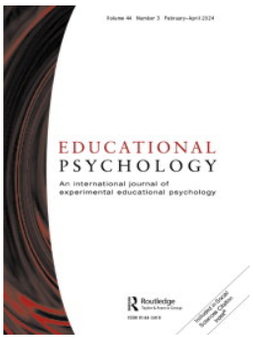

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Student situational engagement and its associations with regard for adolescent perspectives, productivity, and instructional learning formats in the classroom

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ABSTRACT

Teacher–student interactions are considered to influence student engagement. As such, building on the teaching through interaction framework, this study presents an investigation of specific features of teacher–student interactions (regard for adolescent perspectives, productivity, and instructional learning formats) and their association with student engagement in a particular lesson. The sample consisted of 404 8th–10th grade students from 18 classrooms. The data comprised 87 videorecorded lessons, divided into 216 observation cycles, coded using the Classroom Assessment Scoring System – Secondary observational instrument. Additionally, the students' self-reports of their situational engagement were collected using the web-based In Situations (InSitu) instrument at the end of six separate lessons. The data were analysed with cross-classified multilevel structural equation modelling, with engagement ratings cross-classified by students and lessons. In line with the study hypothesis, the results revealed positive associations between situational engagement and the two dimensions of regard for adolescent perspectives and instructional learning formats, yet there were unexpected negative associations with productivity.

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KEYWORDS
Situational engagement; teacher–student interactions; regard for adolescent perspectives; productivity; instructional learning formats

Student engagement is found to vary for the same student from lesson to lesson (Martin et al., 2015; Pettersen et al., 2023; Pöysä et al., 2018; van Braak et al., 2021); thus, research indicates that every lesson or activity is a new opportunity to engage students (Martin et al., 2015) and that the fluctuation of student engagement can be influenced by teacher–student interactions (Fredricks et al., 2004; Pianta, Hamre, & Allen, 2012; Reyes et al., 2012; Skinner et al., 2009). Teacher–student interactions have been organised into three main domains: emotional support, classroom organisation, and instructional support (Pianta, Hamre, & Allen, 2012). Pöysä et al. (2019) found a positive significant association between teachers' emotional support and students' emotional engagement in a particular lesson and between classroom

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organisation and situational behavioural and cognitive engagement in lower secondary schools. To expand on this work, this study is focused on specific dimensions of teacher–student interactions within each domain, as they represent different aspects of teaching: regard for adolescent perspectives, productivity and instructional learning formats, considering one dimension within each of the three domains. The domains are organised into dimensions, which are further defined in terms of indicators (see Table 1) and behavioural markers (Pianta, Hamre, & Mintz, 2012). The goal of the study is to investigate the associations of these dimensions with situational behavioural and cognitive engagement and situational emotional engagement. Those specific dimensions of teacher–student interactions are of particular interest as regard for adolescent perspectives is especially salient in a developmental context for adolescent growth (Ryan & Deci, 2000), is associated with overall or general student engagement (Hafen et al., 2012; Ruzek et al., 2016), and is relevant in daily instructional practice (i.e. situational aspects) (Patall et al., 2018). Productivity contain aspects that promote a well-regulated classroom environment, which is expected to positively affect self-regulated learning (Hamre et al., 2013) and hence student engagement (Wolters & Taylor, 2012). Instructional learning formats contain strategies linked to several effective teaching behaviours that are found to influence both academic engaged time and positive student outcomes (Gettinger & Walter, 2012; Muijs & Reynolds, 2017), e.g. focusing on explicit learning objectives, facilitating active student responses, presenting information with a high degree of clarity and enthusiasm and pacing class effectively. No previous study has investigated specific features of the framework of teaching through interaction (TTI) in association with the situational aspect of engagement; hence, in addition to theoretical knowledge, the current study has the potential to provide knowledge for classroom practice to affect student engagement during a particular lesson in lower secondary school classrooms.

Table 1. Descriptions of regard for adolescent perspectives, productivity, and instructional learning formats in the Classroom Assessment Scoring System – Secondary.

Dimension	Description	Indicators	Domain
Regard for adolescent perspectives	The degree to which teachers meet and capitalise on adolescents' social and developmental needs and goals for decision-making, autonomy, relevance, having their opinions valued and meaningful interactions with peers	Flexibility and adolescent focus Connections to current life Support for autonomy and leadership Meaningful peer interactions	Emotional support
Productivity	How well the teacher manages time and routines so that instructional time is maximised. This dimension captures the degree instructional time is effectively managed and down time is minimised for students	Maximising learning time Routines Transitions Preparation	Classroom organisation
Instructional learning formats	Focuses on the ways in which the teacher maximises student engagement in learning through clear presentation of material, active facilitation, and provision of interesting and engaging lessons and materials.	Learning targets/ organisation Variety of modalities, strategies, and materials Active facilitation Effective engagement	Instructional support

Notes. Pianta, Hamre, and Mintz (2012) and Allen et al. (2013).

