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FINAL DRAFT

Teacher-Student Interaction and Lower Secondary School Students' Situational Engagement

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ABSTRACT

Background

Prior research has shown that engagement plays a significant role in students' academic learning.

Aims

The present study sought to expand the current understanding of students' engagement by examining how situational engagement during a particular lesson is associated with the observed teacher–student classroom interactions (i.e., emotional support, instructional support, and classroom organization) in the same lesson.

Sample

The participants were 709 Grade 7 students (47.7% girls) from 59 classrooms in 26 lower secondary schools and 51 teachers.

Methods

The data consisted of 155 video-recorded lessons (90 language arts and 65 mathematics lessons) coded using the Classroom Assessment Scoring System – Secondary (CLASS-S) observational instrument. Students' self-ratings of their situation-specific engagement were collected using the mobile-based In Situations (InSitu) Instrument at the end of each lesson. The data were analyzed with cross-classified two-level hierarchical modelling.

Results and conclusions

The results indicated that emotional support in the classroom was positively associated with students' emotional engagement and help-seeking, whereas classroom organization was associated with students' behavioural and cognitive engagement. Overall, the findings provide novel evidence suggesting that students' engagement can be fostered by supportive teacher-student interactions.

Teacher-Student Interaction and Lower Secondary School Students' Situational Engagement

Evidence from prior research indicates that students' engagement contributes to their learning and academic success (e.g., Fredricks, Blumenfeld, & Paris, 2004). Students exhibiting high engagement receive better grades (Li & Lerner, 2010), manifest higher academic competence (Li, Lerner, & Lerner, 2010), and invest more effort in learning (Skinner, Kinderman, & Furrer, 2009). Further understanding of the key factors that promote or impede students' engagement in different learning situations is, however, still needed (e.g., Eccles & Wang, 2012). One factor that may contribute to students' engagement and its fluctuation across lessons is teacher-student interaction in the classroom (Fredricks et al., 2004; Pianta, Hamre, & Allen, 2012; Skinner et al., 2009). In order to add to the literature on the role of classroom-level factors in students' situational engagement, the present study set out to examine the extent to which the teacher-student interactions (i.e., emotional support, instructional support, and classroom organization) during a particular lesson in lower secondary school are associated with students' situational engagement in the same lesson.

Student Engagement

According to the widely employed definition by Fredricks et al. (2004), student engagement consists of three distinct, yet interrelated components of students' commitment and involvement with school and learning, namely, behavioral, emotional, and cognitive engagement (see also Wang, Willett, & Eccles, 2011). *Behavioral engagement* refers to students' positive conduct and actions towards school and learning (e.g., attending classes, concentrating, and completing schoolwork), and involvement in academic and social activities in the classroom and school in general (e.g., attending and contributing to class discussions) (Fredricks et al., 2004; Wang et al., 2011). *Cognitive engagement* encompasses students' self-regulated and strategic approach to learning, such as the pursuit and effort to

comprehend complex ideas and master difficult skills (Appleton, Christenson, & Furlong, 2008; Archambault et al., 2009). The third component termed alternatively as *emotional or affective engagement* focuses on students' sentiments toward school, such as feelings of happiness, interest, or anxiety, and sense of belonging with other students, teachers, and the school. In some conceptualizations, this component also involves students' perceived support from important others (Appleton, Christenson, Kim, & Reschly, 2006; Finn 1989; Skinner & Bellmont, 1993).

Students' engagement has been seen as shaped by student-related individual factors such as their gender, academic ability or ethnicity (e.g. Wang & Eccles, 2013). In a study by Lam et al. (2014), for instance, gender difference in engagement was present in data collected from 12 countries. Their results showed that engagement of girls was higher than that of boys in students' self-ratings as well as ratings made by their teachers. It has also been suggested that perceptions of support from teachers and peers may be different among girls and boys (Rueger, Malecki, & Demaray, 2010).

According to Fredricks et al. (2004) engagement is presumed to be malleable, and recent research has indicated that student engagement varies situationally from one learning situation to another (e.g., Vasalampi et al., 2016; Pöysä et al., 2018; Martin et al., 2015; Schernoff et al., 2016). Thus, in everyday learning at school, this fluctuating engagement can be shaped by factors such as structural features of the classroom, and factors related to the interactions between teachers and students (Fredricks et al., 2004). However, the existing findings on the role of these factors are still inconclusive because they have often been drawn based on ratings of engagement as a general or overall trait (i.e., ratings of overall engagement across typical school situations), rather than on situation-specific ratings of engagement (i.e., ratings of lesson-by-lesson experiences).

In the present study, students' situational engagement was approached by focusing on students' individual experiences of their behavioral and cognitive engagement, emotional engagement, competence experiences, disaffection, and help-seeking during a particular lesson. Tripartite conceptualization of engagement (i.e., behavioral, cognitive and emotional engagement; e.g., Wang et al., 2011) was extended in order to reach different aspects of situationally fluctuating engagement in the lessons. These extensions assumed to be relevant for student situation-specific engagement comprised in situational experiences of *competence*, focusing on students' expectations for success during the lesson (cf., Eccles et al., 1993), situational *disaffection*, including both, behaviors and emotions identified in literature on students' maladaptive motivational states and engagement (cf., Skinner et al., 2009), and situational *help-seeking*, focusing on seeking support from peers or their teacher during the lesson (cf., Marchand & Skinner, 2007).

Student Engagement and Teacher-Student Interactions

Among the critical factors assumed to contribute to student engagement is teacher-student interactions in the classroom (e.g., Furrer, Skinner, & Pitzer, 2014; Niemiec & Ryan, 2009; Skinner & Pitzer, 2012; Wang & Eccles, 2013). In prior literature understanding of classroom practices and interactions contributing to student learning has been approached from various perspectives, both theoretically and operationally (see, e.g., Corso et al., 2013; Cronbach & Snow, 1977; Fredricks et al., 2004; Pianta, Hamre, & Allen, 2012; Shernoff et al., 2016), with one of the more recent ones being the *Teaching Through Interaction (TTI)* framework (Allen et al., 2013; Hafen et al., 2015; Pianta, Hamre, & Mintz, 2012). The TTI framework conceptualizes teacher-student interactions in the classroom through three components: emotional support, classroom organization, and instructional support. Emotional support focuses on ways in which classroom practices foster and facilitate students' social and emotional functioning (Hamre et al., 2013). When teacher-student interaction contains

emotional support, students are, for example, willing to express their academic, social, and emotional needs and teacher responds to such needs. Classroom organization focuses on interactions and practices related to effective ways of organizing and managing classroom situations (Allen et al., 2013; Hafen et al., 2015). Fostering of students' positive behavior and supporting their functioning via clear routines, for instance, can be seen as indicators of classroom organization. Finally, instructional support focuses on ways of which the teacher utilizes instructional strategies and feedback to support students' learning (Allen et al., 2013; Hafen et al., 2015). These include, for example, opportunities for students to extend their prior knowledge and participate in discussions expanding their understanding. The components of TTI framework are operationalized in the Classroom Assessment Scoring System (CLASS; e.g., Hamre et al., 2013) which assesses key aspects of teacher-student interactions at classroom level (see descriptions for dimensions in Table 1).

