.45	–	.30	.40	−.36	−.33	−.27	.55	–	.08	−.04	−.25	−.17	−.10	.33	–	.24	.31	−.24	−.24	−.14	.53	–
Homework																												
Ej	–	.78	−.51	−.69	−.70	.63	.14	–	.79	−.36	−.62	−.76	.63	.20	–	.76	−.50	−.83	−.87	.66	.30	–	.63	−.42	−.74	−.82	.57	.22
Pr	.82	–	−.54	−.63	−.54	.69	.16	.89	–	−.43	−.59	−.58	.68	.23	.83	–	−.39	−.55	−.59	.65	.30	.80	–	−.30	−.43	−.36	.54	.24
Ax	−.49	−.51	–	.98	.59	−.65	−.26	−.40	−.44	–	.90	.56	−.51	−.25	−.58	−.52	–	.81	.55	−.59	−.29	−.37	−.43	–	.90	.52	−.60	−.32
Ag	−.67	−.59	.97	–	.89	−.63	−.16	−.65	−.67	.89	–	.87	−.64	−.25	−.78	−.65	.86	–	.92	−.62	−.29	−.67	−.61	.83	–	.93	−.50	−.25
Bo	−.68	−.52	.65	.91	–	−.41	−.10	−.71	−.65	.62	.92	–	−.56	−.25	−.81	−.65	.64	.93	–	−.57	−.29	−.77	−.57	.61	.96	–	−.36	−.15
SC	.57	.64	−.54	−.53	−.36	–	.41	.68	.71	−.53	−.61	−.57	–	.32	.46	.46	−.39	−.37	−.34	–	.57	.48	.58	−.39	−.42	−.36	–	.37
AA	.13	.23	−.21	−.15	−.19	.45	–	.29	.41	−.29	−.27	−.21	.55	–	.03	.07	−.14	−.06	−.04	.33	–	.13	.23	−.16	−.19	−.17	.53	–

Note. The grade 8 sample is shown below the diagonal ($n = 289$; $p < .05/.01$ for $|r| > .10/.16$). The grade 11 sample is shown above the diagonal ($n = 262$; $p < .05/.01$ for $|r| > .10/.16$). Ej = Enjoyment; Pr = Pride; Ax = Anxiety; Ag = Anger; Bo = Boredom; SC = Self-Concept; AA = Academic Achievement.

Appendix D. Between-domain relations of academic emotions (latent correlations)

	Classroom (C)				Homework (H)			
	Mathematics (M)	Physics (P)	German (G)	English (E)	Mathematics (M)	Physics (P)	German (G)	English (E)
Enjoyment								
M–C	–	.40	.00	−.09	.84	.50	−.05	−.01
P–C	.34	–	.09	−.02	.34	.78	−.05	−.03
G–C	.23	.08	–	.11	.04	.08	.71	.20
E–C	.14	.14	.17	–	−.04	.09	.27	.73
M–H	.83	.42	.18	.10	–	.58	.09	.15
P–H	.37	.86	.12	.16	.55	–	.14	.19
G–H	.14	.05	.77	.10	.24	.15	–	.48
E–H	.12	.18	.15	.80	.29	.33	.29	–
Pride								
M–C	–	.56	.08	.09	.91	.51	−.04	.13
P–C	.50	–	.24	.16	.52	.85	.12	.18
G–C	.27	.22	–	.37	.14	.30	.84	.39
E–C	.16	.17	.45	–	.14	.20	.24	.82
M–H	.82	.49	.31	.17	–	.63	.20	.31
P–H	.37	.86	.32	.26	.49	–	.34	.37
G–H	.21	.23	.77	.32	.35	.41	–	.45
E–H	.13	.21	.46	.81	.30	.36	.53	–
Anxiety								
M–C	–	.64	.20	.14	.89	52	.13	.12
P–C	.33	–	.22	.24	.62	.85	.26	.33
G–C	.30	.36	–	.46	.21	.31	.74	.52
E–C	.30	.18	.41	–	.12	.28	.41	.76
M–H	.83	.44	.39	.31	–	.65	.28	.26
P–H	.34	.82	.43	.28	.60	–	.43	.46
G–H	.35	.44	.85	.35	.50	.58	–	.69
E–H	.34	.33	.54	.73	.54	.51	.66	–
Anger								
M–C	–	.44	.15	.18	.83	.46	.20	.17
P–C	.37	–	.25	.35	.46	.85	.25	.30
G–C	.30	.26	–	.20	.15	.27	.72	.31
E–C	.35	.26	.37	–	.19	.34	.35	.73
M–H	.77	.46	.41	.29	–	.58	.27	.24
P–H	.38	.85	.35	.29	.59	–	.27	.40
G–H	.37	.33	.82	.36	.51	.46	–	.57
E–H	.33	.29	.46	.78	.42	.47	.55	–
Boredom								
M–C	–	.32	.15	.12	.77	.43	.23	.20
P–C	.23	–	.20	.21	.32	.83	.17	.25
G–C	.34	.17	–	.14	.16	.24	.75	.28
E–C	.30	.23	.15	–	.24	.32	.32	.67
M–H	.75	.38	.42	.19	–	.60	.38	.41
P–H	.30	.81	.25	.28	.55	–	.37	.44
G–H	.43	.20	.79	.23	.55	.38	–	.58
E–H	.36	.26	.27	.77	.39	.38	.50	–

Note. The grade 8 sample is shown below the diagonal ($n = 289$; $p < .05/.01$ for $|r| > .13/.17$). The grade 11 sample is shown above the diagonal ($n = 262$; $p < .05/.01$ for $|r| > .13/.18$).

Appendix E. Descriptive statistics for self-concept and achievement measures

Scale	Grade 8			Grade 11		
	M	*SD*	α	*M*	*SD*	α
Self-concept						
Mathematics	3.24	1.14	.90	3.24	1.22	.91
Physics	3.12	1.16	.90	3.40	1.09	.91
German	3.58	0.84	.78	3.45	1.01	.87
English	3.47	1.04	.89	3.58	0.92	.84
Achievement						
Mathematics	4.68	1.92	–	4.98	2.24	–
Physics	4.42	1.79	–	4.23	1.99	–
German	4.11	1.39	–	4.48	1.56	–
English	4.47	1.65	–	4.43	1.63	–

Note. Self-concept: Means (*M*) and standard deviations (*SD*) refer to summative scales divided by the number of scale items; 4 items were used for each scale; response format consisted of a 5-point Likert scale ranging from (1) *strongly disagree* to (5) *strongly agree*. $N = 288/261$ for grade levels 8/11 (56/47% female).

Appendix F. Between-domain relations for self-concepts (latent correlations) and achievement scores (manifest correlations)

	Self-concept				Academic achievement			
	Mathematics	Physics	German	English	Mathematics	Physics	German	English
Mathematics	–	.60	−.15	−.11	–	.25	.10	.14
Physics	.48	–	−.08	−.07	.32	–	.26	.23
German	.01	.01	–	.30	.31	.36	–	.25
English	−.04	−.15	.24	–	.32	.19	.42	–

Note. The grade 8 sample is shown below the diagonal ($n = 289$; $p < .05/.01$ for $|r| > .04/.15$). The grade 11 sample is shown above the diagonal ($n = 262$; $p < .05/.01$ for $|r| > .11/.15$).

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