Student engagement

Student engagement is commonly viewed as a multifaceted construct consisting of three distinct yet interrelated components: *behaviour*, *emotion*, and *cognition* (Fredricks et al., 2004; Wang et al., 2011). *Behavioural engagement* concerns student participation and involvement in academic and social activities in the classroom and at school (e.g. attending class, completing schoolwork, showing effort, and concentrating on learning) (Wang et al., 2011). *Emotional engagement* reflects students' affective responses to teachers, classmates, academics, and school, such as feelings of happiness, interest, or anxiety. (Fredricks et al., 2004; Wang et al., 2011). *Cognitive engagement* draws on students' self-regulated and strategic approaches to learning and the inclination to put in effort to understand complex ideas and to manage difficult skills; it also refers to student use of metacognitive strategies to plan, monitor and evaluate their learning (Fredricks et al., 2004; Reschly & Christenson, 2012; Wang et al., 2011). These three engagement components are dynamically interwoven, implying that, for example, positive emotional engagement at school interacts with and influences behavioural and cognitive involvement in school learning (Wang et al., 2011). This tripartite conceptualisation is the most prevalent definition of engagement. Other conceptualisations are used in the literature, such as agentic engagement (Reeve, 2012) and social engagement (Fredricks et al., 2019). In the current study, the concept of behavioural, cognitive, and emotional engagement is of interest for comparison with other relevant studies, such as Pöysä et al. (2019).

Engagement and motivation are overlapping constructs, and many scholars describe the relationship between them as engagement being the outward manifestation of motivation. In ,this view, motivation is the internal factor that provides energy to engagement, while engagement is reflecting more observable external factors (e.g. Martin et al., 2022; Skinner et al., 2009). In our work, we share this view.

Student engagement is commonly viewed as an outcome that is malleable and influenced by contextual factors such as teacher–student interactions (Fredricks et al., 2004; Pianta, Hamre, & Allen, 2012; Skinner et al., 2008). However, most research looks at general or overall engagement measured at one timepoint (i.e. ratings of overall engagement across typical school situations), implying that engagement is a property of a student rather than something that can change rapidly from lesson to lesson (Pöysä et al., 2019; van Braak et al., 2021). Pöysä et al. (2020) documented a concordance between overall and situational engagement, meaning that the two levels of engagement are transactionally related to each other (see also Lawson & Lawson, 2013). Examining the variation in engagement from lesson to lesson, a consistent finding of intraindividual variations in students' situational engagement has been documented, both internationally and in Nordic countries (Martin et al., 2015; Pettersen et al, 2023; Pöysä et al., 2018; van Braak et al., 2021; Vasalampi et al., 2016). In the present study, students' situational engagement draws on the students' individual experience of behavioural and cognitive engagement and emotional engagement during a particular lesson.

Student engagement and teacher–student interactions

Teacher–student interactions are one critical factor assumed to affect student engagement (e.g. Opdenakker & Minnaert, 2011; Virtanen et al, 2015). Classroom processes

and interactions between teachers and students have been approached and explained in different theoretical frameworks over many years (e.g. Fauth et al., 2014; Wubbels & Brekelmans, 2005). The TTIs framework is a theoretically and empirically supported framework that organises classroom interactions into three domains: emotional support, classroom organisation, and instructional support (Hafen et al., 2015; Pianta, Hamre, & Allen, 2012). This framework recognises that students develop through dynamic interactions between the capacities and skills of the student and the resources in the environment that are available in different settings; this is in line with the assumption that engagement can vary from one lesson to another, depending on contextual factors. Supporting this acknowledgement, Pöysä et al. (2019) found a positive association between teacher–student interactions in a lesson at the domain level in the TTI and the students' situational engagement in the same lesson. In the present study, we move beyond that finding by uniquely focusing on dimensions in TTI and examining the extent to which regard for adolescent perspectives, productivity, and instructional learning formats explain students' situational engagement during a particular lesson. When investigating dimensions, our goal was to select one dimension within each domain, which represents distinct parts of teaching. Previous CLASS research indicates substantial associations between student engagement and the dimensions of regard for adolescent perspectives, productivity, and instructional learning formats (Gregory et al., 2014; McKellar et al., 2020) which makes it relevant to study them more thoroughly in association with situational engagement. By doing this, we can evaluate if these dimensions of teaching practices promote specific types of student engagement in a lesson. In the review below, we provide a more detailed description of each dimension.

Regard for adolescent perspectives

In classrooms with high quality on the dimension *regard for adolescent perspectives*, the teacher frequently asks for the students' thoughts and ideas, consistently follows and shows flexibility in reaction to student responses, connects the content to adolescent lives, supports autonomy and gives chances for leadership. Additionally, the teacher initiates and actively encourages students to work together (Pianta, Hamre, & Allen, 2012; Pianta, Hamre, & Mintz, 2012). The self-determination theory of motivational development is an important theoretical and empirical foundation for the dimension of regard for adolescent perspectives. Teachers who support student autonomy generate greater intrinsic motivation, curiosity and desire for challenge in students (see Ryan & Deci, 2000). Furthermore, the need for autonomy is especially important for adolescents due to developmental changes (Eccles et al., 1993; Hafen et al., 2015). Adolescents feel autonomous when given opportunities to express their point of views, and meaningful choices during schoolwork. In addition, the teacher should provide a structure which is not experienced as overly controlling (Hofkens & Pianta, 2022). A considerable amount of literature has documented the positive relationship between student engagement and teacher support for their autonomy (Hafen et al., 2012; Ruzek et al., 2016; Skinner et al., 2008) and interventions focused on supportive practices to enhance autonomy consistently increase student engagement (e.g. Reeve et al., 2019). Relevance, inherently one of the indicators of the dimension of regard

