



Domain-specific motivation and self-assessment practice as mechanisms linking perceived need-supportive teaching to student achievement

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Abstract

The self-system model of motivational development was used in this study to examine whether and how student motivation and self-assessment practices—as psychological and behavioural mechanisms, respectively—link need-supportive teaching to students' objective achievement scores in English language learning. We applied a multilevel mediation analysis on Rasch-calibrated data from 796 students (53% females; mean age = 14.12, $SD = 1.51$) nested within 30 classes (mean class size = 26.53) in a secondary school in the Philippines. We collected all predictor variables (i.e. need-supportive teaching, motivation, self-assessment practice) in time 1, while achievement scores were collected eight weeks later (time 2). Lower-level mediation results show that students' perceptions of involved teaching and structured teaching are associated with higher controlled motivation and autonomous motivation. Furthermore, only autonomous motivation was associated with higher achievement in time 2. Self-assessment practice significantly mediated the link between both controlled and autonomous motivation to achievement. These results held while controlling for age, gender, and socioeconomic status. Hence, involved teaching and structured teaching correlated with higher motivation and increased self-assessment practice, which, in turn, leads to higher achievement in English language learning. The findings highlight that motivation and self-assessment practices are psychological and behavioural pathways that can theoretically and empirically explain how need-supportive teaching practices impact student achievement in a specific subject. Implications and directions for future research are discussed.

Keywords Need-supportive teaching · Motivation · Self-assessment practices · English achievement · Domain-specific · Lower-level mediation analysis

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Introduction

Teachers' instructional practices that satisfy students' basic psychological needs for relatedness (e.g. sense of connection and belonging), competence (e.g. sense of mastery or efficacy), and autonomy (e.g. sense of choice and volition) are referred to as need-supportive teaching (Leenknecht et al., 2017; Reeve, 2006; Ryan & Deci, 2000, 2017; Vansteenkiste et al., 2012). Need-supportive teaching consists of involved, structured, and autonomy-supportive teaching strategies that foster a wide range of positive student outcomes in school (e.g. motivation, engagement, self-regulated learning; Kiefer et al., 2015; Mouratidis et al., 2011, 2013; Reeve, 2012; Reeve & Jang, 2006; Tas, 2016) as well as student achievement (Baeten et al., 2013; Burns et al., 2021; Kiefer et al., 2015; Olivier et al., 2021). Because of such impact, researchers have studied *how* need-supportive teaching predicts student school outcomes (Aelterman et al., 2014; Baeten et al., 2013; Burns et al., 2021; Ntoumanis et al., 2017; Olivier et al., 2021). However, research into the underlying psychological and behavioural mechanisms that can explain the link between need-supportive teaching and achievement remains sparse, with several research gaps (cf. Connell & Wellborn, 1991; Skinner & Belmont, 1993; Skinner et al., 2008).

A crucial research gap in studies that examine the link between need-supportive teaching and achievement is the overreliance on self-reported student outcomes focused on schooling in general. For instance, studies have examined how need-supportive teaching impact self-reported outcomes like student engagement (Kiefer et al., 2015; Olivier et al., 2021; Tas, 2016), motivation (Haerens et al., 2015; Ntoumanis et al., 2017), or both (see Stroet et al., 2013 for a review); but very few have examined objective student achievement scores at outcomes. Relatedly, despite the varied impact of instructional practices on student outcomes depending on the subject domain (see Chanal & Guay, 2015; Wigfield et al., 2004), few have studied objective achievement in a specific subject domain (e.g. science achievement; Burns et al., 2021; Haw et al., 2021). Another research gap is the focus of current studies on autonomy-supportive teaching (e.g. Baker & Goodboy, 2019; Bureau et al., 2022; Haerens et al., 2015; Occhino et al., 2014; Reeve, 2006, 2016; Wang et al., 2016). Autonomy-supportive teaching satisfies students' basic psychological need for autonomy, involved teaching satisfies relatedness needs, and structured teaching satisfies students' need for competence. Still, little attention is given to the impact of involved teaching and structured teaching practices on student achievement and other outcomes (cf. Mouratidis et al., 2013; Vansteenkiste et al., 2012). Finally, there has been little attention placed on secondary school students from non-WEIRD (i.e. White, educated, industrialised, rich, and democratic) and non-Western contexts, limiting the representativeness, generalisability, and impact of current and international research findings in Educational Psychology.

To address these gaps, the current research will examine how students' perceptions of involved, structured, and autonomy-supportive teaching are linked to English learning achievement through motivation and self-assessment practice. Under the self-system model (see Connell & Wellborn, 1991; Skinner & Belmont, 1993; Skinner et al., 2008), we integrate domain-specific student motivation (Deci & Ryan, 2000; Ryan & Deci, 2000) and self-assessment practices (Yan, 2020; Yan & Brown, 2017), as psychological and behavioural mechanisms, respectively. Moreover, the focus of this study is on a specific subject domain, i.e. English language learning among secondary school students in the Philippines. The domain-specific nature of this study is especially relevant given the recent results of the OECD Programme for International Student

Assessment (PISA) 2018, where the Philippines ranked lowest on reading achievement among the participating countries (OECD, 2019).

Specifically, we hypothesise that need-supportive teaching practices (i.e. involved, structured, and autonomy-supportive teaching) will be positively associated with student motivation. Moreover, we expect student motivation to positively affect English learning achievement directly and indirectly through self-assessment practices as a behavioural mediator. We test these hypotheses using Rasch-calibrated data and lower-level mediation analysis, accounting for students ($n = 796$) having the same teacher and being nested in the same classroom ($n = 30$), thereby accounting for the clustered nature of the data.