The TTI can provide a promising framework for examining the relation between features of classroom interactions and variation in situational engagement, as it focuses on aspects of teacher-student interactions that have consistently been documented as being associated with student engagement as well (c.f., Fredricks et al., 2004; Lam et al., 2012; Skinner & Pitzer, 2012). Few prior studies have focused on this relation by utilizing the TTI framework and measures of student engagement. Virtanen et al. (2013), for instance, demonstrated positive associations between both classroom organizational and instructional support and student-rated, teacher-rated, and observed general behavioral engagement among lower secondary school students. Furthermore, it has been suggested that students' general engagement is higher when they study in an emotionally supportive learning environments (e.g., Lam et al., 2012; Skinner & Pitzer, 2012), and that emotionally supportive learning environments might be particularly important for girls (Roorda, Koomen, Spilt, & Oort, 2011).

In line with propositions concerning situational variations and the malleability of engagement (e.g., Vasalampi et al., 2016; Martin et al., 2015), the TTI framework acknowledges that the teacher-student interaction may vary from one lesson to another (Curby et al., 2011; Pianta, Hamre, & Mintz, 2012). However, the vast majority of previous research examining links between engagement and teacher-student interactions has employed student ratings of overall or general student engagement, and very few studies have contained parallel assessments of teacher-student interactions and students' engagement in a particular lesson. In a recent study by Rimm-Kaufman, Baroody, Larsen, Curby and Abry (2015), the authors collected simultaneous data of observed teacher-student interactions and the 10-year-old students' self-reported engagement in a mathematics lesson. Although situational engagement was the focus of this study, their results suggested that emotional support and classroom organization were positively related to students' engagement in a particular lesson. In a similar vein, Malmberg et al. (2010) found that observed student engagement was higher in lessons with high emotional support, classroom organization, and instructional support as all assessed using the CLASS. Higher classroom organization was also related to less variability in the students' observed engagement during the lessons (both were assessed one to four times per lesson). The present study moves beyond these studies by focusing specifically on situational engagement in lower secondary school classroom and examining the extent to which students' experiences of their situational engagement during a particular lesson can be explained by the classroom-level teacher-student interactions during the same lesson.

The Present Study

The aim of the present study was to examine the extent to which the teacher-student interactions (emotional support, classroom organization, and instructional support) in a particular lesson are associated with students' situation-specific engagement at the end of the

same lesson. Observations were conducted in the language arts and mathematics lessons in Grade 7. Based on previous findings, we expected that students' situation-specific engagement would be positively associated with observed classroom emotional support (Hypothesis 1a; Lam et al., 2012; Rimm-Kaufman et al., 2015; Tucker et al., 2002), classroom organization (Hypothesis 1b; Malmberg et al., 2010; Virtanen et al., 2013), and instructional support (Hypothesis 1c; Virtanen et al., 2013). In addition, we examined whether associations between the teacher-student interactions and situation-specific engagement would differ between boys and girls.

Method

Participants and Procedure

The present study was part of a longitudinal First steps follow-up study (Lerkkanen et al., 2006-2016), which comprises approximately 2,000 students along with their parents and teachers from four municipalities in different parts of Finland. The aim of the follow-up study was to investigate the development of learning and motivation in the contexts of school and home from the kindergarten year to the end of lower secondary school. The study was approved by the Committee of Ethics in University of Jyväskylä, and only those students whose guardians had given their written consent for their children's participation were involved in the study.

The present analyses concern data on 709 students (338 girls, 371 boys) from 26 lower secondary schools and 59 Grade 7 classrooms. The subsample of classrooms and the respective students, drawn from the larger sample of the longitudinal study, was based on the sample of subject teachers' (teaching mathematics or language arts) who volunteered to participate in video recordings of their ordinary lessons. No statistically significant differences were found in educational background or years of work experience between those teachers ($N = 51$; 35 female, 16 male) who agreed to participate in classroom video

recordings and other Grade 7 subject teachers who participated in the follow-up only by filling out questionnaires.

The average age of the participating students' was 13 years and 2 months ($SD = 4$ months) at the beginning of Grade 7. They all attended general education in mainstream Finnish-speaking schools. The present subsample of students was representative of the larger longitudinal study with respect to maternal educational level. In the present subsample, a total 71% of mothers ($N = 503$) had provided information concerning their educational level. Of these mothers 29 (5.8%) had a low educational level (i.e., no vocational degree), 335 (65.9%) had an intermediate educational level (i.e., vocational school degree, vocational college degree, and Bachelor's degree), and 126 (27.4%) had a high educational level (i.e., Master's, Licentiate's or Doctor's degree). The sample was representative of the Finnish population (Statistics in Finland, 2015) with respect to the distribution of maternal education.

A total of 155 lessons (90 language arts and 65 mathematics lessons) were video-recorded during March–May of 2014. The most of the lessons lasted 45 minutes (except for six language arts and four mathematics lessons lasting 75 minutes). The video-recorded lessons were coded for teacher-student interactions using the Classroom Assessment Scoring System – Secondary (CLASS-S; Pianta, Hamre, & Mintz, 2012) observational tool. At the end of each video-recorded lesson, the students completed self-ratings of their situation-specific engagement using the mobile-based In Situations (InSitu) Instrument (Lerikkanen et al., 2012; Vasalampi et al., 2016). The data for the present study contained a total of 1,647 time-stamped ratings of students' situation-specific engagement ($M = 2.32$ ratings for a student, range 1–9, $SD = 1.56$).

Measures

Situational engagement. Students' self-rated situation-specific engagement was measured at the end of each video-recorded lesson. The ratings were made using a mobile

application of the In Situations (*InSitu*) Instrument (Lerikkanen et al., 2012; Vasalampi et al., 2016). The application was preprogrammed into smartphones, which were used only for research purposes. Students were asked to rate their experiences concerning the whole lesson, and in addition, to provide identification information.

The InSitu consists of 17 items rated on a 5-point scale (1 = *not at all*; 5 = *very much*). It assesses the following five components of students' situation-specific experiences: (1) behavioral/cognitive engagement (7 items, e.g., "How persistent were you in studying during the lesson?"; "How important did you find the studied contents?", $\alpha = .81$); (2) emotional engagement (3 items, e.g., "How much did you like the lesson?", $\alpha = .85$); (3) competence experiences (2 items, "How easy was the lesson for you?", $\alpha = .81$); (4) disaffection (3 items, e.g., "How boring was the lesson?", $\alpha = .67$); and (5) help-seeking (2 items, e.g., "How much did you ask for help from the teacher/another adult during the lesson?", $\alpha = .76$). The first two components are directly drawn from the tripartite conceptualizations of engagement (e.g., Wang et al., 2011), while the three latter components are closely related to or facilitate engagement by capturing students' experiences of competence in the lessons (cf., Eccles et al., 1993), disaffection (maladaptive behaviors and emotions; cf., Skinner et al., 2009), and help-seeking (cf., Marchand & Skinner, 2007), respectively. The factor scores of these five components of student engagement were used in the subsequent analyses.

The InSitu instrument has been validated in the Finnish context (see Vasalampi et al., 2016), and confirmatory factor analyses (CFA) verified the expected five-factor solution for the used data (Vasalampi et al., 2016).

