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Opportunities on improving student motivation at all levels of education

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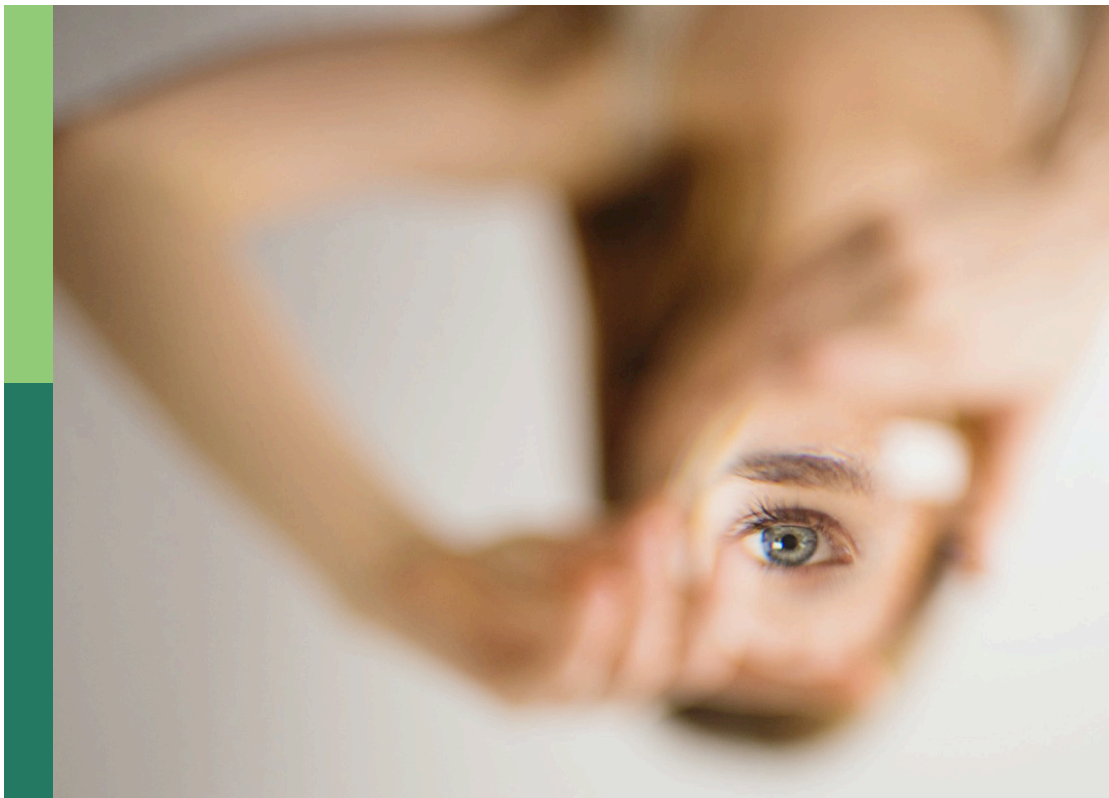

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Opportunities on improving student motivation at all levels of education

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Editorial: Opportunities on improving student motivation at all levels of education

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KEYWORDS

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Editorial on the Research Topic
Opportunities on improving student motivation at all levels of education

There is no single recipe for improving student motivation. Current research trends on motivation are well represented in our Research Topic. Although the scope of the research published is relatively large, both from substantive and methodological standpoints, it helps forecast future trends in motivation research.

Common takeaways

When it comes to improving student motivation, the teacher will always come as a point of agreement for its important role. While four papers (Radil et al.; Tharaldsen; Wang and Hu; Zhou et al.) specifically focused on teachers' role in fostering student motivation, two of those papers qualitatively detail how teachers spontaneously engage in supporting strategies as well as what elements of the classroom they identify as crucial for supporting student motivation (Radil et al.; Tharaldsen). While many aspects brought forward by the teachers themselves clearly align with motivation research, others, such as the importance of "key students" (i.e., popular class figure) acting as motivation champions in the class, break the mold of motivation-enhancing strategies typically put forward in the literature. This research thus present teachers not only as motivational supporters, but also as references for understanding motivational patterns and developing insightful motivating strategies.

Half of the manuscripts in the topic (Pulkka and Budlong; Chen and Zhang; Nagy et al.; Paumier and Chanal; Wang and Hu; Yang et al.) include quantitative analyses that combine more than one motivation variable (e.g., self-efficacy, goals, self-determination, engagement). In this context, one must keep in mind that students' motivational landscape is complex and dynamic. The labels for various motivational concepts bring this complexity to more interpretable grounds for researchers, but they must not be used to infer simplicity about the motivational experiences that students undergo. In other words, while coining and juggling with precise motivational terms is helpful for researchers, this does not imply that motivational experiences of engagement, goal striving, and self-efficacy, for example, happen in silos and are devout of complexity. When inferring from results using multiple motivational variables, one must keep in mind that the concepts presented are overlapping, imprecise, and dynamic.

This highlights the crucial importance of measurement in the context of motivational research. As much as a good measurement will help to reduce ambiguity in presentation and interpretation of results, a weak measurement gives the overall impression that the field of motivational research is approximative and negligent. Thus, strong measurement will help better to outline the motivational experience of students as well as contribute to identifying the processes and causation sequence that lead to improved motivation. It is important to keep in mind that not all motivational concepts wield similar power in determining the quality of the student experience, such that the more we manage to delineate to boundaries of various motivational concepts, the more targeted the motivational interventions that derive from the research will be.

