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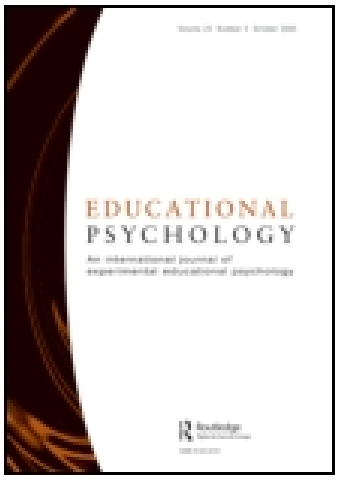

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Teachers' estimates of their students' motivation and engagement: being in synch with students

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Teachers' estimates of their students' motivation and engagement: being in synch with students

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Being aware of, monitoring and responding constructively to students' signals of motivation and to students' signals of engagement represent two important teaching skills. We hypothesised, however, that teachers would better estimate their students' engagement than they would estimate their students' motivation. To test this hypothesis, Korean high-school teachers rated three aspects of motivation and four aspects of engagement for each student in their class, while students completed questionnaires to provide referent self-reports of these same aspects of their motivation and engagement. Multi-level analyses showed that, after statistically controlling for the potentially confounding information of student achievement, teachers' engagement estimates corresponded significantly to their students' self-reports while their motivation estimate did not. These findings validate teachers' skill in inferring their students' classroom engagement and lead to the recommendation that teachers monitor classroom engagement to be in synch with their students during instruction.

Keywords: motivation; engagement; teachers

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Being aware of, monitoring and responding constructively to students' motivation signals during instruction is an important teaching skill. This is so because classroom motivation is a reliable predictor of students' subsequent engagement, learning and achievement (Ames, 1992; Bandura, 1997; Dweck & Leggett, 1988; Pintrich & De Groot, 1990; Ryan & Deci, 2000). The instructional problem with monitoring students' motivation, however, is that it is difficult to do, largely because motivation is a private, subjective and difficult-to-directly-observe experience. Estimating students' motivation is made even more difficult for teachers because classrooms are densely populated, multi-task environments (Middleton, 1995). This is not to say that estimating student motivation is beyond teachers' capacities, as one study showed that teachers of late elementary-grade students were able to judge students' self-reported 'learning goals' (i.e. mastery goals) reasonably well (average $r = .26$ across multiple assessments; Givvin, Stipek, Salmon, & MacGyvers, 2001). Overall, however, little empirical research exists to confirm that teachers can reliably infer their students' classroom motivation.

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Being aware of, monitoring and responding constructively to students' engagement signals during instruction is also an important teaching skill. This is so because classroom engagement, like classroom motivation, is a reliable forerunner of students' learning and achievement (Ladd & Dinella, 2009; Skinner, Kindermann, & Furrer, 2009). Fortunately, monitoring students' engagement is a less difficult instructional task, largely because engagement is not only highly salient to teachers (Stenlund, 1995) but also because it is a relatively public, objective and easy-to-observe classroom event (Fredricks, Blumenfeld, & Paris, 2004; Skinner, Kindermann, Connell, & Wellborn, 2009). That is, teachers can readily observe the extent to which a student is paying attention, putting forth effort or persisting in vs. giving up on a learning activity. A few studies have confirmed that teachers are able to judge their students' self-reported engagement reliably, as shown by late elementary-grade teachers' reasonable judgements of their students' behavioural engagement (average $r = .36$ across multiple indicators) and emotional engagement (average $r = .30$ across multiple indicators) (Skinner, Kindermann, & Furrer, 2009). Other studies qualify this general conclusion, however, by noting that elementary-grade teachers better judge their students' behavioural engagement than they do their students' emotional engagement (Furrer & Skinner, 2003; Skinner & Belmont, 1993).

A recurring finding throughout this literature in which teachers estimate their students' motivation and engagement is that teachers tend to express a high degree of confidence in the ratings they make (Bangert-Drowns & Pyke, 2002; Reeve & Arndt, 1998). Because teachers' ratings actually range from poor to modest, this confidence needs to be explained. A likely explanation is that teachers are aware of their students' classroom performances and class-specific abilities (Bangert-Drowns & Pyke, 2002; Givvin et al., 2001), and they use this performance- and ability-based information to inform their inferences of motivation and engagement. If so, then the covariance with student performance information inflates teachers' confidence that their inferences correspond highly to students' classroom motivation and engagement, as student performance is typically positively correlated with students' self-reported motivation and engagement. Any motivation and engagement that is associated with high versus low achievement is of course important. That said, the question we pursued in the present research was not whether teachers use a students' successful vs. unsuccessful performance (i.e. a high vs. low grade in the class) to infer high vs. low levels of motivation and engagement but, rather, whether teachers could judge their students' motivation and engagement from sources other than – or, more precisely, in addition to – students' past performance information. That is, we wanted to hold students' level of classroom performance constant (statistically speaking) and then assess the extent to which teachers can distinguish motivated from unmotivated students and engaged from unengaged students. This is an important consideration because past performance often reflects students' relatively stable or historical personal characteristics, such as their abilities, intelligence, socio-economic status and prior experience. A focus on students' motivation and engagement, however, represents an instructional shift toward more malleable processes that are notably more sensitive to a teachers' day-to-day instructional strategies (Finn & Voelkl, 1993).