Teacher-student interactions. The assessment of teacher-student interactions at the classroom level was conducted by coding the video-recorded lessons using the Classroom Assessment Scoring System – Secondary (CLASS-S; Pianta, Hamre, & Mintz, 2012). The

CLASS-S contains the following three domains and their respective dimensions each of which focuses on different features of effective teacher-student interactions: Emotional Support (3 dimensions: Positive Climate, Teacher Sensitivity, and Regard for Adolescent Perspectives); Classroom Organization (3 dimensions: Behavior Management, Productivity, and Negative Climate [reversed for analysis]); and Instructional Support (5 dimensions: Instructional Learning Formats, Content Understanding, Analysis and Inquiry, Quality of Feedback, and Instructional Dialogue). The CLASS-S also includes a dimension of Student Engagement, which does not belong under any of the three domains. Short descriptions for the dimensions are presented in Table 1. The CLASS-S has been validated in the Finnish context (Virtanen et al., 2017).

The classroom-level assessment of each of the dimensions was conducted on a 7-point scale (*Low* 1–2 , *Mid* 3–5 , or *High* 6–7) in line with the CLASS-S manual (Pianta, Hamre, & Mintz, 2012). The coding is based on the indicators of effective interactions and observable behavioral markers provided in manual. Each dimension was scored individually. Furthermore, the CLASS-S manual (Pianta et al., 2012) recommends that each lesson is divided into cycles (approximately 15 minutes) which are observed and scored independently to ensure reliability of observations. In the present data, the 45-minute video-recorded lessons were divided into three cycles (with length between 8 and 15 minutes depending on the exact length of the lesson), and 75-minute lessons into five cycles to produce maximal observation time. The average time for each cycle was 13 minutes 52 seconds ($SD = 1$ minute 25 seconds). The unit of observation was one cycle, and thus, for most lessons (145 out of 155) each item (i.e., dimensions) was observed three times during a lesson (remaining 10 lessons included five scoring cycles). For analyses, ratings across the cycles within each lesson were aggregated to produce average lesson-specific score for each dimension.

Ratings were performed by a group of trained coders following the CLASS-S procedure. Prior to actually coding the present data, the coders (eight female graduate and post-graduate students in the field of education or psychology) participated in rigorous training in which they familiarized themselves with the TTI framework and the CLASS-S manual guidelines and procedures. The training consisted of seven training sessions and several independent ratings of videotapes. Before continuing to code actual data the coders were required to reach 80% agreement or higher with at least four master coded cycles and also between each other (Pianta, Hamre, & Mintz, 2012). Twenty percent (20%) of the lessons were double-coded by two independent coders. Interrater reliability was calculated with intraclass correlations (ICCs; Landers, 2015) and Krippendorff's alpha (Hayes & Krippendorff, 2007). Both of these indicators showed high interrater reliability ($\alpha_{icc} = .895$ and $\alpha_{Krippendorff} = .862$).

Preliminary analyses

Factor scores for InSitu factors. Factor scores (sum scores) of students' situational engagement were calculated based on the five-factor solution. Factor scores were used in subsequent analyses in order to allow more degrees of freedom for the modelling.

Treatment of correlating CLASS-S domain scores. Similarly to earlier studies (e.g., Rimm-Kaufmann et al., 2015; Virtanen et al., 2017), our preliminary analyses showed high correlations between CLASS-S domain scores (emotional support, classroom organization, and instructional support). Cross-domain correlations suggested multicollinearity between the domains, and reaching a satisfactory fit for the expected three-factor solution would have required freeing the residual correlations. Thus, we decided to model each CLASS-S domain separately (for a similar procedure, see, e.g., Rimm-Kaufmann et al., 2015).

Statistical Analyses

Because of nested data, we applied two-level hierarchical modelling using the Mplus statistical program (version 7.3; Muthén & Muthén, 1998–2012). At the *within level* variation was modelled within students across different lessons. The *between level* contained two factors, student and teacher, which were cross-classified with each other. In cross-classified two-level modelling, these two factors could be modelled simultaneously. The reason for using cross-classified hierarchical modelling was that one subject teacher could teach more than one group of students, and one group of students was taught by more than one subject teacher (for different subjects, respectively). In cross-classified modelling, at the between level we were able to separate variation due to variation between subjects and variation between teachers.

The standard missing at random (MAR) approach was applied, and the parameters of the models were estimated using full information maximum likelihood (FIML) estimations. Cross-classified hierarchical modelling provided a means to deal with the unequal number of measurements across students (Hox, 2010). The analyses were conducted with the Bayesian estimation; therefore, the goodness of fit of the estimated models could only be evaluated with Bayesian posterior predictive checks (Muthén & Asparouhov, 2012).

The first level of our hierarchical model was the *within level*, which tested the extent to which the observed teacher-student interactions (i.e., emotional support, classroom organization, and instructional support) predicted variations in student's situation-specific engagement (i.e., intra-individual variation). Gender interaction effects were added to the model to investigate whether the associations between the teacher-student interactions and students' situation-specific engagement differed between boys and girls. The second level of the cross-classified model (between level) modelled variations *between students* and *between teachers*. At this level variation due to student gender was modelled between students.

Moreover, based on preliminary analyses, the effects of the subject being studied (language arts or mathematics) were controlled for between teachers.

Cross-classified two-level hierarchical modelling using a similar procedure was conducted separately for the three CLASS-S domains: Emotional Support, Classroom Organization, and Instructional Support. Estimations of each cross-classified three-level hierarchical model provided a good fit according to Bayesian posterior predictive checks (Emotional Support, $p = .413$; Classroom Organization, $p = .219$; and Instructional support, $p = .316$), the p-value for optimal fit being .500.

Results

Descriptive Statistics

Descriptive statistics for students' situation-specific engagement and teacher-student interaction are shown in Table 2. Students' situation-specific engagement ranged, on average, from 1.84 to 3.69 in language arts lessons, from 1.89 to 3.53 in mathematics lessons, and from 1.86 to 3.62 when the two subjects combined. The mean value for observed teacher-student interaction in language arts lessons was 4.53 for emotional support ($SD = .92$), 5.81 for classroom organization ($SD = .77$), and 3.70 for instructional support ($SD = .71$). In mathematics lessons, the mean value for observed teacher-student interaction was 4.43 for emotional support ($SD = .90$), 6.03 for classroom organization ($SD = .90$), and 4.19 for instructional support ($SD = .76$). When two subjects were combined, the mean value for observed teacher-student interaction was 4.31 for emotional support ($SD = .90$), 5.90 for classroom organization ($SD = .83$), and 3.94 for instructional support ($SD = .78$). The results indicated that the instructional support was statistically significantly higher in mathematics lessons than in language arts lessons ($\beta = .463$, 95% CI [.214, .637]). No mean level differences emerged for emotional support and classroom organization.

Intra-individual variations for the five dimensions of situational engagement ranged from moderate to high (Table 3), suggesting that student engagement varied from one lesson to another. Between-student variation for different dimensions of engagement varied from moderate to high, indicating that students differed from each other in their engagement, independent of the lesson. Proportions of teacher-student interaction variance ranged from low to moderate within teachers, but variance was uniformly high between teachers. Thus, these findings suggest that the teacher-student interactions varied to some extent from one lesson to another (instructed by the same teacher), but more substantially from one teacher to another (Table 4).