Informed suggestions for future research

Two manuscripts in the topic (Pulkka and Budlong; Yang and Cai) have presented research using profile analysis to identify patterns in student motivation. Person-centered analyses in general are helping researchers to uncover how their participants can be grouped in clusters of motivation types. Although this line of analysis remains very promising, we reckon it could be pushed even farther in large datasets by including more than motivational variables in the creation of profiles. In doing so, it could be possible to distinguish, within profiles of participants that share the same motivational pattern, other factors that could be associated with the onset or perpetuation of this pattern. Looking in the various ways students end up with similar motivational patterns is a path seldom taken but that holds important potential for improving our understanding, and the quality, of student motivation.

Finally, only one manuscript (Anyichie and Butler) pertained to culturally informed pedagogies and their purported motivational effect. One-size-fits-all solutions to improving motivation belong in the past, and although profile analyses are one way researchers look beyond global effects to focus on the experiences of individuals, there are many other ways to take into accounts the diverse backgrounds students come to our schools with. With culturally responsive teaching, culturally relevant pedagogy and culturally sustaining pedagogy, one goes beyond the idea of "what's good for the goose is good for the gander" to rather embrace the motivational influence of cultural experiences. Many more research on this topic is needed to better understand how our schools will support all students through culturally informed practices.

Conclusion

In sum, this topic has garnered a host of relevant and cutting-edge research on student motivation that, when taken together, give a promising outlook on the next decades of motivational research. Thank you to authors and reviewers who contributed in making this topic possible.

Author contributions

JB drafted the editorial. FG, WL, and KD provided relevant feedback. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Associations Between Achievement Goal Orientations, Preferred Learning Practices, and Motivational Evaluations of Learning Environment Among Finnish Military Reservists

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In this study, it was examined whether individuals' self-efficacy, preferred forms in learning, and evaluations of the learning environment vary as a function of their goal orientation profiles. It was also explored whether the preferred forms in learning played a role in this association. The participants were 177 reservists of Finnish Defense Forces participating in rehearsal training exercises. Four homogeneous groups based on goal orientation profiles were found: mastery oriented ($n = 47$, 26.5%), success-performance oriented ($n = 49$, 27.7%), indifferent ($n = 43$, 24.3%), and avoidance oriented ($n = 38$, 21.5%). The mastery-oriented group and the success-performance-oriented group reported higher levels in self-efficacy, legislative form in learning, and mastery goal structure when compared to the avoidance-oriented group or to the indifferent group. The avoidance-oriented group reported elevated levels of perceived strain and performance goal structure in comparison to the mastery-oriented group. Controlling the learners' preferences for different forms in learning revealed some slight differences in the observed pattern of between-group differences regarding perceptions of performance goal structure and self-efficacy. Controlling for the legislative form of learning diminished the difference between the mastery-oriented and the avoidance-oriented groups in perceptions of performance goal structure, and controlling for the executive form of learning revealed differences between success-performance oriented and the indifferent and the avoidance oriented. The role of the learning environment in highlighting certain types of activities in learners' choices and the relevance of this regarding their goal preferences are discussed.

Keywords: goal orientation, motivation, learning environment, self-efficacy, thinking styles

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INTRODUCTION

Learners' activities in achievement situations are guided by both individual factors and environmental cues (e.g., Magnusson and Törestad, 1993; Fraser, 1994). These activities manifest in varying forms of engagement, or attitudes or stances toward certain forms of engagement that reflect, then, both generalized personal factors as well as more acute responses to the environment. Research on motivation in learning comprises these viewpoints on both

individuals' motivation as well as the ways the learning environment and instruction hold motivational cues (Urdan, 1997). Individual learner's motivation and his/her view on the learning environment are dependent on each other: learners with different kinds of motivational disposition may act and perform differently in achievement situations, but they also interpret instruction through "motivational glasses" (Fraser and Tobin, 1991; Wolters, 2004). What is more, motivation in learning has both generalized and context-specific components (Pintrich, 2003, p. 676) meaning that despite more generic patterns of cognition, emotion, and behavior, certain environments or topics may elicit varying ways of responses or engagement despite more generic motivational disposition. To take this further, learners may, for example, balance between learning and wellbeing goals (Boekaerts and Niemivirta, 2000, p. 427–431), or, more practically, adapt their study strategies based on their interpretation of teacher's demands (Broekkamp and Van Hout-Wolters, 2007).

Research has shown that different types of motivation lead to different kinds of behavioral outcomes and more practical forms of preferences in what comes to engagement, as well as perceptions of instruction (Niemivirta, 2002a; Tapola and Niemivirta, 2008; Pulkka and Niemivirta, 2013). Also, it has been shown that preferences for different styles or forms of learning activities are related to how the learning environment or instruction is perceived (Simpson and Du, 2004; Akkoyunlu and Soylu, 2008). However, to our reading, the interaction of these two effects has been less examined.

What comes to context, we examine these interactions in a special environment of the reserve training exercise in Finnish national defense scheme. The importance of the context is emphasized as military training universally is well-formalized, including, for example, clear instructions, rules, and given orders that are expected to be complied with. Such clear structures might well-highlight the effects of environment on individuals' conduct.

The aim of our study is to examine whether learners' evaluations of their competence and learning environment vary as a function of their motivational profiles, and further explore if varying preferences for learning and studying in a specific environment play an independent role in this.