Range of student motivation and student engagement

In the school setting, motivation is the process whereby students initiate and persist in classroom activity (Schunk, Pintrich, & Meece, 2008). The motivational

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processes that energise and sustain students' classroom activity are multidimensional and include students' needs, expectations or beliefs and goals. Recognising this, we conceptualised student motivation broadly in the present study by focusing on and assessing the following three aspects: psychological need satisfaction, self-efficacy and mastery goals. We focused on these three aspects of student motivation in particular because they are well-defined, highly studied, conceptually distinct, and highly constructive student classroom experiences that collectively represent the range of educationally important motivational constructs (i.e. needs, expectations and goals, respectively; Covington, 2000; Schunk et al., 2008).

As for psychological need satisfaction, self-determination theory proposes that students function positively in the classroom in terms of their learning, development and psychological well-being to the extent that their classroom experiences nurture and satisfy their needs for autonomy, competence and relatedness to such an extent that they self-report high, rather than low, class-specific levels of perceived autonomy, competence and relatedness (Deci & Ryan, 1985; Ryan & Deci, 2000). As for self-efficacy, social-cognitive theory proposes that students function positively in the classroom to the extent that they have high and resilient expectations in their capacity to cope with and master academic challenges to such an extent that they self-report high, rather than low, class-specific levels of perceived efficacy (Bandura, 1997; Multon, Brown, & Lent, 1991; Schunk, 1991). As for mastery goals, achievement goal theorists propose that students function positively in the classroom to the extent that they participate in learning activities with the goals to learn new things or to develop and improve their competencies to such an extent that they self-report high, rather than low, class-specific mastery goals (Ames & Archer, 1988; Elliott & Dweck, 1988).

In the school setting, engagement refers to the extent of a students' active involvement in classroom learning activities (Skinner, Kindermann, & Furrer, 2009). There is no single correct definition for engagement, though most – and perhaps all – engagement theorists conceptualise it as a multidimensional construct (Christenson, Reschly, & Wylie, 2012). Recognising this, we conceptualised student engagement broadly in the present study by focusing on and assessing the following four aspects: behavioural, emotional, cognitive and agentic (Fredricks et al., 2004; Jimerson, Campos, & Grief, 2003; Reeve & Tseng, 2011). We focused on these four aspects of engagement because they are well-defined, highly studied, conceptually distinct and highly constructive student classroom experiences that collectively represent the range of educationally important engagement constructs (Christenson et al., 2012; Fredricks et al., 2004; Ladd & Dinella, 2009; Reeve & Tseng, 2011; Skinner, Kindermann, & Furrer, 2009).

Behavioural engagement represents the extent of students' on-task attention, effort exertion and persistence while initiating and sustaining learning activity (Furrer & Skinner, 2003; Skinner & Belmont, 1993; Skinner, Kindermann, & Furrer, 2009). Emotional engagement represents the extent of students' positively valenced emotional states, such as interest, enjoyment and enthusiasm, while initiating and sustaining the learning activity (Skinner & Belmont, 1993; Skinner, Kindermann, & Furrer, 2009). Cognitive engagement represents the extent to which students metacognitively plan, elaborate on, and revise their academic work and use sophisticated (rather than simple or disorganised) learning strategies while doing so (Greene & Miller, 1996; Meece, Blumenfeld, & Hoyle, 1988). Agentic engagement represents the extent to which students contribute constructively and proactively

into the flow of instruction they receive to create a more supportive learning environment for themselves (Reeve & Tseng, 2011).

Relation of student motivation to student engagement

A key assumption of the present study is that student motivation represents a subjective, privately experienced condition that energises and directs students' action, while student engagement represents the objective, publically observable manifestation of students' underlying motivational status. That is, student motivation is the private cause, whereas student engagement is the public effect. This antecedent–consequence relation is a commonly held theoretical assertion among motivation and engagement researchers (see Skinner, Kindermann, & Connell et al., 2009, p. 224–226). Further, empirical investigations of the motivation–engagement relation have confirmed the antecedent–consequence relation between each specific motivational state featured in the present study – including psychological need satisfaction (Reeve & Tseng, 2011), self-efficacy (Bandura, 2006) and mastery goals (Ames & Archer, 1988) – with students' behavioural, emotional, cognitive and agentic engagements.

Hypotheses

Our research strategy was to collect concurrently teachers' ratings and students' self-reports of students' class-specific motivation and engagement along with students' objective course-specific achievement information (i.e. course grade). Having these measures, our plan was to ask the question as to whether teachers, after considering a students' past performance information, can further judge how motivated and how engaged that student typically is during instruction. Our first hypothesis predicted that teachers' estimates of all aspects of their students' engagement (behavioural, emotional, cognitive and agentic) would correspond reasonably well to (i.e. correlate significantly with) their students' self-reported engagements, even after controlling for students' achievement information. The hypothesis was an undifferentiated one, as we expected teachers to be able to estimate all aspects of their students' engagement. That said, we also recognise that some aspects of engagement tend to be somewhat more publically observable (e.g. behavioural and agentic engagement) than are other aspects of engagement (e.g. cognitive and emotional engagement) and also that, in past research, teachers have sometimes judged behavioural engagement more successfully than they have judged emotional engagement. Still, Hypothesis 1 was a general or undifferentiated one – teachers would successfully estimate all four aspects of their students' engagement.