Needs-supportive teaching and student achievement

Need-supportive teaching pertains to a set of teaching practices that satisfies students' three basic psychological needs: the need for competence, need for relatedness, and need for autonomy (Deci & Ryan, 2000; Leenknicht et al., 2017; Reeve, 2006; Ryan & Deci, 2000, 2017; Taylor & Ntoumanis, 2007). Structured teaching satisfies students' competence needs. This practice is enacted when teachers give clear steps, actionable goals, and consistent feedback (Connell & Wellborn, 1991; Pelletier & Rocchi, 2016; Skinner & Belmont, 1993). To fulfil students' relatedness needs, teachers can apply involved teaching practices, including joyful and caring classroom interaction (see also Taylor & Ntoumanis, 2007). Lastly, autonomy-supportive teaching, which communicates the openness to provide students with a choice on how to engage with their learning materials and explain the rationale for the learning tasks, can satisfy students' need for autonomy (Belmont et al., 1988; Haerens et al., 2015). According to the SDT (Deci & Ryan, 2000; Ryan & Deci, 2000), these need-supportive teaching practices initiate students' inherent motivation leading to a wide array of positive school outcomes (Connell & Wellborn, 1991; Skinner & Belmont, 1993; Stroet et al., 2013).

Empirical and experimental studies have shown that need-supportive teaching practices create a learning environment that can influence student achievement, among other positive student outcomes (e.g. student achievement, learning, motivation, and engagement; Baeten et al., 2013; Burns et al., 2021; Kiefer et al., 2015; Mouratidis et al., 2011; Olivier et al., 2021; Reeve, 2012; Reeve & Jang, 2006; Tas, 2016). The impact of learning environments that satisfy students' basic psychological needs on positive outcomes and achievement continues to gain significant research attention (see Hospel & Galand, 2016; Lietaert et al., 2015). For instance, a recent study by Burns et al. (2021) used the 2015 PISA data and found a positive link between students' perception of need-supportive teaching to their science participation, self-efficacy, and achievement (see also Haw et al., 2021 for a study linking need-supportive teaching to reading achievement).

However, the mechanisms that link need-supportive teaching to student achievement remain underexamined. Moreover, research exploring mechanisms that can explain how social contexts influence student achievement is frequently segmented since unpacking multiple mechanisms requires integrating multiple theoretical approaches. Few have examined the context-self-achievement link in an integrated theoretical model (cf. Feraco et al., 2022; Olivier et al., 2021).

Embedding motivation and self-assessment practice within the self-system model

The self-system model of motivational development (Skinner & Belmont, 1993; Skinner et al., 2008) highlights the cascading effect of need-supportive contexts on crucial student outcomes like engagement (Olivier et al., 2021; Skinner et al., 2008), motivation (Ahn et al., 2021; Taylor & Ntoumanis, 2007), and academic performance (Burns et al., 2021; Leenknecht et al., 2017). The model posits that social contexts in school (e.g. need-supportive contexts) allow students to experience a sense of autonomy, competence, and relatedness. When students experience such learning contexts, they report higher motivation (Liu et al., 2021; Pintrich, 2003; Ryan & Deci, 2017; Taylor & Ntoumanis, 2007) and practice more frequent self-regulated learning (e.g. Miller & Brickman, 2004; Sierens et al., 2009; Yan, 2020; Zimmerman & Moylan, 2009). Conversely, when students' environment is chaotic, uninvolved, or controlling, motivation can decline (Deci & Ryan, 2000; Ryan & Deci, 2017), and self-regulated learning strategies can also decrease (Soenens et al., 2012).

Student motivation and self-regulated learning are two core constructs facilitated by need-supportive contexts (Ryan & Deci, 2000; see also Vansteenkiste et al., 2012) and are known to impact student learning and achievement (Dignath & Büttner, 2008; Huang, 2012; Toste et al., 2020). Motivation is one's inherent propensity to learn and grow as facilitated by need-supportive contexts (see Niemiec & Ryan, 2009). Motivation has been conceptualised into two forms, each reflecting one's reasons for task engagement: autonomous and controlled motivation (Deci & Ryan, 2000; Howard et al., 2017). Autonomous motivation is defined as "engaging in a behaviour because it is perceived to be consistent with intrinsic goals or outcomes and emanating from the self", whereas controlled motivation is defined as "engaging in behaviours for externally referenced reasons" (Hagger et al., 2014, p. 566; see also Howard et al., 2017; Ryan & Deci, 2000).

Student motivation is associated with students' higher achievement (Lepper et al., 2005; Pintrich, 2003; Taylor et al., 2014) and increased mastery (Turner et al., 2002), among other positive student outcomes. A recent meta-analysis found that motivation is a positive predictor of reading achievement with a moderate effect size among K-12 students (Toste et al., 2020). Empirical evidence suggests that autonomous motivation is linked with increased in-class performance (e.g. reading comprehension; Law, 2011). When students are motivated, they are more engaged in behaviours and practices that would improve their learning outcomes (Reeve, 2012, 2013).

Self-assessment practice is a fundamental behavioural component of self-regulated learning (Yan, 2020). Considered a twenty-first-century learning skill, self-assessment pertains to a learner's ability to "reflect on the quality of their work, judge the degree to which it reflects explicitly stated goals or criteria, and revise accordingly" (Andrade & Valcheva, 2009, p. 13) by seeking and using feedback information from various sources (McMillan & Hearn, 2008; Yan & Brown, 2017). Four critical practices of self-assessment have been theoretically proposed and empirically tested by Yan and Brown (2017): seeking external feedback by monitoring (SEFM), seeking external feedback by inquiry (SEFI), seeking internal feedback (SIF), and self-reflection (SR). These formative practices are behaviours that students can enact before, during, and after learning activities that enable them to seek feedback and reflect on their learning process and outcomes.