Personal Achievement Goal Orientations

Our take on motivation is based on research on achievement goal orientations that are generalized tendencies to value and prefer certain kinds of outcomes in learning and achievement contexts (Urdan, 1997; Pintrich, 2000a, 2003; Elliot, 2005). Early research on achievement goals was based on two somewhat opposing dimensions: task, mastery, or learning goals (goals of personal improving) and ego or performance goals (goal of proving or showing ability) (Nicholls, 1984; Dweck, 1986). Although researchers used different terms to describe the categories. It was postulated that task- or mastery-oriented learners pursue and prefer goals that represent learning new things and gaining competence with intrapersonal reference, whereas performance-oriented learners strive to prove their ability relative to others (e.g., Ames and Archer, 1987; Elliot and Dweck, 1988). The later research has distinguished between approach and avoidance forms of performance goals. In this view, performance-approach goals represent specifically outperforming others and appearing competent, whereas performance-avoidance goals have focus on not appearing less competent than others and avoiding judgements of incompetence. Also, it has been established that learning or mastery can be pursued with varying criteria. It has been suggested, for example, that approach/avoidance-valence applies also to mastery goal pursuit (Elliot and McGregor, 2001) or that the mastery goals can be approached with extrinsic criteria (good grades and other evaluations) (Niemivirta, 2002a).

In this study, we use a five-dimensional model (Niemivirta, 2002a) that includes two mastery goal orientations: mastery-intrinsic orientation that has focus on learning itself and the mastery-extrinsic goal orientation that also focuses on learning but with external criteria, such as grades or other evaluations. Regarding performance-goal preferences, we use the performance-approach and performance-avoidance dimensions. In this conceptualization, it is also postulated that not all learners' strivings refer to achievement or performance. Following this, in this study, we also utilize a dimension of a work-avoidance orientation that reflects aims of minimizing effort and avoiding challenges (Nicholls et al., 1985; Thorkildsen and Nicholls, 1998).

Our analytical strategy is based on the person-oriented approach (see Niemivirta et al., 2019), where the focus is on profiles of scores and their effects instead of associations between variables (Laurse and Hoff, 2006). As an analytical strategy, similar patterns in variables as displayed by individuals are identified and these groups are examined (von Eye and Bogat, 2006). The relevance of the person-centered approach in research on motivational goals arises from the widely accepted multiple-goal perspective, meaning that a person can be motivated by different types of goals simultaneously (e.g., Pintrich, 2003, p. 676; Pastor et al., 2007). Grouping participants based on their scores of multiple goal orientation dimensions aims to reveal the effects of different combinations instead of separate paths between variables.

The results from research on achievement goal orientation profiles indicate that there seems to be somewhat recurring patterns of achievement goal preferences, although studies using this approach differ not only in contexts but also in instrumentation and profiling methods. However, Niemivirta et al. (2019, p. 575–576) present in their review that usually certain categories of profiles seem to emerge (based on pattern of levels in all measured dimensions). These profiles are predominantly mastery goal profile, predominantly performance goal profile, combined mastery and performance goal profile, moderate or low-level profile (on the level of all dimensions), and work-avoidant goal profile (that is, in studies that include work-avoidant dimension) (Niemivirta et al., 2019).

Classroom Goal Structures

In addition to personal achievement goals, it was postulated by early goal researchers (e.g., Ames, 1992a,b) that this theory also has contextual pedagogical implications. Accordingly, learning environments or instructional features may take forms that hold specific motivational cues. Goal structures represent the motivational classroom climate that is mostly explicated by

the teachers, either by the actual instruction or other features (Wolters, 2004; Wolters and Gonzalez, 2008; Bardach et al., 2020). These features emphasize the types of achievement goals on a contextual level; for example, if evaluation of a certain task is based on ranking the students or, in other words, on a comparison between students, it can be argued that this highlights a goal of outperforming others, and thus may foster the adoption of certain achievement goals by the learners (e.g., Ames, 1992a).

The goal structures were first conceptualized by two dimensions. First a classroom that includes mastery-goal structures supports learners to focus on learning and development itself, and understanding of materials, whereas performance-goal structure has a focus on social comparison and demonstration of ability (Midgley and Urdan, 2001; Miller and Murdock, 2007). The performance-goal structure was later on defined to approach and avoidance components: the performance-approach structure includes practices that emphasize outperforming peers and the performance-avoidance goal structure emphasizes avoidance of incompetence, or performing lower than peers (e.g., Midgley et al., 1998, 2000; Karabenick, 2004; Murayama and Elliot, 2009). In more detailed terms of pedagogical recommendation, much of the research concerning aspects of instruction derives from the so-called TARGET framework (Ames and Archer, 1988), which defines six categories of motivationally relevant features: tasks, authority, recognition, grouping, and evaluation. The challenge and diversity of learning tasks have an influence on motivation and learning skills. Authority refers to students' involvement in and responsibility for their learning in terms of available choices in method and pace. Recognition is the use of rewards and incentives in different forms, and grouping means cooperation and peer interaction in groups. Evaluation concerns the practices, standards, and references of evaluation and feedback; and time means the workload and pace in reference to individual differences in knowledge and skills (Ames, 1992a).

Outcomes and Correlates

Personal achievement goal orientations have distinct outcomes in terms of other motivational factors, affect, and learning (Elliot, 2005; Dweck and Grant, 2008). In brief, mastery orientations usually have more positive correlates than performance orientations. Especially performance-avoidance orientation and work-avoidance orientation have generally maladaptive outcomes (Urdan, 1997; Hulleman et al., 2010).