for adolescent perspectives, is consistently shown to influence adolescent engagement (Hofkens & Pianta, 2022). Making the content relevant is done by connecting it to the adolescents' personal lives, and by communicating its usefulness. Previous research has documented a positive relationship between the dimension regard for adolescent perspectives and student achievement (Allen et al., 2013). Furthermore, McKellar et al. (2020) identify regard for adolescent perspective to be the strongest predictor of emotional engagement in early adolescence compared to all the other CLASS-S dimensions. McKellar et al. (2020) also found based on exploratory analysis that regard for adolescent perspectives where likely to predict behavioural engagement in conjunction with productivity and quality of feedback. Despite these promising findings, regard for adolescent perspectives consistently has a low score among classrooms compared to the other dimensions in the emotional support domain, both in Nordic countries and internationally (Pianta, Hamre, & Mintz, 2012; Virtanen et al, 2018; Westergård et al., 2019). Taking these findings into account, the dimension of regard for adolescent perspectives may affect student situational engagement. Thus, we anticipated that the association between regard for adolescent perspectives and both situational behavioural and cognitive engagement and situational emotional engagement would be positive.

Productivity

The dimension *productivity* reflects interactions that contribute to classroom organisation and describes how well teachers maximise student learning time through the effective management of tasks, time, and routines (Pianta, Hamre, & Mintz, 2012). In highly productive classrooms, the students know what to do, and the teacher provides clear instructions for all students. The teacher is well prepared, and little time is lost in transition or other basic management activities (Pianta, Hamre, & Allen, 2012; Pianta, Hamre, & Mintz, 2012). Importantly, productivity is not a code for student engagement or the quality of instruction. A classroom can be highly productive when the students are continually provided with a learning activity (e.g. listening to the teacher), even though the students are not fully engaged (Pianta, Hamre, & Mintz, 2012). Theory regarding self-regulated learning serves partly as grounding for the productivity dimension (Pianta, Hamre, & Mintz, 2012). Most importantly, in this context, the development and expression of regulatory skills are highly dependent upon the classroom environment (see Pianta, Hamre, & Mintz, 2012); this means that classrooms with clear routines for time use, support students in developing these crucial self-regulatory skills (see Hamre et al., 2013). Previous research has clearly demonstrated that both student self-regulatory processes and student engagement promote success in school (e.g. Fredricks et al., 2004; Zimmerman & Schunk, 2001), and due to many similarities between those theoretical concepts (i.e. self-regulated learning and student engagement), they have been proposed to be theoretically and practically linked (Wolters & Taylor, 2012). As such, we would expect student engagement to share the same benefit of a well-regulated classroom environment as of self-regulatory skills. McKellar et al. (2020) found that productivity was the only dimension in the classroom organisation domain that predicted behavioural engagement in early adolescence. Pöysä et al. (2019) found a positive

association between the domain classroom organisation (which comprises productivity and two other dimensions) and students' situational behavioural and cognitive engagement. Taking these findings into account, there may be a positive association between productivity and situational behavioural, cognitive, and emotional engagement.

Instructional learning formats

The dimension *instructional learning formats* reflects the degree to which the teacher maximises student engagement in learning through clear presentation of information, learning objectives, clear summaries, and logically sequence of the material (Gregory et al., 2014). Furthermore, instructional learning formats focus on the skill level of the teacher in regard to actively facilitating student involvement by asking questions and scaffolding (Pianta, Hamre, & Mintz, 2012). In classrooms where the teacher provides interesting materials and a variety of modalities to actively engage students (e.g. hands-on activities, peer collaboration) there is a high focus on instructional learning formats. At middle and high school, Gregory et al. (2014) found that the dimension instructional learning formats had the highest bivariate correlation with adolescents' behavioural engagement measured both at fall (0.70***) and spring (0.72***) compared to four other selected dimensions (positive climate, teacher sensitivity, regard for adolescent perspectives and analysis and inquiry). Many of the strategies in the instructional learning formats dimension share strategies with interactive teaching (i.e. evidence-based teaching behaviours that actively engage students in learning) (Gettinger & Walter, 2012). Interactive teaching strategies have been shown to have a significant impact on academic engaged time and involve (a) focusing on explicit learning objectives, (b) facilitating active student responses, and (c) providing frequent feedback (Gettinger & Walter, 2012). Moreover, the dimension of instructional learning formats has been found to predict student achievement in secondary schools (Allen et al., 2013), influence middle and high school students observed behavioural engagement (Gregory et al., 2014), and include some types of interactions with adolescents that may be more malleable for secondary teachers than, for instance, socioemotional aspects of interactions with students (Gregory et al., 2014). When looking at the situational aspects of engagement, Pöysä et al. (2019) found no association between situational engagement and the overarching domain instructional support, which includes the dimension instructional learning formats. This could imply that instructional learning formats, as a part of instructional support, are more related to overall (trait-like) sentiments and attitudes towards school (Virtanen et al, 2015). However, as instructional learning formats focus explicitly on how teachers maximise student engagement, and taking all these findings into account, there is reason to anticipate that the dimension will have a positive association with situational behavioural, cognitive and emotional engagement.