Teacher-Student Interactions as a Predictor of Student Engagement

First, we investigated the associations between the teacher-student interactions (e.g., emotional support, classroom organization, and instructional support) and students' situation-specific engagement. The results showed, first, that emotional support was positively related to students' emotional engagement and help-seeking ($\beta = .140$, 95% CI [.068, .214] and .109, 95% CI [.037, .181], respectively): the higher the observed emotional support in a classroom, the higher the students' emotional engagement and help-seeking (Figure 1). No significant relations emerged between emotional support and students' behavioral/cognitive engagement, competence experiences, and disaffection.

Second, the modelling indicated that classroom organization was positively associated with students' behavioral/cognitive engagement ($\beta = .079$, 95% CI [.016, .154]): the higher the classroom organization in a classroom, the higher the students' behavioral and cognitive engagement (Figure 2). No significant relations emerged between classroom organization and other dimensions of situational engagement. Instructional support in the classroom was not significantly associated with students' situation-specific engagement (Figure 3).

Gender as a Predictor and Moderator

Finally, we investigated associations between students' gender and students' situation-specific engagement, as well as whether associations between teacher-student interaction and students' situational engagement differed between boys and girls. The results showed that boys reported significantly higher levels of disaffection and help-seeking than girls (Figures 1, 2, and 3), and girls reported significantly higher behavioral/cognitive engagement than boys (Figure 3). Furthermore, the results showed a statistically significant interaction effect for gender, suggesting that girls benefited more from high emotional support than boys for their situation-specific emotional engagement ($\beta = -.088$, 95% CI [- .161, -.018]).

Discussion

The present study examined associations between teacher-student interaction and lower secondary school students' situational engagement. As the majority of previous studies have focused on overall teacher-student interaction aggregated across different lessons and overall rather than lesson-specific measures of students' academic engagement, the present study is one of the first to investigate the extent to which teacher-student interactions during a particular lesson is associated with students' situation-specific engagement during the same lesson. The data consisted of 155 video-recorded lessons (90 language arts and 65 mathematics lessons) from 59 Grade 7 classrooms, coded using the CLASS-S with respect to classroom interactions and students' ($n = 709$) self-ratings of situational engagement (InSitu). The results showed that the higher the emotional support in the classroom, the higher the students' rated their emotional engagement and help-seeking, and the higher the classroom organization, the higher the students' rated their behavioral/cognitive engagement. The results showed further that girls benefited more from emotional support than boys for their situation-specific emotional engagement.

As expected (Hypothesis 1a), our results showed, first, that emotional support in the classroom was positively related to students' self-rated situation-specific engagement. In lessons where the interactions between teachers and students were rated high for emotional support as assessed by CLASS-S indicators (e.g., capturing an emotional connection, showing warmth, mutual respect between teachers and students, and teachers responding to students' social and emotional needs), students were likely to experience higher emotional engagement and to engage in help-seeking. In line with theoretical assumptions presented in models of student engagement (e.g., Fredricks et al., 2004) and the TTI framework (Pianta, Hamre, & Allen, 2012), the results suggest that emotionally supportive teacher-student interactions in the classroom may affect and promote lower secondary school students' emotional engagement.

The results documenting a positive relation between teachers' emotional support and situation-specific help-seeking is in accordance with prior findings among elementary school students, which indicate that students' tend to be more motivated to ask for guidance and seek help from their teachers in emotionally supportive classrooms (Marchand & Skinner, 2007). Although the prevailing evidence indicates that during adolescence, students' are typically more reluctant to ask for help and are more inclined to manifest task avoidance behavior (Turner et al., 2002), our results contradict these findings by suggesting that students in Grade 7 respond to emotionally supportive environments similarly as younger students do. Teacher-student interactions that contain high emotional support appear to increase students' willingness to seek help and guidance during the lesson. Overall, our findings corroborate prior findings, highlighting the influential role of an emotionally supportive learning environment in adolescence (e.g., Perry et al., 2010; Skinner & Pitzer, 2012).

Second, as expected (Hypothesis 1b), the results showed that classroom organization, defined in CLASS-S as teacher reinforcement of desirable behavior, managing time

effectively, and providing predictable routines (Allen et al., 2013; Hafen et al., 2015), was positively related to students' situation-specific behavioral/cognitive engagement during the same lessons. This finding adds to the prior literature by indicating that classroom organization fosters not only students' general engagement (e.g., Virtanen et al., 2013) but situational engagement as well. However, in contrast to prior literature which found classroom structure to be positively related to all aspects of students' engagement, including emotional engagement (Hospel & Galand, 2016), in the present study, organizational support was not associated with students' situation-specific ratings of emotional engagement, competence experiences, disaffection, and help-seeking. Thus, in the present sample, classroom organization seemed to contribute to behavior/cognitive engagement but not to other dimensions of situational engagement.

Third, contrary to our expectations (Hypothesis 1c), the results did not show a significant relation between class-level instructional support and students' situational engagement. This finding is in line with findings by Rimm-Kaufmann et al. (2015) among primary school students. However, it is in contrast with findings by Virtanen et al. (2013), which showed associations between instructional support and students' general engagement in lower secondary school. One possible explanation for these contradictory findings is that the effects of instructional support may not be evident on situational engagement within particular lessons although they are associated with students' overall (trait-like) sentiments and attitudes towards school. Overall, the results of the present study suggest that in everyday learning situations, students' situational engagement is supported more by emotional support and classroom organization in classroom interactions than by instructional support.

In the present study, we also examined whether teacher-student interactions would have different associations with situation-specific engagement for boys and girls. In order to do that, we first examined differences in students' situation-specific engagement with respect

to student gender. Our results were in accordance with findings of previous studies (e.g., Lam et al., 2016), indicating higher situational engagement for girls than for boys. In the present sample, a gender difference was found with regard to boys' higher ratings of disaffection and help-seeking and their lower ratings of behavioral/cognitive engagement. The interaction effect, which was found for gender, indicated that emotional support in the classroom predicted students' emotional engagement differently for girls and boys: girls seemed to benefit more than boys from emotional support in teacher-student interactions with respect to their situational experience of emotional engagement (cf., Roorda et al., 2011; see also Lietaert, Roorda, Laevers, Verchueren, & De Fraine, 2015). The reasons behind this gender difference cannot be inferred based on the present data. However, these results suggest future studies are needed to better understand the ways in which boys' engagement, in particular, could be supported in everyday interactions between teachers and students.

Limitations and Suggestions for Further Research

Some limitations need to be taken into account in generalizing the findings of the present study. First, the results concerning students' situational engagement are based on students' self-ratings. Although students as informants have first-hand experiences and their opinions can be taken at face value, there is an evident need in the future to conduct studies that include situational data consisting of teacher ratings and observed engagement. Second, the current measure of students' situation-specific engagement combined two of the dimensions of engagement into one dimension, namely, behavioral and cognitive engagement. In order to learn more about these two dimensions of engagement, further instruments should optimally distinguish between behavioral and cognitive components of engagement. Third, although no differences were found between the teachers who voluntarily participated in the observations and those who did not participate, it is possible that teachers who chose to participate may differ in ways not studied here. Fourth, teacher-student

interactions were here approached using a class-level assessment, which does not take into account that students in a classroom are not necessarily equally affected by teacher practices during lessons (e.g., Cronbach & Snow, 1977; Roorda et al., 2011). Thus, in future studies observations could also utilize measures capturing the individual student's level (e.g., by utilizing InClass; see Downer, Booner, Lima, Luckner, & Pianta, 2010), and by collecting more detailed data from students on their perceived support. Finally, the present study was carried out in one educational context, that of Finnish lower secondary schools, and cultural and educational features need to be taken into account in any generalizations to other contexts.