The mastery goal emphasis predicts positively self-esteem and self-regulation (Middleton and Midgley, 1997), self-regulated and deep or interest-based learning and studying (Senko and Miles, 2008; Yeh et al., 2019), and interest (Harackiewicz et al., 2000). The mastery-extrinsic orientation has shown to be associated with positive outcomes such as commitment and high effort, but it also has links with increased stress and exhaustion (Tuominen-Soini et al., 2008, 2011). The performance-approach orientation has a more mixed pattern of outcomes as, for example, it has been negatively associated with interest-based studying (Senko and Miles, 2008), but positively associated with self-efficacy (Skaalvik, 1997). The performance-avoidance orientation has negatively predicted self-efficacy (Skaalvik, 1997) and self-esteem (Elliot and Sheldon, 1997), as well as interest and enjoyment of lectures (Harackiewicz et al., 2002). The work-avoidance orientation has been shown to have maladaptive consequences and correlates, such as surface-level learning strategies (Ng, 2009) and low interest (Barron and Harackiewicz, 2003).

In sum, when it comes to student evaluations of learning and studying (e.g. interest, enjoyment, competence beliefs, studying preferences), mastery orientation has positive outcomes, performance-approach orientation has mixed outcomes, and the avoidance-focused orientations have negative outcomes.

Different profiles also have different outcomes, and it seems that dominant mastery goal profile and combined mastery and performance-approach goal profile are beneficial in what comes to their correlates and consequences in many respects, such as other motivational factors, wellbeing, and perceptions of learning environment (Niemivirta et al., 2019, p. 577–585).

Mastery-oriented and mastery-performance-approach-oriented students have reported more frequent use of adaptive approaches to learning and tasks (e.g., elaboration, regulation, deep, or analytical approach) and have been more persistent and active, and invested more effort (Valle et al., 2003; Kolic-Vehovec et al., 2008; Pulkka and Niemivirta, 2013, 2015). In comparison, performance and work-avoidance-oriented learners had lower levels of these aspects of learner engagement. However, more mixed results have also been reported: for example, Luo et al. (2011) reported that mastery- performance-approach-oriented and dominantly performance-oriented students reported equally high levels of class, homework, and time management, and high meta-cognitive and effort regulation, when compared to a moderate- or a low-level profile.

Learners with different motivational profiles also differ in their perceptions and preferences of learning environment. Mastery- and/or combined mastery-performance-oriented learners have given more positive evaluations of teaching and assessment methods, clarity of goals, and workload (Cano and Berben, 2009; Pulkka and Niemivirta, 2013, 2015) and have perceived learning environment to be more learning focused, cooperative, meaningful, and include more task variety (Tapola and Niemivirta, 2008; Koul et al., 2012) when compared to learners with other kinds of profiles. Differences that reflect the achievement goal orientation profiles also concern preferences: performance-oriented students have preferred public evaluation practices, whereas avoidance-oriented learners reported less preferences for challenges and task focus in class (Tapola and Niemivirta, 2008).

What comes to relationships between personal motivational orientations and experiences of learning environment, individually varying needs affect the view individual has on the instruction in terms of person-environment match (e.g., Fraser and Rentoul, 1980). The view adopted in this study thus postulates not only that the environment does influence motivational goal preferences but also that learners perceive and interpret a learning environment and instruction in ways (to a

certain extent) as a function of their motivational mindset (Fraser and Tobin, 1991; Wolters, 2004; Lyke and Kelaher Young, 2006; Tapola and Niemivirta, 2008; Pulkka and Niemivirta, 2013).

Self-Efficacy; Believing in Yourself Matters

In addition to personal goal preferences, we also look at students' beliefs of their competence that is importantly associated with learning and motivation, for instance, in a performance context (Zimmerman, 2000). The self-efficacy refers to a learner's personal, often situational, cognitive judgement as an evaluation or a personal belief on how one is able to perform different tasks (Bandura, 1993, 2010; Pajares, 1996; Bong and Clark, 1999). A sense of self-efficacy can be related to what kind of attitude a person has toward challenges and how he/she is dealing with them (Zimmerman, 2000; Pajares and Schunk, 2001).

A high sense of self-efficacy is expected to increase an individual's resilience to work harder and longer even in challenging situations. In case of a mistake or a failure, high reliance on one's competence would make it more tolerable (Pajares and Schunk, 2001). Then again, in the long run, a series of failures undermines a sense of self-efficacy (Bong and Skaalvik, 2003). In addition, a low sense of self-efficacy can even promote avoiding the task at hand (Schunk, 1991).

Interactions between self-efficiency, motivation, and learning can be considered slightly complex. In the context of learning, self-efficiency can vary based on the personal understanding of one's skills, abilities, and past experiences (Zimmerman, 2000; Pajares, 2003). However, it seems that although the results may vary to some extent, mastery- and performance-approach goals predict self-efficacy, but performance-avoidance goals predict self-efficacy negatively (Ahn and Bong, 2019, p. 75–76). What comes to results concerning research on goal orientation profiles, predominantly mastery, and combined mastery-performance profiles have been found to be related higher self-efficacy when compared to other kinds of combinations of personal achievement goal orientation (Luo et al., 2011; Korpershoek et al., 2015).

Preferred Forms in Learning, Revisiting Thinking Styles

Processes of self-regulation in learning, such as learning strategies, are positively related to students' sense of self-efficacy and motivation (Zimmerman and Martinez-Pons, 1990; Zimmerman, 2000). It follows that individuals differ in their tendencies to evaluate or choose tasks based on the preferred forms of engagement in learning. This is rather an individual's generalized feature than a trait that leads to choosing certain types of activities to perform a task.

Regarding engagement in learning, we rationalize our take on different types or learner activities based on different types of thinking.[1] In other words, we postulate that different approaches learners choose or would prefer in learning activities arise from their cognitive styles or mindset.