Need-supportive teaching practices can influence self-assessment practices (see Mendoza & Yan, 2021a; Miller & Brickman, 2004; Wang et al., 2016; Yan, 2020; Zimmerman & Moylan, 2009). For example, Mouratidis et al. (2013) found evidence to show

that when teachers provide clear expectations in the classroom (i.e. structured teaching), middle school and secondary school students were more likely to practice effective self-regulated learning strategies (e.g. metacognitive self-regulation; effort regulation). Similarly, Sierens et al. (2009) showed that the synergy of structured and autonomy-supportive teaching was also found in self-regulated learning among secondary school students. When self-regulated students practice self-assessment, they tend to have higher achievement scores (McDonald & Boud, 2003; Mega et al., 2014; Yan, 2020; Yan et al., 2020b; Zimmerman & Schunk, 2001).

Given that meta-analytic findings (see Panadero et al., 2017; Sitzmann et al., 2010) and more recent empirical work (Leenknecht et al., 2020; Panadero et al., 2012) support the association between motivation and self-assessment practices, the integration of both under the self-system model have theoretical and empirical backing. In the self-system model, the social context (e.g. need-supportive teaching) will activate psychological mechanisms (e.g. motivation) that will enable behaviours (e.g. self-assessment practices) that will, in turn, yield learning and achievement (see Fig. 1). Therefore, motivation and self-assessment practices are posited as mechanisms that can link need-supportive teaching to student achievement. Specifically, when one’s learning contexts satisfy the basic psychological needs, one becomes motivated and enacts meaningful self-assessment practice, which will, in turn, enhance student achievement.

Secondary school students in the Philippines and English language learning

Secondary school education marks a key transition point for student life inside and outside school. Along with the challenges of adolescent life, students also experience a decline in school motivation during secondary school (Gnambs & Hanfstingl, 2016). Relatedly, achievement in language learning has also been documented to decline from Grade 7 to Grade 9 (Fraine et al., 2007). Hence, secondary school is a crucial period necessitating interventions or initiatives to enhance student motivation and achievement.

Most of the research on need-supportive teaching and how it impacts student achievement have been conducted in Western contexts. Eastern contexts, especially in Southeast Asia, have been featured less in studies that examine the interplay of social, psychological, and behavioural mechanisms that drive student achievement and learning outcomes (cf. King & Mendoza, 2021; Mendoza & King, 2020). The lack of representation of secondary school students from non-Western contexts in this research area limits the generalisability and potential impact of existing research. Pioneering efforts to conduct research

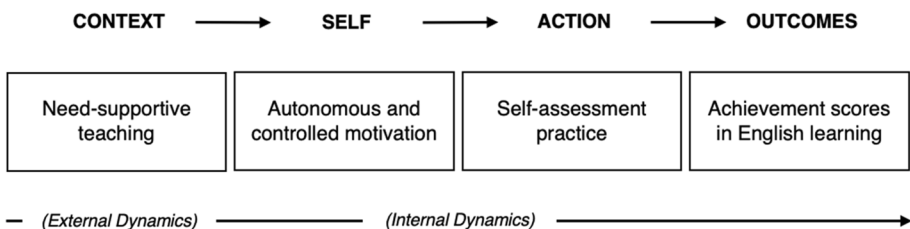


Fig. 1 The self-system model of motivational development (Skinner et al., 2008), including student motivation and self-assessment practices as internal dynamics linking need-supportive teaching and learning outcomes

that includes non-Western counterparts is necessary to extend research generalisability and applicability (see King & Bernardo, 2016).

The Philippines is a Southeast Asian country that can benefit from studies focused on secondary student motivation and achievement. From a practical perspective, the country fared dismally in its first participation in the recent PISA 2018 assessments (OECD, 2019), ranking lowest on reading achievement. Although efforts and initiatives are being made to improve performance in such international assessments, classroom-level and student-level interventions are equally necessary. From a theoretical perspective, Wigfield et al. (2004) detailed the importance of domain-specificity in examining motivation and achievement, given that both can vary across domains. Hence, a domain-specific approach can best explore the pathways and mechanisms that foster student motivation and achievement. Overall, exploring English language learning is practically driven, and the domain-specific approach is theoretically informed.

Study aims and hypotheses

The reviewed literature points to the gaps, opportunities, and practical implications of examining the psychological and behavioural constructs that link students' perception of need-supportive teaching and their achievement in English learning. The current study uses the self-system model of motivational development, which highlights the dynamic interplay between positive social, psychological, and behavioural outcomes, leading to achievement. Specifically, this study aims to explore how student motivation (controlled and autonomous) and self-assessment practices—as psychological and behavioural mechanisms, respectively—link need-supportive teaching (i.e. involved, structured, and autonomy-supportive teaching) to student achievement. We control for age, gender, and socioeconomic status in addressing these aims. The study hypotheses are as follows:

H1. Involved, structured, and autonomy-supportive teaching will have a positive association with autonomous motivation (H1.1), controlled motivation (H1.2), and self-assessment practices (H1.3).

H2. Students' autonomous and controlled motivation will have a positive association with self-assessment practices (H2.1) and will have a positive link to English achievement scores (H2.2).

H3. Students' self-assessment practices will have a direct and positive association with achievement scores (H3.1) and significantly mediate the link between controlled motivation (H3.2) and autonomous motivation (H3.3) to English achievement scores.

Method

Participants and procedures

Participants in the study were 796 secondary school students clustered in 30 classrooms. The average number of students per classroom was 26.53. The data consists of 233, 197, 183, and 183 students from Grades 7, 8, 9, and 10. The students were 11 to 19 years old ($M = 14.12$, $SD = 1.51$) with nearly equal numbers of boys and girls ($n = 424$ girls, 53.27%).