Our second hypothesis predicted that teachers' estimates of all aspects of their students' motivation (psychological need satisfaction, self-efficacy and mastery goals) would correspond poorly to (i.e. not correlate significantly with) their students' self-reported motivations, at least after controlling for students' achievement information. This hypothesis was also a general and undifferentiated one, as we expected teachers to be unable to estimate any of the three privately experienced aspects of their students' motivation. Hypothesis 2 was not a null prediction because we expected students' achievement information to significantly account for and fully explain any significant bivariate association between teachers' ratings and students' self-reports of the three aspects of student motivation.

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Method

Participants

Participants included both teachers and their students. For the students, we recruited 340 students (230 females, 110 males) from 11 classes situated in six different high schools located in urban and suburban Seoul, Korea. Sixty-five students were 10th graders; 210 students were 11th graders; and 65 students were 12th graders. All students were ethnic Korean. For the teachers, we recruited eight teachers (six females and two males) who taught an average class size of 30.9 students (SD = 4.13) per class. The teachers taught different subject matters, including Korean, English, Japanese, social studies and math. All teachers were ethnic Korean.

Procedure

In the ninth week of a 16-week semester, high-school students were asked to complete a series of questions assessing the three types of motivation and the four types of engagement. During that same week, teachers were asked to complete a questionnaire that featured a one-item rating for each type of motivation and for each type of engagement for each student in their class. For this work, we provided each teacher with a gratuity of the equivalent of $40. We selected the ninth week of the semester to collect these data because we wanted to provide teachers with sufficient time and opportunity to gain familiarity with their students while simultaneously selecting a time period that best represented the developing relationship between teacher and students, as week nine represented the median week in the semester. Both students and teachers completed the questionnaires on a voluntary basis, and the study was approved by the university human research participants committee.

Measures (see Table 1)

We collected three types of data – students' course-specific achievement, students' self-reported motivation and engagement and teachers' ratings of their students' motivation and engagement. For students' achievement data, we collected each individual students' mid-term achievement score from objective school records for the particular class in which he or she completed the questionnaire. These student achievement scores were reported on a scale from 0–100, were standardised within each class, and represented the students' grade for their work during the first eight weeks of the course (i.e. mid-term course grade). For the data on students' motivation and engagement, we assessed both students' self-reports and teachers' ratings for each student in the class using the parallel structure shown in Table 1. Table 1 lists the seven assessed constructs (three aspects of motivation and four aspects of engagement) and provides each construct's conceptual definition, item for the teachers' ratings and items for the students' self-reports.

Students' self-reported motivation and engagement

Student participants completed three measures of motivation and four measures of engagement, as well as demographic information. For each measure, we used the same 1–7 bipolar response scale that ranged from 'strongly disagree' to 'strongly agree'. We calculated a total score for each scale by averaging participants' scores on each individual item into an overall score. To assess each construct, we used a

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Table 1. Conceptual definitions for all seven aspects of student motivation and engagement with their corresponding items for the teacher ratings and student questionnaires.

Variable	Conceptual definition	Item for teacher rating	Items for student questionnaire
Psychological Need satisfaction	Experiences of autonomy, competence and relatedness that generate the desire to interact with the environment to advance personal growth, social development and psychological well-being	Psychological need satisfaction: this student shows high perceived competence, high perceived relatedness or closeness to others and high-perceived autonomy or a sense of choice, volition and 'wants to'	During the class, I feel: (1) free (2) I am doing what I want to do (3) free to decide for myself what to do (4) pushed and pressured (*R*) (5) capable (6) competent (7) my skills are improving (8) I belong and the people here care about me (9) involved with close friends (10) emotionally close to the people around me
Self-efficacy	Belief in one's capabilities to organise and execute the courses of action required to produce given attainments	Self-efficacy: this student shows high self-confidence in being able to master class-specific challenges, as well as low doubt and low anxiety	(1) I am certain I can master the skills taught in class this year (2) I am certain I can figure out how to do the most difficult class work (3) I can do almost all of the work in this class if I do not give up (4) Even if the work is hard, I can learn it (5) I can do even the hardest work in this class if I try

(*Continued*)

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Table 1. (*Continued*).

Variable	Conceptual definition	Item for teacher rating	Items for student questionnaire
Mastery goals	Goals to develop competence by improving, learning and making progress	Mastery goals: this student shows a challenge-seeking form of self-regulation focused on the goals of developing high competence and mastering tasks	(1) I am striving to understand the content of this course as thoroughly as possible (2) My aim is to completely master the material presented in this class (3) In this class, my goal is to learn as much as possible
Behavioural engagement	Extent of a student's on-task attention, effort, intensity and persistence in the face of difficulties	Behavioural engagement: this student shows high on-task attention and concentration, high effort, high persistence, especially on difficult tasks	(1) I try to work very hard in this class (2) When I am in this class, I listen very carefully (3) I put a lot of effort into this class (4) Even on really difficult problems, I keep working hard (5) When I am in class, my mind often wanders and I think about other things (*R*)
Emotional engagement	Extent of a student's positive emotions during learning activity, such as interest and enjoyment, and absence of negative emotions, such as boredom and sadness	Emotional engagement: this student shows frequent and strong positive emotions (interest, joy and curiosity) and infrequent negative emotions (anger, boredom and discouragement)	(1) When I am in this class, I feel good (2) Class is fun (3) This class is very interesting to me (4) My curiosity is constantly stimulated in this class (5) During this class, I often feel unhappy and discouraged (*R*)

(*Continued*)

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Table 1. (*Continued*).