According to Sternberg (1997), one can speak of an individual's style profile or personality-based styles rather than individual ways of thinking. In this theory, a model of cognitive styles consists of five dimensions (functions, forms, levels, scopes, and leanings) that include 13 thinking styles. In our study, we use preferred thinking styles that belong to the dimension of functions. This dimension consists of three different thinking styles: judicial, legislative, and executive (Sternberg, 1990, 1994; Sternberg et al., 2008; Minbashian et al., 2019).

In the particular context of the military environment where essentially the following orders and instructions are emphasized, but on the other hand, initiative is valued. Based on this, we chose to include two classes of thinking styles that specifically refer to these two aspects: the executive and legislative that we hereafter refer to as preferences for forms in learning or engagement.

Individuals with a legislative mindset tend to seek solutions to problems, set their own rules, and be creative. Regarding the executive mindset, the tendency is to do things in familiar ways and face pre-defined problems with precise rules (Sternberg, 1994, 1997).

According to Sternberg et al. (2008), it is natural for individuals with legislative preferences to plan ideas, and they prefer that they themselves can decide what to do and how. More specifically, the legislative form in learning involves independent experimentation, exploring, responsibility, and independence (Sternberg, 1988, p. 202–203).

In turn, individuals with executive preferences prefer for instance tasks that include a clear structure, procedures, or rules, thus emphasizing implementation instead of planning. It involves following instructions, clear instructions, precise boundary conditions, and completing well-defined tasks (Sternberg, 1988, p. 203–204; Sternberg et al., 2008).

Legislative and executive forms in learning may not necessarily be mutually exclusive, but an individual may generally have stronger emphasis on one or the other when performing tasks (Sternberg, 1988, p. 204).

Regarding motivation, learning/mastery orientation has been found to be positively related to legislative preferences among other aspects; in turn, performance-prove orientation was positively related to executive preferences (Minbashian et al., 2019).[2]

Learning preferences have also shown to contribute to academic achievement and they are also related to self-esteem and students' characteristics. For instance, legislative preferences of learning are accentuated with students who are from higher socio-economic-status families and students have reported more extracurricular experience. Finally, executive preferences of

[1] Sternberg (1988) used term thinking styles in his theoretical work. Given that learning and thinking are intertwined, we rather use a concept of preferred forms of engagement in learning instead of the thinking styles to highlight the fact that the "styles of thinking" refers more to variance in tendencies of behavior and action rather than fixed categorical styles. Also, the term thinking styles may be mixed by readers to learning style research that includes unwarranted assumptions we do not postulate.

[2] In Minbashian's (2019) study, thinking styles were divided into two. Type I included legislative and judicial thinking styles, liberal leanings (prefer to run tasks or projects in a novel way or unfamiliar way), and hierarchic forms (refers to individuals who prefer to run multiple tasks in a given time frame and with different priorities). Type II included executive thinking style, conservative leaning (prefer running tasks and projects in a traditional and familiar way), and monarchic form (prefer to run only one task or project at a time until finished) (Sternberg, 1988; Minbashian et al., 2019).

learning are related to fewer extracurricular experiences (Zhang and Sachs, 1997; Zhang, 1999).

What comes to associations between learning styles and students' evaluations of instruction, Akkoyunlu and Soylu (2008) examined students' perceptions in a blended learning environment based on different learning styles and showed that students with a preference for logic, thinking, and watching had more positive view when compared to those that prefer observing instead of action. On the other hand, Simpson and Du (2004) found that in an online learning where several types of activities were expected, a preference for logic, thinking, and watching was related to lower level of enjoyment than styles that preferred actively doing things. Despite that these examples, prior studies used different conceptualisations, and that the findings seem to vary; it seems that, in general, student preferences seem to have influence on how they perceive learning environment to some extent.

The Present Study

For the most, goal structures are operationalised as student measures, in which case students' interpretations of the goals emphasized by the instruction are assessed (Maehr and Midgley, 1991; Lüftenegger et al., 2017). Also, as reviewed above, the student perceptions of instruction are then again slightly affected not only by their motivational mindset in what comes to their preferred goals but also possibly by what kind of activities they prefer and how these preferences match with the pedagogical delivery (Simpson and Du, 2004; Tapola and Niemivirta, 2008). Moreover, learners may hold to some extent varying goal emphasis in what comes to different contexts or domains (e.g., Bong, 2001; Sparfeldt et al., 2015), but less is known whether preferred types of activities or one's stance to different types of work or tasks in achievement situations are more generalized or dependent on domains. Based on this, we consider that by including both these factors (motivational goals and learning preferences) in our analysis, we will be able to highlight the interplay of motivational goals and specific preferences of learning activities in experiencing the learning environment.

In this study, we examine how different motivational profiles (achievement goal orientations) explain the differences in self-efficacy and learners' evaluations of instruction (classroom goal structures). In addition, we examined if thinking styles as forms of preferred engagement play a role in this association.

MATERIALS AND METHODS

Sample

Our sample came from the two army reserve exercises of Finnish Defense Forces and consisted of 177 male soldiers (aged 21–35 years, mean age 23.5) who had filled complete data in the questionnaire. The Finnish reservists are called to rehearsal training most often ∼5 years after their national military service that is obligatory for male Finns and voluntary for female Finns. Reserve training is also mandatory and absence requires justified plea; usually a quite high percentage of called reservists take part in exercises.

At the end of the exercise, the participants completed a questionnaire assessing personal achievement goal orientations, preferred learning activity types, and evaluations of exercise's goal structure. The questionnaire was administered by the first author, participation was voluntary, and the participants were assured of the anonymity of measures. The research was approved by the National Defense University as well as the commanding staff of the individual exercises. No personal or sensitive information was collected.