Earlier studies in Norway show that regard for adolescent perspectives is the dimension with the lowest score in the emotional support domain (Westergård et al., 2019). Furthermore, students report limited student autonomy in Norwegian classrooms (Tvedt et al., 2021). Productivity is, in Norwegian studies, the dimension with the lowest score in the classroom organisation domain (Westergård et al., 2019). As such, it will be

useful to investigate regard for adolescent perspectives and productivity in association with situational engagement, to extend our knowledge of these dimensions and to investigate if the dimensions have yet untapped potential to expand the engagement of students in a particular lesson. The dimension of instructional learning formats is also included in the model, as it is inherently expected to promote student engagement.

The present study

The present study investigates whether specific dimensions of teacher–student interactions (regard for adolescent perspectives, productivity, and instructional learning formats) in a particular lesson are positively associated with students' situational engagement in the same lesson, at Norwegian lower secondary school. The following hypothesis was specified based on the theoretical insights outlined above:

Teacher–student classroom interactions in terms of (1) regard for adolescent perspectives, (2) productivity, and (3) instructional learning formats are positively associated with students' (a) situational behavioural and cognitive engagement and (b) situational emotional engagement (Hypothesis 1a and 1b, Hypothesis 2a and 2b, Hypothesis 3a and 3b).

Materials and methods

Participants and procedure

The present study was a part of a pilot study of the professional development intervention INTERACT (Ertesvåg et al., 2022; Pettersen et al, 2023). The sample consisted of 404 (196 girls) 8th–10th grade students from 18 classrooms in five schools located in the southwestern and eastern parts of Norway. One classroom was excluded due to overlap between two teachers in the same classroom, and one classroom was excluded for reasons not related to the study. The study was considered by the Norwegian Agency for Shared Services in Education and Research. Consent to participate was collected from the students' guardians, and the teachers. The participants were informed that their participation was voluntary, and they could withdraw from the study at any time without consequences. In the present data, 87 lessons were videorecorded during the spring of 2019. Each teacher was videotaped teaching the same subject in the same class, up to six times over 2–4 months. The lessons were observed and rated by the Classroom Assessment Scoring System – Secondary (CLASS-S; Pianta, Hamre, & Mintz, 2012). The students answered a digital survey of the In Situations (InSitu) Instrument (Lerkkanen et al., 2012; Vasalampi et al., 2016) at the end of each videorecorded lesson.

Measures

Situational engagement

Students' self-rated situational engagement for each specific lesson was measured using the InSitu Instrument (Lerkkanen et al., 2012; Vasalampi et al., 2016) at the end of each of the six observed lessons. The InSitu Instrument consists of 17 items rated

on a scale from 1 *(not at all)* to 5 *(very much)*. The survey was digital and completed in approximately three minutes. Items assessed (1) behavioural and cognitive engagement (seven items, e.g. 'How well did you concentrate during the lesson?' and 'How much did you plan your tasks ahead instead of just doing them right away?'); and (2) emotional engagement (three items, e.g. 'How enjoyable was the lesson?'). The InSitu Instrument has been validated in the Norwegian lower secondary school context (Pettersen et al., 2023).

Teacher–student interactions

The teacher–student interactions were measured by coding videorecorded lessons with the CLASS-S protocol (Pianta, Hamre, & Mintz, 2012). The CLASS-S consists of dimensions organised within three main domains based on effective teacher–student interactions in the classroom. The three domains are emotional support (three dimensions: positive climate, teacher sensitivity, and regard for adolescent perspectives), classroom organisation (three dimensions: behaviour management, productivity, and negative climate), and instructional support (five dimensions: instructional learning formats, content understanding, analysis and inquiry, quality of feedback, and instructional dialogue). One additional dimension is student engagement, i.e. the observed engagement level of all students in the classroom. The CLASS-S has been validated for use in the Norwegian context (Westergård et al., 2019).

Each dimension was rated from 1 (minimally characteristic) to 7 (highly characteristic) (Pianta, Hamre, & Mintz, 2012). The score is based on to what degree certain behavioural, emotional, and physical markers are present and makes the specific dimension a characteristic of that classroom. The CLASS-S recommends that each cycle of observation be approximately 15–20 min (Pianta, Hamre, & Mintz, 2012), increasing the number of observation cycles will ensure the reliability of the measurement. In the present data, 87 videorecorded lessons were divided into 216 cycles. Depending on the length of the lesson, it was divided into one to four observation cycles. 1 lesson included one cycle, 46 lessons included two cycles, 37 lessons included three cycles, and 3 lessons included four cycles. The average time for each cycle was 17 min 35 s (S.D. = 2 min 4 s). The ratings across the cycles within each lesson were averaged for each dimension in that classroom. That lesson average score was assigned to every student in the same lesson.

Twenty percent of the segments were double coded to examine the interrater reliability (IRR) of the observation coders. IRR was assessed using a two-way mixed, total agreement ICC (Landers, 2015) and percent within one (PWO) (see Pianta, Hamre, & Mintz, 2012). The resulting ICCs for regard for adolescent perspectives and instructional learning formats were in the fair range, ICC = 0.48 and 0.53, respectively, and for productivity, it was in the good range, ICC = 0.64 (Cicchetti, 1994), indicating that coders had a fair to good degree of agreement. The percentage of double-codes that were exactly matched ranged from 27.2% to 36.3%, and the percentage of double-codes that were within one point of each other ranged from 79.5% to 84.0%. The findings in the present study are similar to those in previous studies, as reported in the CLASS-S manual (Pianta, Hamre, & Mintz, 2012).