Procedures for this study were approved by the Human Research Ethics Committee of the affiliated university of the first author and second author. The first author approached

a public secondary school located two hours north of Manila through the Department of Education Divisions Office to conduct a research survey. Upon the school principal's approval, informed assent forms were sought from the students, which their guardians and their teachers also reviewed. In addition, the parents/guardians were provided with passive consent forms. Before administering the surveys, the questions were reviewed by the principal and the English teachers at the school to evaluate whether the questions were crafted to the student's level of English language comprehension. The questionnaires were in the English language as English is the medium of instruction in the Philippines (Department of Education, 1974).

Data were collected through a paper-and-pen method at the beginning of the final quarter of the school year (time 1; T1). A trained research assistant administered the questionnaires containing the instruments described below to 30 classrooms. Students were briefed about the questionnaires, and questions were entertained. The English teacher was also present during the data collection. The students took about 10 to 12 min to complete the questionnaire. After eight weeks (time 2; T2), objective achievement scores on English learning were computed and provided by the school. The achievement scores were then paired to the respective students' respondent ID.

Measures

The instruments used were selected considering their theoretical underpinnings and recent utility in relevant studies focused on need-supportive teaching, student motivation, and self-assessment practice. Developed in the last three decades, the instruments assessing need-supportive teaching and motivation remain relevant in current research, given that both constructs are core educational and psychological constructs (e.g. Guay et al., 2015; Leenknecht et al., 2017; Olivier et al., 2021; Reeve, 2013). The instrument used for self-assessment was also selected because it is theoretically driven, anchored in self-regulated learning (Yan & Brown, 2017) and empirically validated among the target sample (Mendoza & Yan, 2021b). We describe the instruments used below and cite their psychometric properties. All instruments are adjusted to refer to English teachers and the English subject for domain specificity.

Teacher as Social Context Questionnaire (TASCQ) The TASCQ (Belmont et al., 1988) measures students' perceptions of their teachers' use of need-supportive practices. The questionnaire consists of 24 items assessing involved, structured, and autonomy-supportive teaching practices. To specify the English teacher as the referent of the instrument, we added: "English teacher" to the scale items. For instance, for involved teaching (e.g. "My English teacher really cares about me"), for structured teaching (e.g. "My English teacher makes sure I understand before he or she goes on"), and for autonomy-supportive teaching (e.g. "My English teacher gives me a lot of choices about how I do my schoolwork"). Items are scored on a 5-point scale, ranging from 1 (*not at all true*) to 5 (*very true*). In the present study, the internal reliabilities of the subscales are all $\alpha=0.73$.

Student motivation We used the 10-item autonomous motivation subscale and the 8-item controlled motivation subscale of the Academic Motivation Scale (AMS; Guay et al., 2015; King & Caleon, 2021; Vallerand et al., 1992). The beginning sentence was adjusted to "I study English because..." to assess students' motivation to study English learning. Students responded using the scale of 1 (*strongly disagree*) to 7 (*strongly agree*), with 4

being neutral. The autonomous motivation subscale consists of items like “Because I really like studying English”. The controlled motivation subscale includes sample items such as “Because I think studying English will help me better prepare for the job that I like”. In this study, the internal reliabilities of the autonomous motivation and controlled motivation subscales are $\alpha=0.87$ and $\alpha=0.82$, respectively.

Self-assessment Practices Scale (SaPS) The SaPS (Yan, 2018) is a 20-item instrument based on the cyclical model of the self-assessment process (Yan & Brown, 2017). The subject-specific version of the scale was used in this study (Mendoza & Yan, 2021b) to measure self-assessment practices in English learning. It is composed of four subscales, all with adequate internal reliability in this study: seeking external feedback by monitoring (SEFM; $\alpha=0.70$), seeking external feedback by inquiry (SEFI; $\alpha=0.74$), seeking internal feedback (SIF; $\alpha=0.66$), and self-reflection (SR; $\alpha=0.79$). The internal reliability of the full SaPS scale in this study is $\alpha=0.89$.

Achievement scores in English learning The K to 12 Basic Education Program (Department of Education, 2013, 2016) uses a standard-based and competency-based grading system where grades are based on the weighted raw score of the learners’ summative assessments. The academic year in the basic education of the Philippines consists of four quarters, each with around two months of duration (Department of Education, 2013, 2016). The 1st quarter starts around June, and the last quarter ends around March of the following year. Achievement scores are computed each quarter. The grades in English language learning for the 4th quarter were used in this study. The average grade of the students is 85.38.

Data analysis

Before the primary analyses, we evaluated item-level missing data. More than half of the participants ($n=466$; 58.54%) have complete responses. Two hundred ninety-one participants (36.56%) had item-level missing data of less than five per cent, and only 39 participants had missing data ranging from 6 to 36%. All item-item level missing data were imputed using multiple imputation by chained equation (MICE; Azur et al., 2011). Consequently, Rasch calibrations and lower-level mediation analysis were implemented.

Rasch rating scale analysis in ConQuest (Wu et al., 2007) was first used to examine the measures’ psychometric properties and calibrate students’ respective measures on each latent construct. Rasch analysis has been used in previous studies to measure latent or unobserved constructs prior to mediation analyses (Boon, 2014; Yan et al., 2020a; Yan & Cheng, 2015). Rasch person-measure calibrations have been widely applied and advocated in education and social science research to achieve fundamental measurement (Bond et al., 2020). The Rasch model overcomes the limitations of conventional analytical techniques (e.g. factor analysis) by converting ordinal data (typically from Likert scales) into interval measures that have a constant interval meaning and, therefore, provide objective measurement than of ordered category responses (Linacre, 2006). After the interval metric is created, person measures and item difficulties are calibrated onto a single unidimensional latent trait scale. The Rasch-calibrated person measures were imported to Mplus 8.0 ver. 1.6 (Muthén & Muthén, 1998–2019) to analyse the lower-level mediation analysis.