Instruments

We assessed five types of achievement goal orientations (Niemivirta, 2002a): mastery-intrinsic orientation (two items, e.g., "*To acquire new knowledge was an important goal for me in this exercise*"), mastery-extrinsic orientation (two items, e.g. "*Getting good evaluations was important for me in this exercise*"), performance-approach orientation (two items, e.g., "*An important goal for me in this exercise was to do better than other reservists*"), performance-avoidance orientation (two items, e.g., "*It was important for me not to fail in front of other reservists*"), and work-avoidance orientation (two items, e.g., "*I tried to get away with as little effort as possible in this exercise*"). On these, and all the following scales, the participants rated each statement on a 7-point Likert scale (1 = not true at all, 7 = very true).

The instrument has been used in several studies showing high reliability and validity (e.g., Tuominen-Soini et al., 2011; Pulkka and Niemivirta, 2013, 2015; Tuominen et al., 2020). Confirmatory factor analysis (as implemented in Mplus) was used to verify the structural validity of an instrument. We used the chi-square statistics, the comparative fit index (CFI, cutoff value >0.95), and the root mean square error of approximation (RMSEA, cut-off value <0.06) to evaluate the model fit (cf. two index strategy, Hu and Bentler, 1999). The model fits the data very well: $\chi^2_{(25)} = 27.43$, $p = 0.33$; CFI = 0.99, RMSEA = 0.023, 90% CI [0.000, 0.066].

For measuring the self-efficacy, we used six items, e.g., "*I can always manage to solve difficult problems if I try hard enough,*" modified from the New General Self-Efficacy Scale (Chen et al., 2001). The NGSE items refer more to complex or challenging situations than to specific knowledge or defined skill, and such a frame of reference is more readily relatable to the military exercise environment, which requires comprehensive adaptation rather than use of one defined skillset. The participants were asked to evaluate the items in reference to their actions in the exercise.

Regarding the self-efficacy scale, the model fits the data reasonably: $\chi^2_{(9)} = 33.98$, $p = 0.0001$; CFI = 0.95, RMSEA = 0.023, 90% CI [0.000, 0.066] when the error terms of two pairs of variables were specified to correlate.

Features of a learning environment were assessed with three scales. First, we used classroom goal structure scales adapted from PALS (Midgley et al., 2000): mastery goal structure (3 items., e.g., "*My instructor wants us to understand our work, not just memorize it*" and performance goal structure (2 items, e.g., "*My instructor only recognizes really good performance*"). Second, we also measured the perceived (excessive) workload

or strain imposed. The rationale to choose this aspect is that the level of challenge or tasks in relation to available time are motivationally relevant (e.g., TIME dimension in TARGET framework cf. Ames, 1992a) and because in practice this is contextually very much salient given the intensive tempo of military exercises. The perceived strain was assessed with two items (e.g., "*My instructors demand too much from us*"). The model of the learning environment scales fits the data well: $\chi^2_{(11)} = 15.77$, $p = 0.1499$; CFI = 0.98, RMSEA = 0.050, 90% CI [0.000, 0.101]. However, because the internal consistency of performance goal structure was quite low, we chose to use only 1 item that taps well the core of the performance strivings.

Next, as we considered the dimensions of preferred forms in learning new or modified to some extent, at least in this context, we used an exploratory factor analysis to examine the structural features of these scales.

We assessed the preferred forms of engagement with two scales (Niemivirta, 2002b; personal communication November 21, 2021): executive form (2 items, e.g., "*I would like to follow certain rules or instructions in the tasks of the exercise*") and legislative form (2 items, e.g., "*I would like to experiment new ways of performing tasks and solving problems in the exercise*"). The participants were asked to consider what they think they would like to do in future exercises given their past experience.

Regarding the preferred forms of engagement in learning, the extracted factor solution consisted of two factors with eigenvalue > 1, where the factors explained 60.453% of the variance, and factor loadings were between 0.713 and 0.858. The factors included items that had primary loadings corresponding to the proposed original dimensions (see **Appendix 1**).

Altogether, based on structural analysis, the composite variables were calculated with the respective internal consistencies (Cronbach's alpha): mastery-intrinsic orientation ($\alpha = 0.89$), mastery-extrinsic orientations ($\alpha = 0.76$), performance-approach orientation ($\alpha = 0.52$), performance-avoidance orientation ($\alpha = 0.71$), work-avoidance orientation ($\alpha = 0.81$), self-efficacy (6 items; $\alpha = 0.89$), legislative form of engagement in learning (2 items; $\alpha = 0.80$), executive form of engagement in learning (2 items; $\alpha = 0.67$), classroom mastery approach goal structure (3 items; $\alpha = 0.79$), classroom performance goal structure (1 item), and perceived strain (2 items; $\alpha = 0.66$).

The descriptive statistics, internal consistencies, and zero-order correlations are reported in **Table 1**.

TABLE 1 | Descriptive statistics, alphas, and zero-order correlations for all scales.