Student factors

Overall behavioural and emotional engagement, gender, grade level, and socioeconomic status (SES) were included as control variables. Overall behavioural and emotional engagement were measured twice using Skinner et al. (2008) scale of behavioural engagement (five items, α ($T1$–$T2$) = 0.85–0.90; e.g. 'I try hard to do well in school') and emotional engagement (five items, α ($T1$–$T2$) = 0.88–0.91; e.g. 'When I am in class, I feel good'). The students completed the survey concerning overall engagement at the beginning of the second semester (February/March 2019) and at the end of the second semester (May/June 2019). The items are measured with a four-point Likert scale ranging from 0 = strongly disagree to 3 = agree strongly. The mean score of the two timepoints measuring overall behavioural and emotional engagement was used in the analysis. By controlling for overall engagement, we are investigating the unique effect of contextual factors. Overall engagement is a control variable at the between student level, and not at the within level, because it is a constant (it does not change from lesson to lesson as does situational engagement).

Gender was scored 1 for boys and 2 for girls. Grade level was scored from 8 to 10, and SES was measured by the mean score of two items (inter-item correlation = 0.44): 'I think our family, compared with others in Norway, is…' (1 = Very poorly off, 2 = Poorly off, 3 = Average, 4 = Quite good, and 5 = Very good), and 'I think my family lives…' (1 = Very badly, 2 = Quite badly, 3 = Average, 4 = Quite good, and 5 = Very good) (Veland et al., 2009).

Statistical analysis

The cross-classified multilevel structural equation model (MSEM) was fitted to the data using the Mplus statistical package version 8.10 (Muthén & Muthén, 1998–2017). The individual student responses (level 1) are nested within a cross-classification of students (level 2a) and lessons (level 2b), as illustrated in Figure 1. The factor loadings were fixed to be equal across levels, and the factor loadings at the first indicators were fixed to 1. The structural model was modelled at the within student and between students level. The control variables were modelled at the between student level. The posterior predictive p value (PPP) was used to assess model fit. Here, a value close to .5 indicates good fit, and a value close to 0 or 1 indicates poor fit. One additional analysis was run to consider the sensitivity of results to different model techniques. Here, we tested whether the maximum likelihood two-level model without taking the cross-classified structure into account would reproduce the same results as the model with the cross-classified structure specified, using Bayes estimation.

Handling of correlated CLASS dimensions

Correlation coefficients showed substantial associations between instructional learning formats and productivity (Table 2). Including both instructional learning formats and productivity in the same model raised multicollinearity concerns. However, analysing them separately meant that the model results for each dimension also contained information about the portion of variance shared across dimensions. As such, a two-part approach was used: first, we analysed each dimension alone (keeping all