Variable	Conceptual definition	Item for teacher rating	Items for student questionnaire
Cognitive engagement	Extent of a student's cognitive and metacognitive strategies that involve meaningful (i.e. elaborative) processing attempts to connect or integrate new information with existing knowledge in an effort to form a richer, more coherent mental representation	Cognitive engagement: this student uses sophisticated learning strategies, is a planful and strategic learner, and monitors, checks and evaluates work	(1) Before starting an assignment for this class, I try to figure out the best way to do it (2) In this class, I keep track of how much I understand the work, not just if I am getting the right answers (3) If what I am working on in this class is difficult for me to understand, I figure out how to change the way I learn the material for the better (4) When I study for this course, I often don't know where to start or what to do (*R*) (5) I find it difficult to make sense of what we are learning in this class (*R*)
Agentic engagement	Extent of a student's constructive contribution into the flow of the instruction she or he receives	Agentic engagement: this student offers suggestions, asks questions, expresses interests, preferences, and likes vs. dislikes	(1) During this class, I ask questions (2) I tell my teacher what I like and what I do not like (3) I let my teacher know what I am interested in (4) During this class, I express my preferences and opinions (5) I offer suggestions about how to make class better

(*R*) Reserve-scored item.

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well-established and previously validated measure that was written in English. To translate the measures from their original English into Korean, we followed the guidelines recommended by Brislin (1980). To do so, we first used a professional English-to-Korean translator to translate each measure into Korean. Next, separate English back-translations were carried out by two graduate students who were fluent in both languages and were native Koreans. Finally, any discrepancies that emerged between the translators were discussed until a consensus translation was reached.

The questionnaire included three scales to assess different aspects of student motivation – psychological need satisfaction, self-efficacy and mastery goals. To assess *psychological need satisfaction*, we used the Activity-Feelings States (AFS) (Reeve & Sickenius, 1994). The AFS offers the stem, 'During this class, I feel' and lists four items to assess perceived autonomy, three items to assess perceived competence and three items to assess perceived relatedness (see Table 1). Previous studies using the AFS to assess psychological need satisfaction have shown the scale to produce strong psychometric properties (i.e. high internal consistency, good construct and predictive validity; Jang, Reeve, Ryan, & Kim, 2009; Reeve, Nix, & Hamm, 2003). In the present study, the overall 10-item assessment showed acceptable reliability (*alpha* = .82). To assess *self-efficacy*, we used the academic efficacy scale from the Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000). The academic efficacy scale included five items (see Table 1) and showed an acceptable reliability in the present study (*alpha* = .85). Previous studies using the PALS to assess academic self-efficacy have shown the scale to produce strong psychometric properties (i.e. high internal consistency, good construct and predictive validity; Linnenbrink, 2005; Midgley et al., 2000). To assess *mastery goals*, we used the mastery goals scale from the revised Achievement Goal Questionnaire (AGQ-R) (Elliot & Murayama, 2008). The mastery goals scale included three items (see Table 1) and showed an acceptable reliability (*alpha* = .75). Previous studies using the AGQ-R to assess mastery goals have shown the scale to produce strong psychometric properties (i.e. high internal consistency, good construct and predictive validity; Elliot & Murayama, 2008).

The questionnaire further included scales to assess four aspects of student engagement – behavioural, emotional, cognitive and agentic. To assess *behavioural engagement*, we used the behavioural engagement scale from the Engagement vs. Disaffection with Learning measure and to assess *emotional engagement*, we used the emotional engagement scale from the same Engagement vs. Disaffection with Learning measure (Skinner, Kindermann, & Furrer, 2009). The behavioural engagement scale included five items (see Table 1) and showed acceptable internal consistency (*alpha* = .80); the emotional engagement scale included five items (see Table 1) and also showed acceptable internal consistency (*alpha* = .82). Previous studies using the Engagement vs. Disaffection with Learning measure to assess behavioural and emotional engagement have shown both scales to produce strong psychometric properties (i.e. high internal consistency, good construct and predictive validity (Skinner & Belmont, 1993; Skinner, Kindermann, & Furrer, 2009)). To assess *cognitive engagement*, we combined three items assessing self-regulated (metacognitive) learning (from Wolters, 2004) and two items from the Disorganised scale assessing (a lack of) cognitive strategies (from Elliot, McGregor, & Gable, 1999) so that we could represent cognitive engagement as part metacognitive self-regulated learning (e.g. planning, monitoring and revising) and part strategic learning (e.g. using elaboration-based rather than simple or disorganised strategies). The

scale included five items (see Table 1) and showed minimally acceptable internal consistency (*alpha* = .65). The relatively low alpha coefficient emerged because some students had difficulty with the two reversed-scored disorganised items. We used this particular measure to represent the two-part character of the cognitive engagement construct and because both scales have been shown independently to produce scores that are sensitive to classroom environmental variables known to affect them and to predict important student outcomes such as course grades (Elliot et al., 1999; Wolters, 2004). To assess *agentic engagement*, we used the Agentic Engagement Questionnaire (AEQ) (Reeve & Tseng, 2011). The scale included five items (see Table 1) and showed high internal consistency (*alpha* = .91). Previous studies using the AEQ to assess agentic engagement have shown the scale to produce strong psychometric properties (i.e. high internal consistency, good construct and predictive validity (Reeve
& Tseng, 2011)).