Scale	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Mastery-Intrinsic orientation	4.11	1.70	0.893	–									
2. Mastery-Extrinsic orientation	4.56	1.54	0.761	0.686***	–								
3. Performance-Approach orientation	4.27	1.28	0.520	0.411***	0.609***	–							
4. Performance-Avoidance orientation	3.68	1.65	0.712	0.075	0.185*	0.296***	–						
5. Work-Avoidance orientation	3.05	1.61	0.810	−0.523***	−0.524***	−0.351***	0.140	–					
6. Self-Efficacy	5.31	0.99	0.889	0.302***	0.366***	0.528***	−0.072	−0.326***	–				
7. Legislative form of engagement in learning	4.82	1.34	0.801	0.387***	0.413***	0.394***	0.110	−0.293***	0.413***	–			
8. Executive form of engagement in learning	3.94	1.24	0.666	0.117	0.121	0.094	0.274***	0.175*	−0.016	0.089	–		
9. Mastery goal structure	4.90	1.21	0.790	0.445***	0.458***	0.390***	0.077	−0.365***	0.369***	0.089	0.149*	–	
10. Performance goal structure	2.61	1.30	_[a]	−0.107	−0.126	−0.052	0.064	0.199**	−0.138	−0.182*	0.083	−0.035	–
11.Perceived strain	2.29	1.38	0.655	−0.352***	−0.385***	−0.250***	0.129	0.455***	−0.215**	−0.196**	−0.020	−0.415***	0.356**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
[a]*Single item.*

RESULTS

Achievement-Goal-Orientation Profiles

A TwoStep Cluster analysis was used to identify homogeneous groups based on the participants' achievement-goal-orientation profiles. The BIC criterion suggested a 3 cluster solution to be the best option (see **Table 2**). However, regarding the 4-cluster solution, the change in the information criteria was minimal, no exceptionally small clusters were observed, and the

TABLE 2 | Information criteria values for different clustering solutions.

Number of clusters	BIC	BIC change	Ratio of distance measures
1	662.693		
2	549.855	−112.838	2.540
3	536.822	−13.033	1.326
4	539.726	2.903	1.794
5	564.248	24.523	1.078
6	590.745	26.497	1.316

correspondence to prior research was clear. Therefore, based on this, we formed four groups following the 4-cluster solution.[3]

Based on the standardized mean score profile (see **Figure 1**), the group 1 was fairly moderate in all respects without any particular dimension emphasized and labeled indifferent (n = 43, 24.3%). The second group scored high on work-avoidance orientation and low on mastery-intrinsic orientation, mastery-extrinsic orientation, and performance-approach orientation in both absolute and relative sense) and was labeled as avoidance oriented (n = 38, 21.5%). The third group scored high on mastery-intrinsic orientation and mastery-extrinsic orientation, but low on work-avoidance orientation and performance-avoidance orientation and was labeled mastery oriented (n = 47, 26.5%). In the fourth group mastery-intrinsic orientation and mastery-extrinsic orientation were emphasized, and the group scored also high on performance-approach orientation and performance-avoidance orientation, thus indicating focus on both personal success (in intra-individual terms) and display of relative performance (in inter-individual terms). Therefore, the fourth group was named as success-performance oriented (n = 49, 27.7%). Mean differences in achievement goal orientations between goal orientation groups are reported in **Table 3**.

Between-Group Differences

The analysis of variance indicated (**Table 4**) that the goal-orientation groups differed significantly from each other on self-efficacy $F_{(3,173)} = 14.867$, $p < 0.01$, $\eta^2 = 0.21$, legislative form in learning $F_{(3,173)} = 15.144$, $p < 0.001$, $\eta^2 = 0.21$, mastery goal structure $F_{(3,171)} = 10.944$, $p < 0.001$, $\eta^2 = 16$, performance goal structure $F_{(3,171)} = 3.226$, $p < 0.05$, $\eta^2 = 0.05$, and perceived strain $F_{(3,171)} = 13.072$, $p < 0.001$, $\eta^2 = 0.19$.

The pairwise comparisons indicated that soldiers with the mastery-oriented profile or the success-performance-oriented profile reported higher scores in self-efficacy, legislative form in learning, and mastery goal structure when compared to the avoidance oriented or the indifferent. The avoidance-oriented group reported higher levels of perceived strain and performance goal structure in comparison to the mastery-oriented group.

Analysis of Covariance

Legislative Form of Engagement in Learning

Series of ANCOVAs were used to find out the association of self-efficacy, evaluations of classroom mastery approach, and evaluations of perceived strain by goal-orientation groups using the legislative form of engagement in learning (called later in the text as legislative form) as a covariate. The Bonferroni pairwise comparisons were used to determine significant differences in the groups (see **Table 5**).

Regarding the self-efficacy, the effect of interaction term (goal orientation group x legislative form in learning) was not significant (F = 1.280, 3.169, p = 0.283), indicating a parallel effect of the legislative form in learning in the profile groups. Significant differences in adjusted means (F = 7.169, 3.172, $p < 0.001$) were found between orientation-profile groups even when the legislative form in learning was controlled. The pairwise comparisons indicated that adjusted mean of self-efficacy of the mastery-oriented group (M_{adj} = 5.79, SE = 0.131) was significantly different from the indifferent group (M_{adj} = 5.05, SE = 0.134) and avoidance-oriented group (M_{adj} = 5.37, SE = 0.126) of soldiers. However, avoidance-oriented and indifferent groups did not differ from each other. The legislative form in learning predicts positively self-efficacy.

Regarding the mastery goal structure, the effect of interaction term was not significant [F = 2.607 (3.167), p =0.053], indicating a parallel effect of the legislative form in learning in the profile groups. Significant differences in adjusted means [F = 11.099 (3.170), $p \leq 0.001$] were found between the orientation-profile groups even when the legislative form in learning was controlled. The pairwise comparisons indicated that the adjusted mean of the mastery-oriented group of soldiers (M_{adj} = 5.57, SE = 0.167) was significantly different from the indifferent group (M_{adj} = 4.65, SE = 0.175) and from the avoidance-oriented group (M_{adj} = 4.11, SE = 0.188) regarding the evaluations of the mastery-goal structure. In addition, the success-performance-oriented group (M_{adj} = 5.14, SE = 0.160) differed from the avoidance-oriented group considering the evaluations of the mastery-goal structure. The legislative form in learning predicts positively the mastery-goal structure.