Given that the data used in this study were clustered into classrooms or sections, we controlled for the effects of clustering using a lower-level mediation model for the main

analyses (i.e. 1–1–1–1; Bauer et al., 2006). All constructs are measured as level 1 (L1) constructs (i.e. based on individual student responses), and the implementation of multi-level analysis accounts for sampling error (Morin et al., 2014). Specifically, the latent L2 constructs are automatically computed in Mplus' two-level analysis (Muthén & Muthén, 1998–2019; see user guide example 9.2, p. 274–275), where L2 represents the classroom-level decomposition of the observed constructs (see Lüdtke et al., 2008), allowing the mediation model at L1 to take into account student responses in the same class (e.g. Burić, 2019; Lüdtke et al., 2008; Morin et al., 2014).

The teaching practices were included in the model as distinct exogenous predictors of motivation and self-assessment practice. Self-assessment practice consisting of four factors (see Mendoza & Yan, 2021b; Yan, 2018) was posited as a doubly-latent construct (e.g. Burić & Frenzel, 2020; Burić & Kim, 2020; Marsh et al., 2012; Morin et al., 2014) to control for measurement error. Controlled and autonomous motivation were entered as predictors of achievement, and the doubly latent self-assessment practice was included as a mediator between motivation and achievement. All constructs were modelled in a unified structural model. Age, gender, and mother's educational attainment were included as demographic covariates. We used mothers' highest educational attainment to proxy for the student's socioeconomic status (see Johnson et al., 2001; Li & Lerner, 2011).

To evaluate the extent to which students from the same classroom share similar English achievement due to clustering effects, we explored the endogenous outcomes' intraclass correlation coefficient (i.e. ICC₁). ICC₁ pertains to the percentage of the variance at the classroom level where values near or higher than 0.10 would suggest the need for a multi-level analysis (see Lüdtke et al., 2011; Marsh et al., 2012). The ICCs and the bivariate correlations on both levels were computed using R (R Core Team, 2016).

The goodness of model fit was examined using the maximum-likelihood and was evaluated using the following indices: Comparative Fit Index (CFI; Bentler, 1990), Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), root mean square error of approximation (RMSEA; Steiger, 1990), and standardised root mean square residual (SRMR; Bentler, 1995). Following the Hu and Bentler (1995) recommendation, a good model fit would include model CFI and TLI of greater than 0.90 and an RMSEA of less than 0.08. An SRMR value of less than 0.08 is considered a good fit (Hu & Bentler, 1999). As multilevel mediation does not allow for bootstrap in Mplus, we implemented a Bayesian estimator to compute for asymmetric confidence interval to evaluate significant indirect effects.

Results

The initial results of the Rasch analysis identified three misfitting items (item #4 in autonomous motivation; and items #14 and #16 in the controlled motivation). As the subscales had sufficient items with adequate coverage of contents for subsequent analysis, the three misfitting items were removed, and the Rasch analysis was re-conducted. The results (see Table 1) demonstrated good item fit statistics for all remaining items. Most items had mean-squared fit statistics (MNSQs) within the desirable range (i.e. 0.75–1.33; Wilson, 2005), and one item was within the acceptable range (i.e. 0.5–1.5; Linacre, 2006). In addition, the Rasch reliabilities for all subscales were higher than 0.70 (see Table 1), indicating the items in each subscale measured the target constructs well.

The descriptive, summary statistics, bivariate correlations at the student-level and class-level, including the ICC₁ and ICC₂, are in Table 2. The strength and direction

Table 1 Rasch psychometric properties of the measurement

| Construct | No. of items | Rasch reliability | Item fit statistics | |
|---|--------------|-------------------|---|--|
| | | | Range of infit mean-squared fit statistics (MNSQ) | Range of outfit mean-squared fit statistics (MNSQ) |
| Involved teaching | 8 | 0.71 | 0.83–1.06 | 0.82–1.06 |
| Structured teaching | 8 | 0.73 | 0.85–1.03 | 0.86–1.03 |
| Autonomy-supportive teaching | 8 | 0.70 | 0.91–1.41 | 0.91–1.41 |
| Autonomous motivation | 9 | 0.89 | 0.89–1.33 | 0.87–1.18 |
| Controlled motivation | 6 | 0.88 | 1.00–1.25 | 1.03–1.14 |
| Seeking external feedback by monitoring | 5 | 0.83 | 0.81–1.11 | 0.79–1.14 |
| Seeking external feedback by inquiry | 4 | 0.79 | 0.92–1.16 | 0.94–1.14 |
| Seeking internal feedback | 4 | 0.76 | 0.96–1.06 | 0.97–1.10 |
| Self-reflection | 7 | 0.87 | 0.94–1.27 | 0.93–1.23 |

Table 2 Level 1 student-level correlations ($n = 796$) and level 2 class-level correlations ($n = 30$)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1. Involved teaching | – | 0.07 | 0.05 | 0.42* | 0.32 | 0.42* | 0.44* | 0.45* | 0.56** | 0.37* |
| 2. Structured teaching | 0.32** | – | 0.56** | 0.24 | 0.20 | 0.04 | 0.02 | 0.13 | 0.29 | 0.43* |
| 3. Autonomy-supportive teaching | 0.25** | 0.31** | – | 0.15 | 0.04 | 0.25 | 0.19 | 0.19 | 0.45* | 0.57** |
| 4. Autonomous motivation | 0.24** | 0.27** | 0.11** | – | 0.91** | 0.58** | 0.58** | 0.58** | 0.70** | 0.24 |
| 5. Controlled motivation | 0.16** | 0.14** | 0.08 | 0.73** | – | 0.53** | 0.51** | 0.67** | 0.60** | 0.19 |
| 6. SEFM | 0.18** | 0.20** | 0.14** | 0.53** | 0.48** | – | 0.81** | 0.75** | 0.78** | 0.43* |
| 7. SEFI | 0.15** | 0.03 | -0.01 | 0.42** | 0.36** | 0.54** | – | 0.63** | 0.72** | 0.42* |
| 8. SIF | 0.16** | 0.12** | 0.12** | 0.37** | 0.42** | 0.44** | 0.39** | – | 0.68** | 0.44* |
| 9. SR | 0.26** | 0.25** | 0.17** | 0.61** | 0.52** | 0.61** | 0.55** | 0.54** | – | 0.51** |
| 10. English achievement | 0.18** | 0.24** | 0.22** | 0.33** | 0.27** | 0.20** | 0.08 | 0.15** | 0.32** | – |
| ICC ₁ | 0.02 | 0.04 | 0.01 | 0.06 | 0.09 | 0.06 | 0.06 | 0.02 | 0.05 | 0.20 |
| ICC ₂ | 0.30 | 0.51 | 0.13 | 0.64 | 0.72 | 0.61 | 0.64 | 0.35 | 0.56 | 0.87 |
| Cronbach's alpha | 0.73 | 0.73 | 0.73 | 0.87 | 0.82 | 0.70 | 0.74 | 0.66 | 0.79 | – |