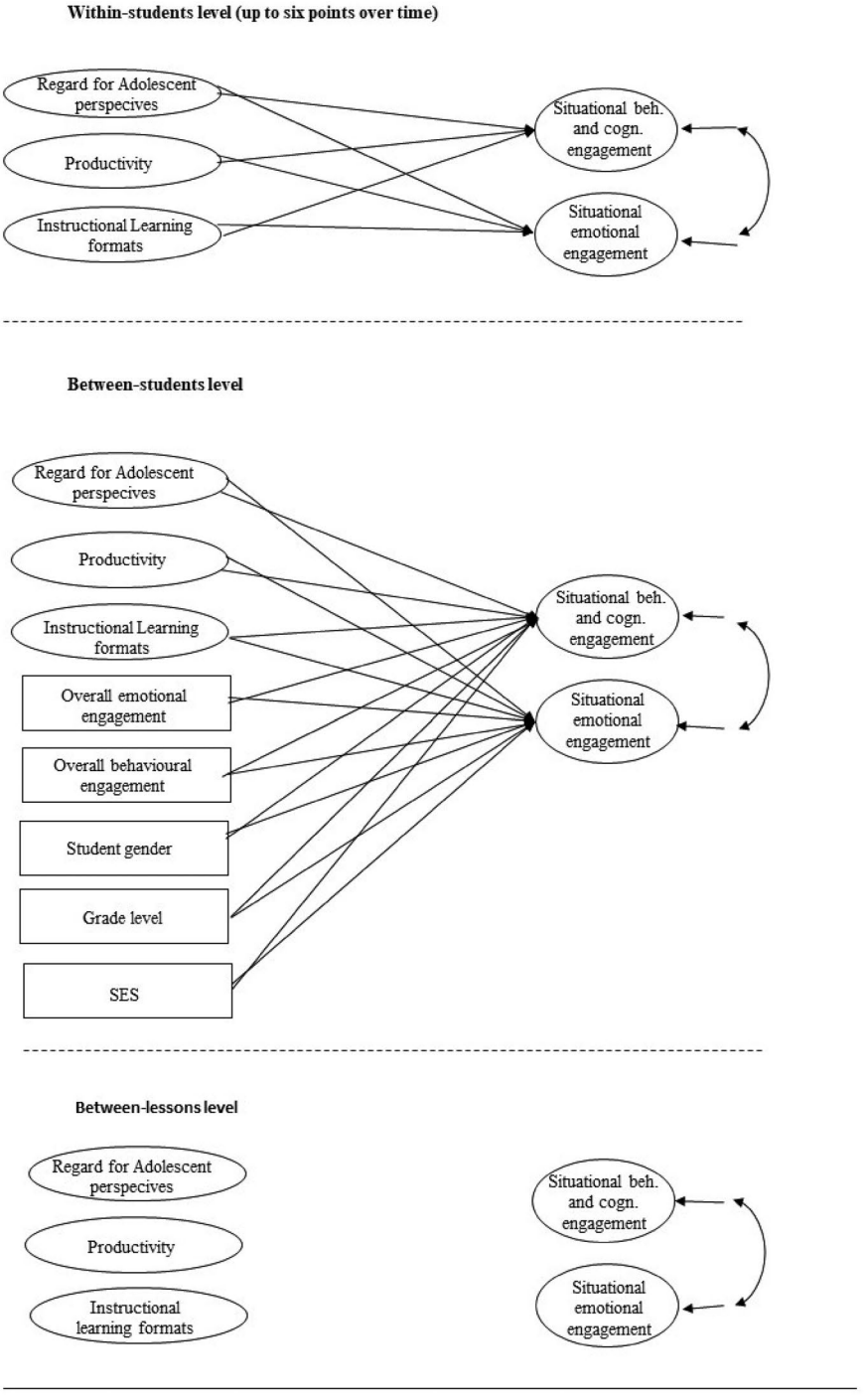

Figure 1. Theoretical cross-classified multilevel model investigating the relationship between classroom quality dimensions and student situational engagement. *Note*. Cross-classified multilevel model. Ovals are latent variables. ILF, P, and RAP are latent variables at the two highest levels due to latent variable decomposition. Small arrows represent residual variances and two-headed arrows represent correlations. Factor indicators of the latent dependent variables are not shown for the sake of clarity. RAP: regard for adolescent perspectives; P: productivity; ILF: instructional learning formats; situational beh. and cogn. engagement: situational behavioural and cognitive engagement.

the covariates the same); second, we computed one model with all three dimensions in the same model. Then, we compared the models. The results for adolescent perspectives and instructional learning formats were comparable regardless of the analytic approach. However, productivity was negatively associated with situational emotional engagement in the model with all dimensions entered simultaneously. The negative association was not present in the model with the productivity dimension alone, as the association became positive and significant, if small (<0.10). Even though the negative association contradicts our hypothesis, there may be some part of the productivity dimension that is not shared with the other dimensions that are negatively associated with situational engagement. As a result, we decided to report results that included all dimensions simultaneously in one model.

Results

Descriptive statistics

Table 2 displays the descriptive statistics and correlation matrix for the variables of interest.

The correlation coefficients in bold indicate that the posterior distribution of the 95% credible interval does not contain zero. Estimates are standardised.

Table 3 shows the variance components and intraclass correlation coefficients (ICCs) for situational behavioural and cognitive engagement, and situational emotional engagement.

Measurement model

The cross-classified two-factor measurement model, with measurement occasions nested within students and students are cross-classified by lessons and timepoints, $p < .001$, and did not provide a good model fit. However, the two-level two-factor measurement model without cross-classification, level 1 being within-students and

Table 2. Mean (*M*), standard deviation (S.D.) and correlation matrix at the between lesson/between student/within student level for the study variables.

Variable	*n*	*M* (S.D.)	2	3	4	5
1. Regard for adolescent perspectives[a]	216	3.19 (0.53)	.08/**.66**/**.08**	.45/**.75**/**.20**	.25/**−.19**/**.08**	−.01/−.13/**.17**
2. Productivity[b]	216	5.53 (0.55)		−.16/**.95**/**.60**	−.32/**−.19**/**.09**	.22/**−.12**/−.03
3. Instructional learning formats[c]	216	4.98 (0.52)			−.38/**−.20**/**.08**	−.25/−.09/**.11**
4. Situational behavioural/ cognitive engagement[d]	1461	3.43 (0.82)				−.43/**.81**/**.73**
5. Situational emotional engagement[e]	1463	3.65 (0.96)				

Notes. The dimensions concerning teacher–student interactions[a,b,c] were measured at the class level using CLASS-S. The rating format for the CLASS-S dimensions was 1–7, with a high score indicating a positive assessment; *n* for CLASS-dimensions is equal to the number of observed sequences. Situational engagement[d,e] was measured at the student level using the InSitu Instrument. The response format for situational engagement was scaled from 1 to 5, with a high score as positive; *n* for the InSitu variables is equal to the number of total InSitu ratings. The correlation coefficients in bold indicate that the posterior distribution of the 95% credible interval does not contain zero. Estimates are standardized.

Table 3. Variance components and intraclass correlation coefficients (ICCs) for situational behavioural and cognitive engagement, and situational emotional engagement.

	Variance			ICC	
	Within	Student	Lesson	Student	Lesson
Situational behavioural and cognitive engagement	0.258[a]	0.230[a]	0.030[a]	0.441[a]	0.058[a]
Situational emotional engagement	0.454[a]	0.388[a]	0.135[a]	0.385[a]	0.141[a]

[a]The posterior distribution of the 95% credible interval does not contain zero. The variance components and ICCs originate from the baseline of the cross-classified model.

level 2 being between-students, provided an acceptable fit to the data (Hu & Bentler, 1999); χ^2 (76) = 480.330, $p < .001$; CFI = 0.92; TLI = 0.90; RMSEA = 0.059, SRMR = 0.049 for the within level and SRMR = 0.103 for the between level. The sensitivity analysis presented in the end of the results, revealed robust results across the two modelling techniques, as such, despite the low model fit, we chose to use the cross-classified measurement model in further analysis.