Conclusions

The present study examined the relation between the of teacher-student interactions in lower secondary school, which were assessed using a widely used observational instrument, CLASS-S, and students' self-ratings of situational engagement at the end of the same lessons. The relevance of this line of research can be justified based on the notion of malleability and situational variability of student engagement (Martin et al., 2015; Pöysä et al., 2017; Vasalampi et al., 2016). Because students' engagement can fluctuate from one lesson to another, each lesson is also a new opportunity for students to become engaged in learning and for teachers to support such engagement. The results of the current study showed that emotional support provided by the teacher and organizational support provided through effective ways of managing the classroom during lessons were beneficial for students' engagement in the same lessons. The findings highlight the influential role of emotional support on students' experiences of emotional engagement, and the relevance of taking into account the gendered effects of classroom on students' experiences during lessons.

References

- Allen, J., Gregory, A., Mikami, A., Lun, J., Hamre, B., & Pianta, R. (2013). Observations of effective teacher-student interactions in secondary school classrooms: Predicting student achievement with the Classroom Assessment Scoring System – Secondary. *School Psychology Review, 42*, 76–97.
- Archambault, I., Janosz, M., Fallu, J-S., & Pagani, L. S. (2009). Student engagement and its relationship with early high school dropout. *Journal of Adolescence, 32*, 651–670. doi:10.1016/j.adolescence.2008.06.007
- Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. *Psychology in the Schools, 45*, 369–386. doi:10.1002/pits.20303
- Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. I. (2006). Measuring cognitive and psychological engagement: Validation of the student engagement instrument. *Journal of School Psychology, 44*, 427–445. doi:10.1016/j.jsp.2006.04.002
- Corso, M. J., Bundick, M. J., Quaglia, R. J., & Haywood, D. E. (2013). Where student, teacher, and content meet: Student engagement in the secondary school classroom. *American Secondary Education, 41*, 50–61.
- Curby, T. W., Stuhlman, M., Grimm, K., Mashburn, A., Chomat-Mooney, L., Downer, J., Hamre, B., & Pianta, R. C. (2011). Within-day variability in the quality of classroom interaction during third and fifth grade. *Elementary School Journal, 112*, 16–37. doi: 10.1086/660682
- Cronbach, L. J., & Snow, R. E. (1977). *Aptitudes and instructional methods: A handbook for research on interactions*. Oxford, England: Irvington.
- Downer, J. T., Booren, L. M., Lima, O. K., Luckner, A. E., Pianta, R. C., (2010). The individualized classroom assessment scoring system (inCLASS): Preliminary

- reliability and validity of a system for observing preschoolers' competence in classroom interactions. *Early Childhood Research Quarterly*, 25, 1-16.
doi:10.1016/j.ecresq.2009.08.004
- Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Maclver, D. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in school and in families. *American Psychologist*, 48, 30–101. doi:10.1037/0003-066X.48.2.90
- Eccles, J., & Wang, M-T. (2012). Part I Commentary: So what is student engagement anyway? In S. L. Christenson, A. L. Reschly (Ed.). *Handbook of research on student engagement* (pp. 133–145). New York: Springer.
- Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research*, 59, 117–142.
doi:10.3102/00346543059002117
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74, 59–109.
doi:10.3102/00346543074001059
- Furrer, C. J., Skinner, E. A., & Pitzer, J. R. (2014). The influence of teacher and peer relationships on students' classroom engagement and everyday motivational resilience. *National Society for the Study of Education*, 113, 101–123.
- Hamre, B. K., Pianta, R. C., Downer, J. T., DeCoster, J., Mashburn, A. J., Jones, S. M., Brown, J. L., Cappella E., Atkins, M., Rivers, S. E., Brackett, M. A., & Hamagami, A. (2013). Teaching through Interactions: Testing a Developmental Framework of Teacher Effectiveness in over 4,000 Classrooms. *The Elementary School Journal*, 113, 461–487.
- Hafen, C. A., Hamre, B., Allen, J. P., Courtney, A. B., Gitomer, D. H., & Pianta, R. C. (2015). Teaching through interactions in secondary school classrooms: Revisiting the

factor structure and practical application of the classroom assessment scoring system

– secondary. *Journal of Early Adolescence*, 35, 651–680.

doi:10.1177/0272431614537117

Hayes, A. F. & Krippendorff, K. (2007). Answering the call for a standard reliability measure for coding data. *Communication Methods and Measures*, 1, 77–89. doi:

10.1080/19312450709336664

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications*. (2nd ed.). New York: Routledge.

Hospel, V. & Galand, B. (2016). Are both classroom autonomy support and structure equally important for students' engagement? A multilevel analysis. *Learning and Instruction*, 41, 1-10. doi: 10.1016/j.learninstruc.2015.09.001

Lam, S-F., Jimerson, S., Kikas, E., Cefai, C., Veiga, F. H., ... Zollneritsch, J. (2012). Do girls and boys perceive themselves as equally engaged in school? The results of an international study from 12 countries. *Journal of School Psychology*, 50, 77–94. doi: 10.1016/j.jsp.2011.07.004

Lam, S-F., Jimerson, S., Shin, H., Cefai, C., Veiga, F. H., ...Zollneritsch, J. (2016). Cultural universality and specificity of student engagement in school: The results of an international study from 12 countries. *British Journal of Educational Psychology*, 86, 137–153. doi:10.1111/bjep.12079

Landers, R.N. (2015). Computing intraclass correlations (ICC) as estimates of interrater reliability in SPSS. *The Winnower*, 4, e143518.81744.

doi:10.15200/winn.143518.81744

Lerkkanen, M-K., Niemi, P., Poikkeus, A-M., Poskiparta, E., Siekkinen, M., & Nurmi, J-E. (2006-2016). *The First Steps Study [Alkuportaati]*. University of Jyväskylä, Finland.