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Teachers' ratings of students' motivation and engagement

In the same week that students completed the questionnaire, teachers completed a seven-item rating sheet to score each individual student in their class on the three aspects of motivation and the four aspects of engagement. Teachers made their ratings using the same 1–7 scale that students used ('strongly disagree' to 'strongly agree'). In Korean education, each student is assigned a student number during that course, and we wrote each students' number into a blank at the top of the page.

For each of the seven ratings, the rating sheet provided the name of the type of motivation or the type of engagement to be rated with an explanatory description of what that type of motivation or engagement was. The item used for each of these seven teacher ratings is shown in the third column of Table 1. To create each teacher item, we relied heavily on the theoretical writings of major theorists associated with each aspect of motivation or engagement (using the theorist's conceptual definitions listed in Table 1), including Ryan and Deci (2000) for psychological need satisfaction, Bandura (1997) for self-efficacy, Elliot and Murayama (2008) for mastery goals, Skinner and her colleagues' (2009) for both behavioural engagement and emotional engagement, Greene, Miller, Crowson, Duke, and Akey (2004) for cognitive engagement and Reeve and Tseng (2011) for agentic engagement. To translate each theorist's conceptual definition into the specific item on the teacher rating scale, we stayed very close to each theorist's specific terminology. For example, to create the teacher item for behavioural engagement, we used the illustrative phrases of 'on-task attention', 'concentration', 'effort' and 'persistence' within its explanatory description because these were the precise terms used by Ellen Skinner and her colleagues in discussing the nature of behavioural engagement (Skinner, Kindermann, & Furrer, 2009, p. 495).

We used only one comprehensive item for the teacher rating (instead of asking teachers to complete the same multi-item scales the students completed) to avoid overburdening the teacher-participants with an unreasonably long instrument. That is, with the single-item ratings, each teacher made about 210 ratings (i.e. seven ratings for each of about 30 students), rather than an overwhelming number of about 1140 ratings (i.e. 38 ratings for each of about 30 students). Because these were newly created one-item assessments, we could not rely on previous studies to document the measure's psychometric properties. In lieu of such evidence, we

worded each item's description in a way that stayed very close to the theorist's own words (to support construct validity).

Data analyses

Among the 340 students enrolled in the classes of the eight participating teachers, 28 (11 females and 17 males) voluntarily elected not to respond to the questionnaire on the day of testing, and, as a result, their teacher rating data were excluded from the analyses. For the 312 students who did volunteer to complete the questionnaire, missing data were infrequent (less than 1%). Accordingly, we used the expectation-maximisation algorithm for imputing missing values (Schafer & Graham, 2002).

Students' data were nested within their teacher. Given the nested structure of the data, we conducted multi-level analyses using hierarchical linear modelling (HLM) (version 6.08) (Raudenbush, Bryk, & Congdon, 2004) to determine whether or not 'between-teacher' effects on teachers' ratings were significant and, if so, to examine the unique relations between teachers' ratings and students' self-reports after partialling out the 'between-teacher' effects. So, the analyses report both the 'level 1' relations between teachers' ratings and students' self-reports that are statistically independent of the teacher-level results and the 'level 2' teacher-level results themselves to address the question of whether some teachers' estimates were more on target than were other teachers' estimates.

Results

Descriptive and correlational statistics of the seven predictor variables (students' self-reports of three aspects of motivation and four aspects of engagement), the seven dependent measures (teachers' ratings of three aspects of student motivation and four aspects of student engagement) and the control variable (i.e. student achievement) appear in Table 2. The numbers in Table 2 confirm that teachers' ratings correlated significantly with students' self-reports (see diagonal of numbers shown in both boldface and underlined in Table 2). These correlations are important because they replicate previous studies that have shown a positive correlation between teachers' estimates and students' self-reports, but these correlations are further important because they confirm the convergent validity of our teacher questionnaire, as each one-item teacher rating correlated significantly and positively with its corresponding student rating ($p < .01$). The numbers in Table 2 also show that (1) students' seven self-reports were positively intercorrelated, (2) teachers' seven ratings were positively intercorrelated and, as expected, (3) student achievement correlated more highly with the teachers' ratings than with the students' self-reports.

HLM analyses showed that the total variance in teachers' ratings attributable to the 'between-teacher' level was meaningful (using Lee's (2000), '$>10\%$ of the variance accounted for' criterion) for the majority of the teacher ratings:[1] 16.1% for psychological need satisfaction; 18.3% for self-efficacy; 11.7% for mastery goals; 6.6% for behavioural engagement; 11.4% for emotional engagement; 13.5% for cognitive engagement; and 10.1% for agentic engagement. What these meaningful levels of 'between-teacher' variance mean is that teachers' ratings of students' motivation and engagement (in terms of mean scores) were influenced by differences among teachers.