The association between regard for adolescent perspectives, productivity, instructional learning formats, and students' situational engagement

To examine all the hypotheses, a cross-classified MSEM was estimated (Figure 1). The model did not have a good fit as PPP = 0.000.

The result of the model (Table 4) posits that hypotheses 1a and 1b were supported, as the higher the levels of observed regard for adolescent perspectives were in classrooms, the more students were situationally behaviourally and cognitively engaged (1a) ($\beta = 0.08$, $p < .05$) and situationally emotionally engaged (1b) ($\beta = 0.154$, $p < .001$). Hypotheses 2a and 2b were not supported, as the association between productivity and situational behavioural and cognitive engagement (2a) was not significant, and the more observed productivity there was in classrooms, the less the students reported situational emotional engagement (2b) ($\beta = -0.14$, $p < .01$). Hypothesis 3a was not supported, as instructional learning formats had no significant association with situational behavioural and cognitive engagement (3a), yet the result indicated that the higher levels of instructional learning formats were, the more students were situationally emotionally engaged (3b) ($\beta = 0.17$, $p < .001$).

Sensitivity analysis

We tested whether the model fit and associations between the predictors (RAP, P, and ILF) and the outcome variables (situational emotional engagement and situational behavioural and cognitive engagement) were comparable without taking the cross-classified data structure into account. The results from a two-level analysis, with student as the cluster and MLR estimator, showed almost identical values and significance for the regression coefficients at the within level, and identical significance for associations between the predictors (RAP, P, and ILF) and the outcome (situational engagement variables) at the between level. Thus, the results relevant to the research questions of the study are robust across the two modelling techniques.

Table 4. Associations of observed classroom interactions and students' perceptions of situational engagement.

	Situational behavioural and cognitive engagement			Situational emotional engagement		
	B	S.D.	95% CI	*β*	S.D.	95% CI
Between student level						
Overall behavioural engagement	0.27	0.09	[.099, .438][a]	0.06	0.09	[−.113, .226]
Overall emotional engagement	0.29	0.09	[.114, .453][a]	0.39	0.09	[.218, .560][a]
Gender	0.12	0.05	[.007, .221][a]	0.09	0.06	[−.016, .201]
Grade level	−0.03	0.06	[−.153, .094]	−0.03	0.06	[−.150, .098]
SES	0.04	0.06	[−.067, .156]	0.06	0.06	[−.055, .167]
Regard for adolescent perspectives	−0.07	0.08	[−.233, .090]	−0.07	0.08	[−.230, .093]
Productivity	−0.03	0.12	[−.275, .203]	−0.16	0.12	[−.369, .077]
Instructional learning formats	−0.09	0.13	[−.328, .172]	0.14	0.12	[−.116, .367]
Within student level						
Regard for adolescent perspectives	0.08	0.04	[.012, .148][a]	0.15	0.03	[.083, .218][a]
Productivity	0.07	0.04	[−.015, .150]	−0.14	0.04	[−.211, −.057][a]
Instructional learning formats	0.03	0.04	[−.052, .118]	0.17	0.04	[.086, .248][a]

S.D.: posterior S.D.
Note. Estimates are standardised.
[a]The posterior distribution of the 95% credible interval does not contain zero.

Discussion

Association between regard for adolescent perspectives and situational engagement

Hypotheses 1a and 1b are supported by the results. There is a positive association between regard for adolescent perspectives and both situational behavioural and cognitive engagement and situational emotional engagement. This expands on the theoretical knowledge linking student engagement to an emotionally supportive environment, by revealing how this specific dimension contributes. This is in line with self-determination theory (Ryan & Deci, 2000), suggesting that teachers should foster a classroom environment supportive of autonomy to enhance student engagement. The finding supports the assumption that autonomy could be particularly important for adolescents (Eccles et al., 1993), as regard for adolescent perspectives was the only dimension of teacher–student interactions in the present sample positively associated with situational behavioural and cognitive engagement. This finding is also in line with studies reporting positive relationships between regard for adolescent perspectives and overall or general student engagement (Hafen et al., 2012; Ruzek et al., 2016), as well as studies pointing to its relevance in daily practice (i.e. situational aspects) (Patall et al., 2018). This finding indicates that an environment providing support for leadership, provision of choices, relevance of the material, and appreciation of student ideas and opinions is important for all aspects of lower secondary school students' engagement in a particular lesson.