- Lerikkanen, M-K., Vasalampi, K., & Nurmi, J-E. (2012). InSituations (InSitu) Instrument. University of Jyväskylä, Finland.
- Li, Y. & Lerner, R. M. (2010). Trajectories of school engagement during adolescence: Implications for grades, depression, delinquency, and substance use. *Developmental Psychology*, 47, 233–247. doi:10.1037/a0021307
- Li, Y., Lerner, J. V., & Lerner, R. M. (2010). Personal and ecological assets and academic competence in early adolescence: The mediating role of school engagement. *Journal of Youth and Adolescence*, 39, 801–815. doi:10.1007/s10964-010-9535-4.
- Liettaert, S., Roorda, D., Laevers, F., Verchueren, K., & De Fraine, B. (2015). The gender gap in student engagement: The role of teachers' autonomy support, structure, and involvement. *British Journal of Educational Psychology*, 85, 498–518. doi:10.1111/bjep.12095
- Malmberg, L-E., Hagger, H., Burn, K., & Mutton, T. (2010). Observed classroom quality during teacher education and two years of professional practice. *Journal of Educational Psychology*, 102, 916–932. doi:10-1037/a0020920
- Marchand, G., & Skinner, E. A. (2007). Motivational dynamics of children's academic help-seeking and concealment. *Journal of Educational Psychology*, 99, 65–82. doi:10.1037/0022-0663.99.1.65
- Martin, A. J., Papworth, B., Ginns, P., Malmberg, L-E., Collie, R. J., & Calvo, R. A. (2015). Real-time motivation and engagement during a month at school: Every moment of every day for every student matters. *Learning and Individual Differences*, 38, 26–35. doi:10.1016/j.lindif.2015.01.014
- Muthén, B. & Asparouhov, T. (2012). Bayesian structural equation modeling: A more flexible representation of substantive theory. *Psychological Methods*, 17, 313–335. doi:10.1037/a0026802

- Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide. Seventh edition*. Los Angeles, CA: Muthén & Muthén.
- Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence and relatedness in the classroom. Applying self-determination theory to educational practice. *Theory and Research in Education*, 7, 133–144. doi: 10.1177/1477878509104318
- Pianta, R. C., Hamre, B. K., & Allen, J. P. (2012). Teacher-student relationships and engagement: Conceptualizing, measuring, and improving the capacity of classroom interactions. In S. L. Christenson, A. L. Reschly (Ed.). *Handbook of Research on Student Engagement* (pp. 365–386). New York: Springer.
- Pianta, R. C., Hamre, B. K., & Mintz, S. (2012). Classroom Assessment Scoring System – Secondary Manual. USA, Charlottesville: Teachstone.
- Perry, J. C., Liu, X., & Pabian, Y. (2010). School engagement as a mediator of academic performance among urban youth: The role of career preparation, parental career support, and teacher support. *The Counseling Psychologist*, 38, 269–295. doi:10.1177/0011000009349272
- Pöysä, S., Vasalampi, K., Muotka, J., Lerkkanen, M-K., Poikkeus, A-M., & Nurmi, J-E. (2018). Variation in Situation-Specific Engagement among Lower Secondary School Students. *Learning and Instruction*, 53, 64-73, <https://doi.org/10.1016/j.learninstruc.2017.07.007>
- Rimm-Kaufman, S. E., Baroody, A. E., Larsen, R. A. A., Curby, T. W., & Abry, T. (2015). To what extent do teacher-student interaction quality and student gender contribute to fifth graders' engagement in mathematics learning? *Journal of Educational Psychology*, 107, 170–185. doi:10.1037/a0037252
- Roorda, D.L., Koomen, H.M.Y., Spilt, J.L. & Oort, F.J. (2011). The influence of affective teacher–student relationships on students' school engagement and achievement: A

meta-analytic approach. *Review of Educational Research*, 81, 493–529.

doi:10.3102/0034654311421793

Rueger, S. Y., Malecki, C. K., & Demaray, M. K. (2010). Relationship between multiple sources of perceived social support and psychological and academic adjustment in early adolescence: comparisons across gender. *Journal of Youth and Adolescence*, 39, 47e61. doi:10.1007/s10964-008-9368-6.

Shernoff, D. J., Kelly, S., Tonks, S. M., Anderson, B., Cavanagh, R. F., Sinha, S., & Abdi, B. (2016). Student engagement as a function of environmental complexity in high school classrooms. *Learning and Instruction*, 43, 52-60.

doi:10.1016/j.learninstruc.2015.12.003

Skinner, E. A. & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, 85, 571–581. doi:10.1037/0022-0663.85.4.571

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection. Conceptualization and assessment of children's behavioral and emotional participation in academic activities in the classroom. *Educational and psychological measurement*, 69, 493–525.

doi:10.1177/0013164408323233

Skinner, E. A., & Pitzer, S. R. (2012). Developmental dynamics of student engagement, coping, and everyday resilience. In S. L. Christenson, A. L. Reschly (Ed.). *Handbook of Research on Student Engagement* (pp. 21–44). New York: Springer.

Statistics Finland. (2015). Statistical database. Retrieved from

http://www.stat.fi/tup/tilastotietokannat/index_en.html

Tucker, C. M., Zayco, R. A., Herman, K. C., Reinke, W. M., Trujillo, M., Carraway, K, ...Ivery, P. D. (2002). Teacher and child variables as predictors of academic

- engagement among low-income African America children. *Psychology in the Schools*, 39, 477–488. doi:10.1002/pits.10038
- Turner, J. C., Midgley, C., Meyer, D. K., Gheen, M., Anderman, E. A., Kang, J. & Patrick, H. (2002). The Classroom Environment and Students' Reports of Avoidance Strategies in Mathematics: A Multi-Method Study. *Journal of Educational Psychology*, 94, 88–106. doi:10.1037//0022-0663.94.1.88
- Vasalampi, K., Muotka, J., Pöysä, S., Lerkkanen, M-K., Poikkeus, A-M., & Nurmi, J-E., (2016). Assessment of students' situation-specific classroom engagement by an InSitu Instrument. *Learning and Individual Differences*, 52, 46-52, <https://doi.org/10.1016/j.lindif.2016.10.009>
- Virtanen, T. E., Lerkkanen, M-K., Poikkeus, A-M., Kuorelahti, M. (2013). The relationship between classroom quality and students' engagement in secondary school. *Educational Psychology*, 35, 963-983. doi:10.1080/01443410.2013.822961
- Virtanen, T. E., Pakarinen, E., Lerkkanen, M-K., Poikkeus, A-M., Siekkinen, M., & Nurmi, J-E. (2017). A validation study of Classroom Assessment Scoring System – secondary in the Finnish school context. *Journal of Early Adolescence*, 42, 1–32. doi:10.1177/0272431617699944
- Wang, M-T. & Eccles, J. S. (2013). School context, achievement motivation, and academic engagement: A longitudinal study of school engagement using a multidimensional perspective. *Learning and Instruction*, 28, 12-23. doi:10-1016/j.learninstruc.2013.04.002
- Wang, M-T, Willett, J. B. & Eccles, J. S. (2011). The assessment of school engagement: Examining dimensionality and measurement invariance by gender and race/ethnicity. *Journal of School Psychology*, 49, 465–480. doi:10.1016/j.jsp.2011.04.001

TEACHER-STUDENT INTERACTION AND SITUATIONAL ENGAGEMENT

Table 1

Dimensions of Classroom Assessment Scoring System – Secondary (CLASS-S) measure (Allen et al, 2013; Pianta et al., 2012)

Domain	Dimension	Description and examples of indicators
Emotional	Positive Climate	The warmth, respect and emotional connection in relationships among teachers and students.
Support	Teacher Sensitivity	Responsiveness to the students' academic, emotional, and developmental cues and needs.
	Regard for Students	Teacher's ability to meet students' developmental and social needs, e.g., by providing
	Perspectives	opportunities for student autonomy and leadership.
Organizational Support	Behavior Management	Teacher's ability to use effective methods with encouraging desirable behavior and prevent/redirect misbehavior.
	Productivity	Teacher's ways of managing time and routines in a way that instructional time is maximized.
	Negative Climate	Overall level of negativity within teacher-student interaction.
Instructional Support	Instructional Learning	Supporting students' engagement in learning through active facilitation, varying and interesting
	Formats	materials, and overall clarity.
	Content Understanding	Ways of supporting students to comprehend framework, key ideas, and procedures connected to content.
	Analysis and Inquiry	Students' possibilities to engage in higher-level thinking through analysis and inquiry.