Correlations on the lower diagonal are student-level while correlations on the upper diagonal are class-level. ** $p < 0.001$; * $p < 0.05$. SEFM, seeking external feedback by monitoring; SEFI, seeking external feedback by inquiry; SIF, seeking internal feedback; SR, self-reflection

of the correlations are theoretically sound, where nearly all constructs are positively correlated. The unconditional model shows that the ICC₁ and ICC₂ of student achievement scores in English are 0.20 and 0.85, respectively, which indicates that a substantial amount of students' achievement can be accounted for by the classroom as clusters. This supports the use of multilevel analysis to account for the clustered nature of the data (see Lüdtke et al., 2011; Marsh et al., 2012). The multilevel model yielded a good fit to the data ($\chi^2[55]=165.24$, CFI=0.956, TLI=0.916, RMSEA=0.050, SRMR_{within}=0.041), and the results support most of the study hypotheses with notable nuances (see Fig. 2).

On the impact of need-supportive teaching (H1), findings suggest that involved teaching ($\beta=0.18$, $p<0.001$) and structured teaching ($\beta=0.20$, $p<0.001$) were both associated with increased autonomous motivation (H1.1). Similarly, involved ($\beta=0.12$, $p<0.01$) and structured teaching ($\beta=0.09$, $p<0.05$) were also linked with increased controlled motivation (H1.2). Only involved teaching was positively associated with self-assessment practice ($\beta=0.10$, $p<0.01$; H1.3). Autonomy-supportive teaching was not associated with motivation and self-assessment practice.

Examining how motivation relates to self-assessment practice and achievement (H2), results show that both autonomous ($\beta=0.46$, $p<0.001$) and controlled ($\beta=0.25$, $p<0.001$) motivation were positively associated with self-assessment practices (H2.1), but only autonomous motivation was positively associated with achievement in English learning ($\beta=0.18$, $p<0.01$; H2.2).

Self-assessment practice was directly associated with student achievement ($\beta=0.14$, $p<0.05$; H3.1), and it also yielded significant mediating effects between student motivation and achievement. Specifically, higher autonomous motivation is linked with higher self-assessment practice which, in turn, was associated to higher achievement ($B=0.32$, PSD=0.14, [95% C.I.=0.093, 0.563]; H3.2). Self-assessment practices also had a significant positive indirect effect on the link between controlled motivation and achievement; that is, higher controlled motivation is linked with higher self-assessment practice which, in turn, was associated with higher achievement ($B=0.17$, PSD=0.08, [95% C.I.=0.048, 0.308]; H3.3).

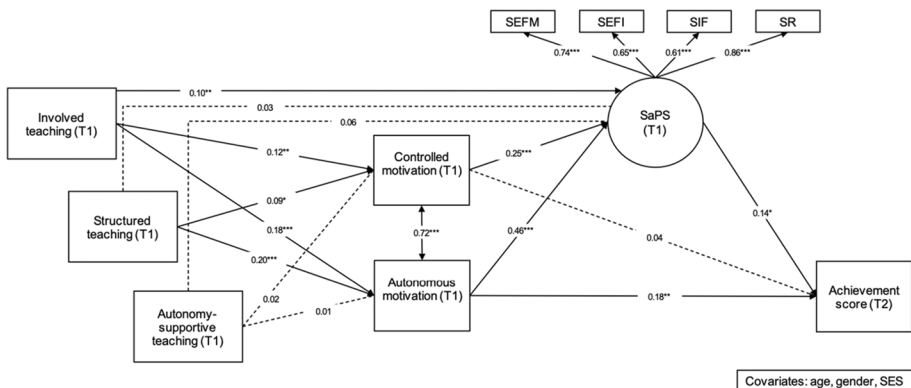


Fig. 2 Lower-level mediation model where need-supportive teaching (i.e. involved, structured, and autonomy-supportive teaching) was entered as predictors of motivation and self-assessment practices. Notes. *** $p<0.001$; ** $p<0.01$; * $p<0.05$; SaPS, self-assessment practices; broken lines are non-significant paths; paths for age, gender, and socioeconomic status as covariates are not illustrated for figure parsimony

Discussion

Prior studies have demonstrated the impact of need-supportive teaching in improving student outcomes. However, limited evidence exists regarding the psychological and behavioural mechanisms that link need-supportive teaching to student achievement. Under the self-system model of motivational development, the current study integrated student motivation and self-assessment practices to examine the pathways linking involved, structured, and autonomy-supportive teaching practices to student achievement, particularly in English language learning.