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Table 2. Descriptive and correlational statistics of students' self-reports, teachers' ratings and the student achievement control variable.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Students' Self-Reports															
1. Psych. need satisfaction (S)	–														
2. Self-efficacy (S)	.55**	–													
3. Mastery goals (S)	.35**	.48**	–												
4. Behavioural engagement (S)	.58**	.64**	.40**	–											
5. Emotional engagement (S)	.69**	.61**	.39**	.71**	–										
6. Cognitive engagement (S)	.53**	.70**	.31**	.67**	.58**	–									
7. Agentic engagement (S)	.55**	.55**	.28**	.50**	.52**	.48**	–								
Teacher Ratings															
8. Psych. need satisfaction (T)	**.19****	.34**	.25**	.35**	.29**	.35**	.23**	–							
9. Self-efficacy (T)	.18**	**.33****	.21**	.35**	.30**	.37**	.21**	.88**	–						
10. Mastery goals (T)	.12*	.27**	**.28****	.35**	.26**	.27**	.15**	.80**	.76**	–					
11. Behavioural engagement (T)	.18**	.29**	.33**	**.40****	.33**	.33**	.15**	.75**	.74**	.81**	–				
12. Emotional engagement (T)	.18**	.30**	.27**	.34**	**.30****	.32**	.17**	.75**	.72**	.77**	.83**	–			
13. Cognitive engagement (T)	.11*	.27**	.30**	.34**	.24**	**.33****	.13*	.80**	.79**	.85**	.85**	.79**	–		
14. Agentic engagement (T)	.25**	.32**	.22**	.35**	.29**	.37**	**.29****	.80**	.71**	.76**	.70**	.73**	.70**	–	
Statistical Control															
15. Mid-term course grade	.18**	.34**	.30**	.37**	.30**	.34**	.19**	.62**	.60**	.60**	.67**	.54**	.61**	.54**	–
Range	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	0–100
Mean	4.13	4.07	5.53	3.99	3.90	3.83	3.16	4.11	3.98	4.28	4.47	4.49	4.08	4.07	60.7
Standard deviation	.94	1.13	1.04	1.04	1.17	.92	1.35	1.51	1.63	1.65	1.58	1.53	1.59	1.60	24.8
Skewness	.05	−.13	−.85	0	.08	.17	.59	−.15	.01	−.19	−.34	−.35	−.03	.15	−.21
Kurtosis	.70	.33	1.15	.48	.09	1.26	.25	−.63	−.72	−.67	−.76	−.64	−.83	−.79	−.99

Note: *S* means students' self-reports and *T* means teachers' ratings. * $p < .05$, ** $p < .01$. $N = 312$.

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Table 3. Hierarchical linear modeling results for teacher ratings of students' motivation.

	Psychological need satisfaction			Self-efficacy			Mastery goals		
Variable	*B*	SE	*T-ratio*(*df*)	*B*	SE	*T-ratio*(*df*)	*B*	SE	*T-ratio*(*df*)
Fixed effects									
Intercept	4.28**	.24	18.02(7)	4.18**	.27	15.34(7)	4.40**	.23	19.16(7)
Student achievement	.04**	.01	6.50(7)	.04**	.01	5.15(7)	.04**	.01	6.60(7)
Student self-report	.12	.15	.77(7)	.14	.09	1.47(7)	.09	.11	.78(7)
	Variance component	SD	X^2(*df*)	Variance component	SD	X^2(*df*)	Variance component	SD	X^2(*df*)
Random effects									
Intercept	.42**	.65	112.12(7)	.56**	.75	122.13(7)	.38**	.62	68.89(7)
Student achievement slope	.00**	.01	30.93(7)	.00**	.02	41.67(7)	.00**	.01	22.57(7)
Student self-report slope	.15**	.38	26.84(7)	.04	.19	13.83(7)	.07	.26	12.72(7)
Within-teacher effect (*R*)	.98			1.17			1.35		

Note: *$p < .05$. **$p < .01$. *B*: unstandardised coefficient.

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Table 4. Hierarchical linear modelling results for teacher ratings of their students' engagement.

	Behavioural engagement			Emotional engagement			Cognitive engagement			Agentic engagement		
Variable	*B*	SE	*T*-ratio (*df*)	*B*	SE	*T*-ratio (*df*)	*B*	SE	*T*-ratio (*df*)	*B*	SE	*T*-ratio (*df*)
Fixed effects												
Intercept	4.54**	.18	25.25(7)	4.57**	.21	21.74(7)	4.20**	.23	18.19(7)	4.21**	.21	20.13(7)
Student achievement	.04**	.00	12.00(7)	.03**	.00	8.08(7)	.04**	.00	7.59(7)	.03**	.01	6.32(7)
Student self-report	.21 [a]	.09	2.33(7)	.11	.08	1.37(7)	.20*	.08	2.38(7)	.20*	.07	2.82(7)
	Variance component	SD	X^2(*df*)	Variance component	SD	X^2(*df*)	Variance component	SD	X^2(*df*)	Variance component	SD	X^2(*df*)
Random effects												
Intercept	.22**	.47	47.45(7)	.31**	.56	54.48(7)	.39**	.63	80.75(7)	.31**	.56	55.95(7)
Student achievement slope	.00	.01	7.83(7)	.00	.01	8.27(7)	.00*	.01	15.75(7)	.00**	.01	22.35(7)
Student self-report slope	.03	.16	6.89(7)	.02	.14	7.28(7)	.01	.08	5.86(7)	.02	.12	10.24(7)
Within-teacher effect (*R*)	1.18			1.40			1.24			1.43		

Note: [a] $p = .052$. * $p < .05$. ** $p < .01$. *B*: unstandardised coefficient.

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HLM results for the teachers' ratings of the three aspects of students' motivation appear in Table 3, while HLM results for the teachers' ratings of the four aspects of students' engagement appear in Table 4. In both tables, the fixed effects shown in the upper half of the table show the predictive value of the hypothesised student self-report predictor and the student achievement control variable on the teacher rating while the random effects shown in the lower half of the table show between-teacher differences in the relations of the hypothesised student self-report predictor and the student achievement control variable with the teacher rating.