Quality of Feedback	The degree to which feedback expands and extends learning and encourages student participation.
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Instructional Dialogue	Cumulative content-focused discussions among teachers and students that lead to a deeper understanding of the content
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Student engagement	Students' participation in the learning activities.
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TEACHER-STUDENT INTERACTION AND SITUATIONAL ENGAGEMENT

Table 2

Descriptive statistics and correlation matrix for students' experiences of their situational engagement and for observed teacher-student interaction in class-level

	LANGUAGE ARTS				MATHEMATICS				SUBJECTS COMBINED				CORRELATION				
	n	M	SD	median	n	M	SD	median	n	M	SD	median	1.	2.	3.	4.	5.
InSitu																	
1. Behavioral/cognitive engagement	949	3.14	.76	3.14	698	3.15	.76	3.14	1647	3.14	.76	3.14	1				
2. Emotional engagement	949	3.06	.91	3.00	698	2.97	.94	3.00	1647	3.02	.92	3.00	.609**	1			
3. Competence experiences	949	3.69	.89	3.50	698	3.53	.98	3.50	1647	3.62	.93	3.50	.579**	.538**	1		
4. Disaffection	949	2.28	.83	2.33	698	2.31	.81	2.33	1647	2.29	.82	2.33	-.179**	-.274**	-.127**	1	
5. Help-seeking	945	1.84	.85	1.50	695	1.89	.89	1.89	1640	1.86	.86	1.50	.022	.057*	-.184**	.404	1
CLASS-S domains																	
1. Emotional Support	91	4.38	.91	4.44	67	4.22	.89	4.33	158	4.31	.90	4.37	1				
2. Classroom organization	91	5.81	.77	5.80	67	6.03	.90	6.22	158	5.90	.83	6.03	.609**	1			
3. Instructional Support	91	3.72	.73	3.72	67	4.22	.76	4.21	158	3.94	.78	3.93	.615**	.523**	1		

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

InSitu used to measure students' situational engagement on a student-level.

CLASS-S used to measure teacher-student interaction on class-level. Unit of observation was one cycle. Values for different cycles from each lesson combined as lesson-specific average.

TEACHER-STUDENT INTERACTION AND SITUATIONAL ENGAGEMENT

Table 3

Proportions of variance for Students' Situational Engagement (measured with InSitu)

	Behavioral/ cognitive engagement	Emotional engagement	Competence experiences	Disaffection	Help-seeking
within _{students}	.396	.410	.534	.535	.509
between _{students}	.486	.420	.371	.366	.354
between _{teachers}	.118	.170	.095	.099	.137

Note. Values are significant according to the Bayesian Credibility Interval (95%).

Table 4

Proportions of variance for Observed Teacher-Student Interactions in Emotional Support, Classroom Organization, and Instructional Support (Measured with CLASS-S)

	Emotional support	Classroom organization	Instructional support
between _{teachers}	.767	.807	.678
within _{teacher}	.233	.193	.322

Note. Values are significant according to the Bayesian Credibility

Interval (95%).

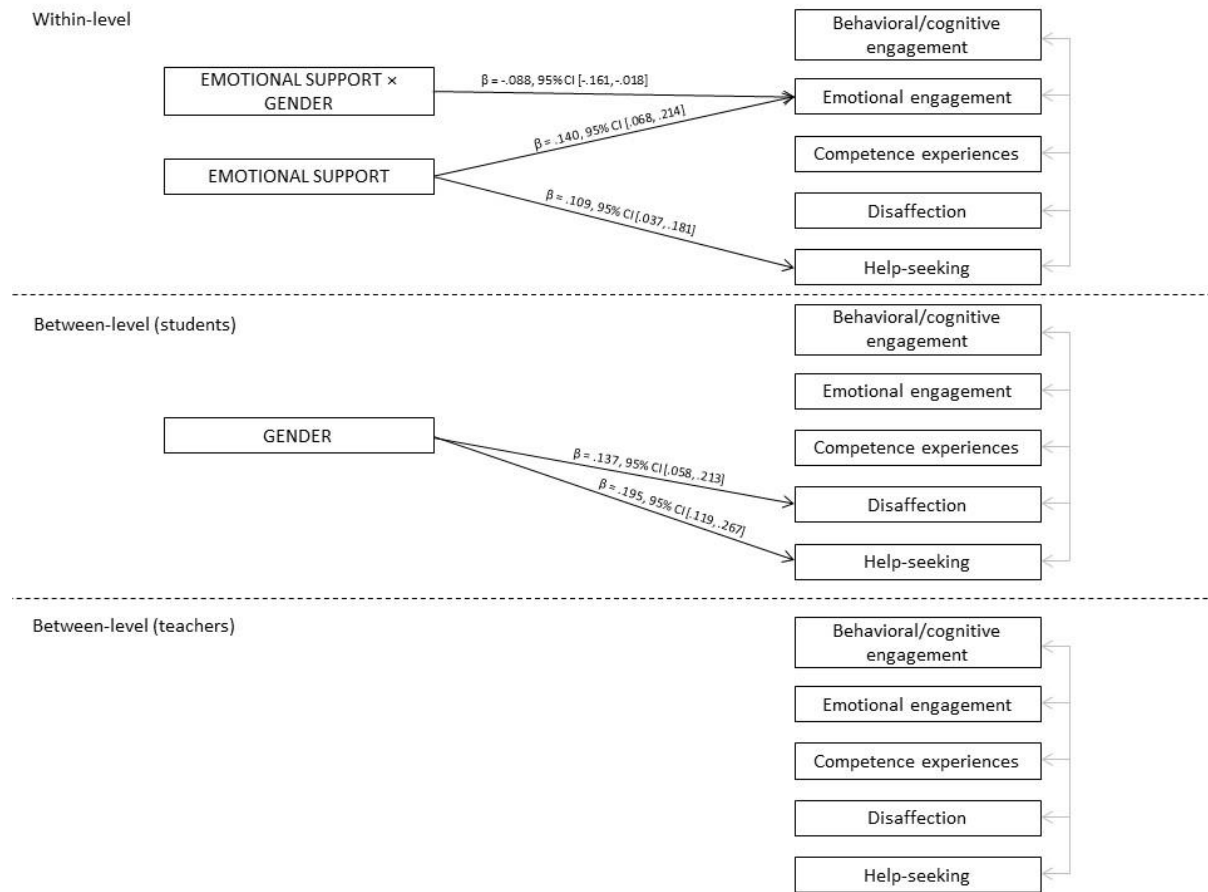


Figure 1. Cross-classified hierarchical model for emotional support.

Estimates are standardized. Positive values from gender to factors of situation-specific engagement in the between level (students) mean that boys have reported higher values than girls, and negative values mean that boys have reported lower values than girls.