The findings of the study provide evidence that involved and structured teaching practices were both associated with autonomous and controlled motivation (partially supports H1.1–2), and only involved teaching was linked with self-assessment practices (H1.3). Both autonomous and controlled motivation were associated with higher self-assessment practices (H2.1), but only autonomous motivation directly influenced student achievement (partially supports H2.2). Finally, student self-assessment practice was linked to increased achievement scores (H3.1) and mediated the link between autonomous and controlled motivation to achievement (H3.2). Overall, the findings suggest that increased controlled and autonomous motivation is linked with more frequent self-assessment practice, which, in turn, was associated with higher achievement. These results held while accounting for the nested nature of the data in classrooms and demographic characteristics. This study is among the first studies that attempted to examine the motivation and self-assessment practice as theoretical mechanisms that can link students' perception of need-supportive teaching to objective achievement in English learning.

Involved and structured teaching impacts student motivation and self-assessment practice

The results support the importance of students' perceptions of specific need-supportive teaching practices (i.e. involved teaching and structured teaching) to student motivation and self-assessment practice. Specifically, involved teaching and structured teaching were positively associated with higher student motivation and more frequent self-assessment. Several studies have provided evidence for the importance of learning environments in fostering student motivation (Baeten et al., 2013; Pintrich, 2003; Ryan & Deci, 2017; Skinner et al., 2008; Tas, 2016) and self-regulated learning strategies (e.g. self-assessment practice; Miller & Brickman, 2004; Mouratidis et al., 2013; Sierens et al., 2009; Wang et al., 2016). We discuss below how involved teaching and structured teaching is linked with motivation and self-assessment practice and why autonomy-supportive teaching was not.

Teachers who are involved and warm help toward creating a learning environment that can help satisfy students' relatedness needs (Furrer & Skinner, 2003; Furrer et al., 2014; Niemiec & Ryan, 2009) by expressing their enjoyment of being and interacting with their students (see Connell & Wellborn, 1991; Taylor & Ntoumanis, 2007). Evidence suggests that as teacher enthusiasm for teaching increases, student motivation also tends to increase (Frenzel et al., 2019). Previous studies have also shown that students' perception of involved teaching practices encourages them to practice self-assessment (Mendoza & Yan, 2021a), which can be due to the safe and caring learning climate that involved teaching creates (see Urdan & Schoenfelder, 2006). Given that a sense of psychological safety is essential for students to engage in self-assessment (Yan et al., 2020a) it is anticipated

that involved teaching is linked with higher self-assessment practice. Culturally, for collective cultures like the Philippines (Hofstede, 2001), warmth is a vital aspect valued in social contexts (e.g. classroom, family; Enriquez, 1986; Mendoza & King, 2021). Hence, although previous studies tend to lean heavily on structured teaching and autonomy-supportive teaching as significant predictors of positive student outcomes (e.g. Baker & Goodboy, 2019; Haerens et al., 2015; Sierens et al., 2009; Wang et al., 2016), our study highlights evidence suggesting the relevance of involved teaching in motivation and self-assessment practice.

Structured teaching practices can impact student motivation. It lays out clear and concrete instructions and expectations for students to achieve their target learning outcomes (see Connell & Wellborn, 1991; Reeve & Jang, 2006; Skinner & Belmont, 1993). Studies have shown that well-structured classrooms cater to student motivation by satisfying students' competence needs (Hospel & Galand, 2016; Leenknecht et al., 2017; Niemiec & Ryan, 2009). By offering appropriate step-by-step support in class, students incrementally build their sense of competence and skills (see Niemiec & Ryan, 2009). This sense of efficacy can, in turn, foster motivation. However, structured teaching was not associated with self-assessment practices, standing contrary to other studies that demonstrate how structured learning environments can lead to more frequent self-regulated learning strategies (e.g. Mouratidis et al., 2013). Due to the specific directions that structured teaching communicates, students can have, paradoxically, fewer opportunities with self-assessment practice. Thus, unless self-assessment practice is included in the subject curriculum, it is likely that students may merely follow the structure that teachers provide and would forgo self-assessment practice.

Although previous studies have emphasised the importance of autonomy-supportive teaching on student motivation (Bureau et al., 2022; Haerens et al., 2015; Reeve, 2006, 2016) and self-regulated learning (Schuitema et al., 2012; Wang et al., 2016), in this study, we found no evidence to support the link between autonomy-supportive teaching to motivation and self-assessment practice. Autonomy-supportive teaching provides students with a choice on how to engage in a specific learning task (Baker & Goodboy, 2019; Connell & Wellborn, 1991; Skinner & Belmont, 1993) by creating an environment that enables students to take ownership of their learning (see Reeve, 2016). However, it is documented that autonomy-support can also be perceived as lacking structure or overly permissive (see Occhino et al., 2014; Reeve, 2006). This perception could attenuate the desired impact of autonomy-supportive teaching on student motivation. Given that high-structure or controlling learning environments can be preferred over autonomy-supportive teaching in Eastern contexts (e.g. Zhou et al., 2012), it is possible that autonomy-supportive teaching may translate to student motivation and self-assessment practice only in specific conditions and contexts. It could be surmised that autonomy-supportive teaching may be more impactful on student motivation and learning in individualistic contexts and cultures, where one's needs for autonomy could be more evident.

The mediating role of self-assessment practice between autonomous and controlled motivation and English achievement

One may regard controlled motivation as the opposite of autonomous motivation (e.g. Baeten et al., 2013; Haerens et al., 2015), but in Eastern contexts, both types of motivation were positively associated with each other (see Caleon et al., 2015). The same holds for motivational outcomes (e.g. mastery and performance goals), which are often negatively

correlated and perceived positively among Filipinos (e.g. King & McInerney, 2019; King & Mendoza, 2020). In this study, controlled motivation and autonomous motivation are positively and highly correlated. Niemiec and Ryan (2009) argued that both types of motivation are conducive to student learning. Although we found a high correlation between controlled and autonomous motivation, their influence on achievement scores is distinct. Our results show that only autonomous motivation predicted students' objective achievement scores. Like most SDT-related studies (e.g. Baeten et al., 2013; Deci & Ryan, 2000; Law, 2011), our findings suggest that motivation rooted in intrinsic goals substantially impacts academic achievement. Because autonomous motivation is internally driven, it is less contingent on external reinforcements or rewards (see Baeten et al., 2013; Eccles & Wigfield, 2002). Such nature of autonomous motivation enables it to be a sustainable source of drive to achieve, thereby increasing student achievement; such may not be the case for controlled motivation which is contingent on explicit external demands or instructions.