As shown in the fixed effect results from Table 3, teachers' ratings of students' psychological need satisfaction were predicted by student achievement but not by students' self-reported need satisfaction ($B = .12$, *ns*). Teachers' ratings of students' self-efficacy were predicted by student achievement but not by students' self-reported self-efficacy ($B = .14$, *ns*). And, teachers' ratings of students' mastery goals were predicted by student achievement but not by students' self-reported mastery goals ($B = .09$, *ns*). As shown in the random effect results, there were significant individual differences among teachers in their ratings of students' psychological need satisfaction ($\tau = .15$, $p < .01$) but not for teachers' ratings of their students' self-efficacy ($\tau = .04$, *ns*) or mastery goals ($\tau = .07$, *ns*).

As shown in the fixed effect results from Table 4, teachers' ratings of students' behavioural engagement were predicted not only by student achievement but also by students' self-reported behavioural engagement ($B = .21$, $p = .052$). Teachers' ratings of students' emotional engagement were predicted by student achievement but not by students' self-reported emotional engagement ($B = .11$, *ns*). Teachers' ratings of students' cognitive engagement were predicted not only by student achievement but also by students' self-reported cognitive engagement ($B = .20$, $p < .05$). And, teachers' ratings of students' agentic engagement were predicted not only by student achievement but also by students' self-reported agentic engagement ($B = .20$, $p < .05$). As shown in the random effect results, there were no significant individual differences among teachers in their ratings of students' behavioural, emotional, cognitive or agentic engagements ($\tau = .03$, .02, .01, .02, respectively).[2]

Discussion

All seven teacher estimates of their students' motivation and engagement correlated significantly with their students' corresponding self-reports (see Table 2). These correlations both replicate prior work in this area to suggest that teachers ably inferred their students' class-specific motivation and engagement and extend it by showing that high-school teachers who spend only a single hour during the school day with their students ably infer their students' class-specific motivation and engagement in the same way that elementary-school teachers who spend many more school day hours with their students do. The HLM analyses, however, qualified this 'ably infer' conclusion in two important ways. First, in estimating their students' motivation, teachers relied rather heavily on their students' achievement information, and it was this information – rather than students' motivation signals per se – that they based their need satisfaction, self-efficacy and mastery goals estimates. In estimating their students' engagement, teachers again relied rather heavily on their students' achievement information, but they were also aware of unique information from their students' behavioural, cognitive and agentic engage-

ment signals. Second, individual differences among teachers emerged in making one of their student motivation estimates – namely, students' psychological need satisfaction, a finding we address later in the discussion. Individual differences among teachers did not, however, emerge for rating their students' self-efficacy, mastery goals or any of the four aspects of engagement.

A handful of earlier studies had suggested that teachers can reasonably estimate their students' classroom motivation and engagement (Givvin et al., 2001; Skinner, Kindermann, & Furrer, 2009). The ratings teachers made in these studies were, however, inherently confounded by the teachers' knowledge about students' achievement. The unique contribution of the present study was that we controlled for this crucial confound within our teachers' estimates. The added statistical control we employed (for student achievement) allows us to sharpen the conclusion that emerges from this literature – namely, that teachers can reasonably estimate their students' classroom engagement but not their students' classroom motivation. This conclusion is important in its own right, but it also leads to important educational implications.

Before addressing the study's educational implications, we consider the question as to why teachers were better able to rate their students' engagement than they were able to rate their students' motivation. Student engagement is especially salient to teachers. That is, teachers routinely ask students to open their book, complete a worksheet or self-regulate themselves during deskwork, and teachers pay attention to whether students do such things (i.e. show behavioural and cognitive engagement). Similarly, teachers easily notice whether or not students ask questions and express preferences (i.e. show agentic engagement). Such expressions of engagement are not only salient, but they are also publically and readily observable classroom events. In contrast to their explicit engagement requests, teachers do not so routinely ask their students to experience autonomy (need satisfaction), cope confidently (self-efficacy) or improve for its own sake (mastery goals). But even on those occasions when teachers do make these particular classroom requests, it is still not clear what publically observable signals students might express for their teachers to confirm whether or not they experienced such motivational states – other than expressions of engagement.

Educational implications

Our findings have important implications for teachers. Teachers in every classroom face the instructional challenge to motivate and engage their students in the learning activities they provide. They look for signs of students' motivation and engagement, and they seek to facilitate both. The first practical question addressed by the present research is therefore to ask whether teachers would be better advised to be aware of, monitor and respond constructively to their students' motivation, engagement or both. Our findings suggest that teachers will profit more by being aware of, monitoring and responding constructively to their students' engagement rather than their students' motivation.

We offer this recommendation for two reasons. First, our findings confirm that teachers were rather universally able to pick up on students' behavioural, cognitive and agentic engagement signals, and they were able to do so in such a way that was above and beyond students' achievement information. The one exception was emotional engagement, a finding that generally confirmed earlier research (Furrer

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& Skinner, 2003; Skinner & Belmont, 1993). That teachers can pick up on their students' engagement signals in a reliable way is good news, because student engagement is a valid indicator for how well students are faring in class and how responsive they are to instructional events (Ladd & Dinella, 2009). Second, our findings suggest that when teachers directly monitor their students' engagement, they will also be indirectly monitoring their students' motivation as well. Motivation and engagement were significantly correlated in the present study, and this was true of both students' self-reports (average $r = .52$; r's ranged from .28 to .71) and teachers' estimates (average $r = .77$; r's ranged from .71 to .88) (see Table 2). These correlations show that students' relative public engagement acts as reasonably reliable indicator of their relatively private motivation. This is so because student engagement is always motivationally enriched (Skinner, Kindermann, & Furrer, 2009), as student engagement is necessarily energised and sustained by psychological need satisfaction (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004), self-efficacy (Bandura, 1993) and mastery goals (Ames & Archer, 1988).