Associations between productivity and situational engagement

Contrary to our expectations, hypotheses 2a and 2b are not supported by the results. The findings revealed a nonsignificant association between situational behavioural and cognitive engagement and productivity and a negative association between situational emotional engagement and productivity. This could reflect the prior observation that in a highly productive classroom, student engagement, and the quality of instruction and activities could still be low (Pianta, Hamre, & Mintz, 2012). Notably, this negative association was not found when each CLASS-S dimension was included in separate models. When productivity was added to a separate model, the association with situational behavioural and cognitive engagement became positive and significant, yet small (0.07). Nevertheless, there is a possibility that the part of productivity that is not shared with the other dimensions in the study (instructional learning formats and regard for adolescent perspectives) contains some aspects that are negatively associated with situational emotional engagement. A possible explanation could be that the tasks provided are not interesting enough to engage students in the lesson. This finding cannot justify a conclusion that productivity is not important for students' situational engagement but could indicate that to obtain behaviourally, cognitively, and emotionally engaged students in a particular lesson; the instruction and activities should also have a high quality with a focus on, for example, regard for adolescent perspectives (autonomy, choices, useful content, etc.), and on instructional learning formats (presenting the learning goals, using a variety of modalities, strategies and materials, and active facilitation, etc.) (see also Inkinen et al., 2019). The results need to be interpreted with care until replications are made and more details are revealed. This finding may underline the assumption that student situational engagement is affected by teacher–student interactions, and it is not neutral which interactions are in play; every activity is a new opportunity to engage students (Martin et al., 2015). Even though we would expect productive classrooms to support student engagement due to the theoretical similarities to self-regulated learning, there may be differences between those concepts (i.e. self-regulated learning and student engagement) that contribute to the results (Wolters & Taylor, 2012). Even though a highly productive classroom helps students manage their own learning (i.e. self-regulated learning), it does not necessarily provide high levels of positive emotions towards the studied tasks and lesson (i.e. student situational emotional engagement), as documented in the present study.

Associations between instructional learning formats and situational engagement

Hypothesis 3b is supported by the results, documenting that the higher the quality of interactions in instructional learning formats in the classroom, the more students were situationally emotionally engaged during the same lesson. This is an interesting finding, as the strategies in this dimension are linked to several effective teaching behaviours that are found to influence both academic engagement time and positive student outcomes (Gettinger & Walter, 2012; Muijs & Reynolds, 2017). This finding implies that the strategies promoted by the dimension of instructional learning formats are effective in increasing students' positive affections towards academics and

studied tasks in a specific lesson. The findings are in line with previous research indicating that the dimension of instructional learning formats is connected to overall student engagement, as well as student achievement (Gregory et al., 2014). This is also an interesting finding, as although the dimension of instructional learning formats is a part of the overarching domain instructional support, Pöysä et al. (2019) did not find any association between the domain instructional support and situational engagement. This finding indicates that it is useful to look at the dimension level of teacher–student interactions in the TTI framework to obtain a more nuanced picture than what is available at the domain level. The regression coefficients may indicate a pattern in which situational emotional engagement is more attuned to the context and more affected by teacher–student interactions than the behavioural aspects of situational engagement. This suggestion is also in line with Pöysä et al. (2020).

Practical implications

Some implications for practice can be suggested. First, the results indicate that educators can foster an environment that supports student engagement in a particular lesson. Thus, every lesson can be a new starting point to facilitate an environment in which students (1) participate and involve themselves in the tasks at hand; (2) attain positive affections towards significant others, academics, and school, and (3) use cognitive strategies and mental effort in their learning processes. Consequently, teachers should be provided with support/PD to identify engagement-increasing opportunities through classroom interactions, and to implement such practice. Learning opportunities that grow engagement could imply encouraging student expression, providing meaningful choices and responsibility, appreciating student ideas and opinions, using varied approaches and forming clear learning targets.

The unexpected negative association between productivity and situational emotional engagement demands careful interpretation. It might suggest that students are sensitive to which learning opportunities are in play, so that even though learning opportunities are available in a lesson, the students' situational engagement is affected by the quality of the activities and materials.

Limitations and methodological considerations

One strength of the present study is that the analysis accounts for the nested nature of the data, with lesson-level data nested within student-level data. Furthermore, it is a strength that the study includes up to six timepoints of collected observations. The present study also has some limitations. The study has a rather small sample of classrooms. A larger timeframe may provide information about variation across the school year. Furthermore, the lessons are of different lengths in the study, and future research may investigate whether this affects the quality of teacher instruction and its relationship with situational engagement.

Regard for adolescent perspectives, productivity, and instructional learning formats do not explain any between student differences in situational engagement. Within-student variation in student engagement from one lesson to another is likely

to be explained by regard for adolescent perspectives, productivity, and instructional learning formats, because they were observed in the same lessons as students' engagement. The InSitu measures at the between-student level are averaged across lessons. As such, it is more relevant that within student variation rather than between student variation in engagement is related to instructional quality. Additionally, the between level was not the main question of the current study, which focuses on association between quality of instruction and the individual students' engagement in a lesson.

The findings could also be a result of the observational measure at classroom level which assesses the average instructional quality for all students in each classroom and does not capture the students' individual experience of instructional quality (Ruzek et al., 2022). Previous research indicates substantial variability in teacher–student interactions as perceived by students in the same class (Ertesvåg & Havik, 2021). Moreover, students' perceptions of their classroom environment are anticipated to be one of the strongest predictors of their own engagement and learning (Ruzek et al., 2022). Nevertheless, previous research has shown associations between observed and student-reported engagement (Virtanen et al, 2015).

The results of the present study indicate that teacher–student interactions affect the situational (lesson-specific) engagement and support the importance of contextual factors to improve the engagement of students. This is in line with intervention efforts that aim to improve student engagement (Fredricks et al., 2019).

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