Although the link between autonomous motivation and student achievement intuitively makes sense, researchers have long argued to explore the behavioural mechanisms that can explain the motivation-achievement link (see Elliot et al., 2017). We found that self-assessment practice directly predicted achievement and mediated the link between both controlled and autonomous motivation to achievement. Specifically, self-assessment practice acts as a behavioural mechanism that links motivation to achievement. Our study highlights that specific self-regulated learning strategies can act as a behavioural mechanism that can link motivation to achievement. Because of the cyclical nature of self-assessment practice (Yan, 2018; Yan & Brown, 2017), it acts as a formative assessment to further impact student achievement. Leenknecht et al. (2020) noted that a bi-directional link exists between student motivation and self-assessment; that is, increased student motivation could foster self-assessment practice, and increased self-assessment practice can also increase student motivation. Overall, our finding suggests that student motivation would require the enactment of behavioural practices that can further improve student achievement, especially if student motivation is more controlled than it is autonomous.

Practical implications

Given the importance of need-supportive teaching for students, school heads, principals, or administrators can encourage professional development that can train and enhance such practices. In-service training for teachers on implementing need-supportive teaching exists (e.g. Aelterman et al., 2013, 2014), and schools can and should make full use of them. It is vital that the implementation of need-supportive teaching is culturally informed, given that our findings suggest that only involved teaching and structured teaching contributed to increased student motivation.

This study found that self-assessment practice mediated the link between motivation to achievement; hence, encouraging self-assessment practices can help promote higher achievement (see Leenknecht et al., 2020). The role of teachers in promoting self-assessment is crucial (e.g. Panadero et al., 2016). Teachers can endorse the use of specific self-assessment practices (e.g. self-assessment diaries; Yan et al., 2020b) that can improve students' academic performance. Recent findings from a meta-analysis showed that explicit instruction to self-assess has a larger impact on academic performance (Yan et al., 2021). Hence, teachers can be trained not only to encourage students to integrate self-assessment practices into their learning but also to provide explicit ways how to do so.

Study limitations and directions for future research

While this research holds theoretical and methodological advantages, we note our study's limitations below to inform future research work. First, while we used multi-level mediation from students nested in 30 classrooms, our analysis relied on individual students' perceived teaching practices of their respective English teachers. Ideally, a true level 2 predictor (i.e. teacher-reported need-supportive teaching) may provide a more ecologically appropriate predictor of student motivation. Future work can consider including multiple schools with more classrooms and with teacher-reported level 2 data. Second, one of the core strengths of our study is that all constructs refer to students' outcomes in a specific subject domain (i.e. English language learning). This is noteworthy since all evaluated constructs are referenced to English language learning. While this is a novel and practical research approach, in aid of generalising the findings, we encourage future studies to examine similar constructs in a different subject domain or among different student populations (e.g. students in primary school or higher education). Finally, the data was collected in the typical classroom setting before the school disruptions brought about by the COVID-19 pandemic. Given the shift in learning modalities due to the pandemic, exploratory research can use qualitative approaches to examine how the predictors of student achievement used in this study operate or apply in online learning. Longitudinal and experimental research designs can also be implemented to support the rigour of the study methods further.

Conclusion

Exploring pathways and mechanisms that can foster and maximise students' opportunities for learning hold theoretical and practical import. Our research shows that student motivation and self-assessment practices are relevant psychological and behavioural mechanisms, respectively, that can explain how teaching as social context can influence achievement. Both mechanisms can be initiated by involved and structured teaching practices and can consequently influence higher student achievement in a specific subject domain. It is crucial that teachers consider using need-supportive teaching practices to foster student motivation among secondary school students. For students, encouraging them to use self-assessment practices (e.g. seeking external and internal feedback and self-reflection) can help them translate their motivation into concrete practices that can improve their learning outcomes in school.

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Declarations

Conflict of interest The authors declare no competing interests.

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Current Themes of Research:

Student engagement in school; formative assessment; achievement goals; and social contagion in the education context.

Most Relevant Publications:

- King, R. B., & Mendoza, N. B. (2021). The social contagion of students' social goals and its influence on engagement in school. *Learning and Individual Differences*, 88, 102004. <https://doi.org/10.1016/j.lindif.2021.102004>
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- Mendoza, N. B., & Yan, Z. (2021). Validation of a subject-specific student self-assessment practice scale (saps) among secondary school students in the Philippines. *Journal of Psychoeducational Assessment*, 39(4), 481-493. <https://doi.org/10.1177/0734282921994374>

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Current Themes of Research:

Self-assessment practice; Self-regulated learning; Rasch analysis.

Most Relevant Publications:

- Yan, Z., Wang, X., Boud, D., & Lao, H. (2021). The effect of self-assessment on academic performance and the role of the explicitness: A meta-analysis. *Assessment & Evaluation in Higher Education*. <https://doi.org/10.1080/02602938.2021.2012644>
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Current Themes of Research:

Student motivation; student well-being; positive psychology and education; and Social Justice Perspective using Big Data.

Most Relevant Publications:

- Zhao, S., Chen, L., King, R. B., Nie, Y., Du, H., & Chi, P. (2021). When adolescents believe that SES can be changed, they achieve more: The role of growth mindset of SES. *Personality and Individual Differences, 183*, 111104. <https://doi.org/10.1016/j.paid.2021.111104>
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