We would add that there is potential downside in teachers' estimates of their students' classroom motivation and engagement. In the case of estimating their students' motivation, the potential downside is clear. Because teachers' estimates of their students' motivation reflect variables other than student motivation (i.e. achievement), teachers' confidence that a student is unmotivated may lead to problematic expectancy effects when the problem is actually low achievement, not low motivation. In the case of estimating their students' engagement, the potential downside is less obvious. Once we confirm that teachers do indeed estimate their students' engagement reasonably well, this confidence can become a two-edged sword. Estimating a students' engagement can help teachers be more in synch with their students and provide appropriate instruction, but confidence in an estimate that a student is unengaged may lead to similar problematic expectancy effects. To avoid this potential downside of judging low engagement in a student, the instructional emphasis would be best served by asking what teachers can do during instruction to enhance students' otherwise low engagement. Fortunately, the literature connecting teachers' instructional strategies to greater student engagement (e.g. provide learning activities that are interesting and important to students, utilise frequent formative assessments) is a mature and highly constructive one (for a comprehensive review, see Christenson et al., 2012).

That teachers enact engagement-fostering instructional strategies is an obviously important teaching skill. But the teachers' skill in enacting timely and appropriate engagement-fostering instructional strategies during instruction partitions into three parts: (1) being aware of and monitoring students' engagement signals, (2) responding constructively to those engagement signals in terms of instructional strategies that enhance students' behavioural, emotional, cognitive and agentic engagement and (3) possessing the prerequisite teacher-owned motivation and engagement to monitor and respond constructively to students' classroom engagement signals. The present study was designed to address teaching skill in terms of only the first of these three parts. Now that this teaching skill has been confirmed and differentiated from that of being aware of and monitoring students' motivation signals, it can be linked to the aforementioned theoretical and empirical work that has been carried out to offer viable and valid engagement-fostering instructional strategies (part 2) and to teachers' own classroom motivation and engagement in terms of having

greater perceived control over the crucial classroom event that is student engagement (part 3).

Another implication of the study's findings is that they provide teachers with a readily available opportunity to be in synch with their students during instruction. We would characterise a teacher and student as being in synch when the two parties form a dialectical relationship in which the actions of one party influence the other and vice versa (e.g. the teacher asks the student to open a book, the student opens the book and begins to read, the student asks a question, the teacher explains, etc.); and we would characterise a teacher and student as being out of synch when the relationship is unilateral in which the actions of one party influence the other but not vice versa (Reeve, Deci, & Ryan, 2004). Monitoring students' engagement signals is an important teaching skill in its own right, but it also enhances a teachers' capacity to enter into and forge a responsive, dialectical relationship with students during instruction. Our findings show that when students display their signals of motivation and engagement, teachers reliably pick up on the latter but not on the former. Hence, the opportunity for teachers to be in synch with their students during instruction is to monitor and respond to their students' engagement signals.

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Limitations and conclusion

Three shortcomings limit the potential educational implications that can be drawn from the present findings. First, we did not measure all possible aspects of student motivation. It is possible that teachers can better estimate student motivations not reported in the present study (e.g. achievement motivation, values, personal control beliefs, possible selves and optimistic attributional style). Second, while we assessed the student self-reports with multidimensional, previously validated and widely used instruments, we had to create a new instrument that utilised only single-item measures to assess the teacher estimates. Finally, we could not explain the 'between-teacher' effects that emerged in our data. That is, some teachers estimated students' psychological need satisfaction better than did other teachers (see Random Effects results reported in Table 3). To explain this difference among teachers would require collecting teacher characteristic information (e.g. years of teaching experience), and we invite future research to collect these data with the intention of explaining the between-teacher differences in estimating their students' classroom psychological need satisfaction.

Overall, even after taking these three limitations into serious consideration, we conclude that our findings might help teachers in two ways. First, our data confirm that teachers' confidence in being able to reasonably estimate their students' classroom engagement is well founded. Teachers do possess this skill. Second, our data confirm that a reliable way for teachers to be in synch with their students is to monitor their students' classroom engagement signals.

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Notes

1. Potentially, four levels are actually represented in each teacher rating: the individual student level; the classroom level; the teacher level; and the school level. We could not analyse the data at either the classroom or school levels, however, as five of the six schools had only one representative teacher and five of the eight teachers taught only a single class. These low representations ($n = 1$) for the majority of the schools and the number of classrooms per teacher made analyses at the classroom and school levels not possible. For the main interest of this study, we analysed the data only considering the individual student and teacher levels.
2. In addition to the HLM analyses we report in Tables 3 and 4, we conducted further HLM analyses that included student gender and student grade level as additional predictor variables. Adding student demographic variables to the HLM analyses did not affect the magnitude of the coefficients (for student self-report and for student achievement) reported in Tables 3 and 4, except for small variations. Adding the two statistical controls also did not affect any of the significance levels (except that the effect on behavioural engagement was increased from $B = .21$, $p = .052$ to $B = .22$, $p < .05$).

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