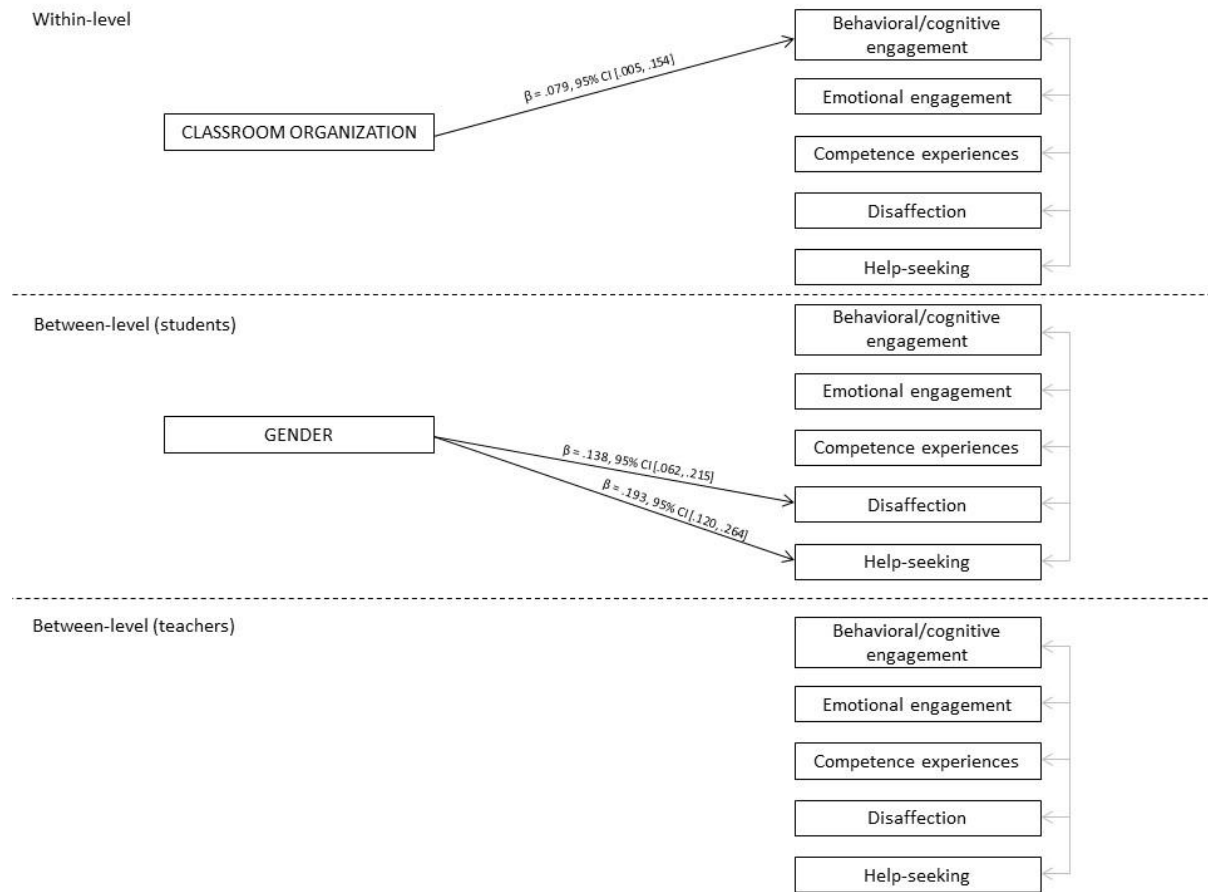


Figure 2. Cross-classified hierarchical model for classroom organization.

Estimates are standardized. Positive values from gender to factors of situation-specific engagement in the between level (students) mean that boys have reported higher values than girls, and negative values mean that boys have reported lower values than girls.

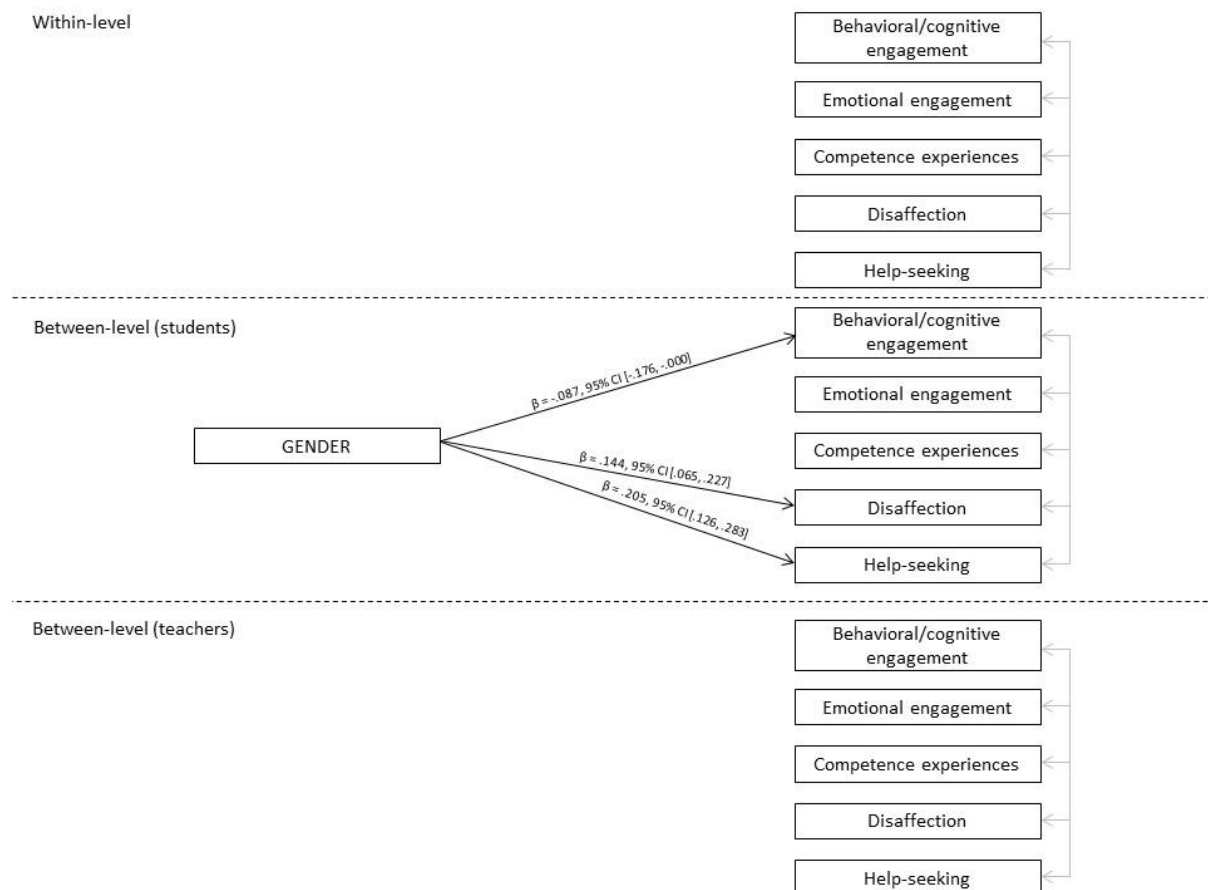


Figure 3. Cross-classified hierarchical model for instructional support.

Estimates are standardized. Positive values from gender to factors of situation-specific engagement in the between level (students) mean that boys have reported higher values than girls, and negative values mean that boys have reported lower values than girls.