Regarding the performance-goal structure, the effect of interaction term was not significant [F = 0.065 (3.171), p = 0.978], indicating a parallel effect of the legislative form in learning in the profile groups. We found no significant differences in adjusted means [F = 2.065 (3.169), p = 0.107] between the orientation-profile groups.

Regarding the perceived strain, the effect of interaction term was not significant [F = 1.027 (3.167), p = 0.382], indicating a parallel effect of the legislative form in learning in the profile groups. Significant differences in adjusted means [F = 10.442 (3.170), $p \leq 0.001$] were found between orientation-profile groups even when the legislative form in learning was controlled. The pairwise comparisons indicated that the adjusted

[3]Despite critique on regular clustering techniques in the past (e.g., Pastor et al., 2007), the two-step cluster analysis has performed equally sufficiently in comparison, for example to latent class cluster analysis (e.g., Benassi et al., 2020) and we deem it an appropriate choice, with sufficient indicators. What is more, when performing a two-step cluster analysis with the SPSS software, it should be noted that the cluster solutions may in some cases appear relatively unstable. In other words, the final solution of the clusters may depend on the order of the cases. To minimize the impact of order, cases can be randomly rearranged. It is recommended to run the cluster analysis again with the SPSS software a few times and obtain different solutions where the cases are sorted in random order (IBM, 2016). According to this stability testing, the cluster solution used in this study was stable.

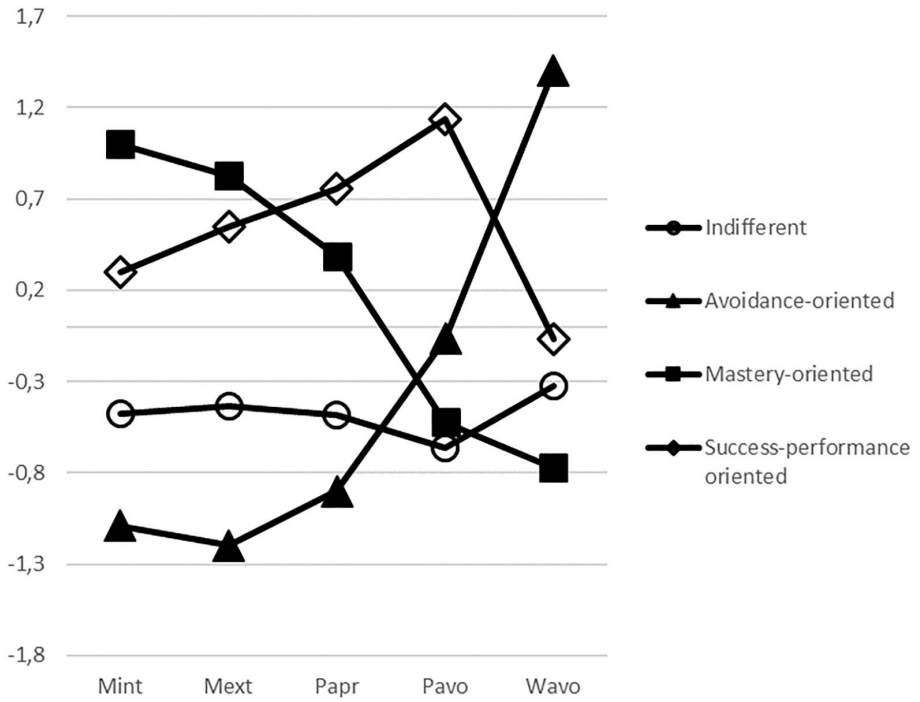

FIGURE 1 | Standardized mean scores on achievement-goal orientation scales as a function of group membership. Mint, mastery-intrinsic orientation; Mext, mastery-extrinsic orientation; Papr, performance-approach orientation; Pavo, performance-avoidance orientation; Wavo, work-avoidance orientation.

mean of the mastery-oriented group ($M_{adj} = 1.69$, SE = 0.191), the success-performance-orientated group ($M_{adj} = 2.18$, SE = 0.181), and the indifferent group ($M_{adj} = 2.13$, SE = 0.201) differed significantly from the avoidance-oriented group ($M_{adj} = 3.31$, SE = 0.216). The legislative form in learning predicts negatively perceived strain.

Executive Form of Engagement in Learning

Series of ANCOVAs were performed similarly, but the executive form of engagement in learning (later called as an executive form) was a covariate in the model instead of the legislative form in learning (see **Table 6**).

Regarding the self-efficacy, the effect of interaction term (goal orientation group x executive form in learning) was not significant [$F = 0.832$ (3.169), $p = 0.478$], indicating a parallel effect of the executive form in learning in the profile groups. Significant differences in adjusted means ($F = 14.801$ (3.172), $p \leq 0.001$] were found between orientation-profile groups even when the executive form in learning was controlled. The pairwise comparisons indicated that the adjusted mean self-efficacy under the mastery-oriented group ($M_{adj} = 5.92$, SE = 0.131) and the success-performance group ($M_{adj} = 5.46$, SE = 0.129) differed significantly from the indifferent group ($M_{adj} = 4.49$, SE = 0.138) and the avoidance-oriented group ($M_{adj} = 4.77$, SE = 0.145). The executive form learning predicts positively self-efficacy.

Regarding the mastery goal structure, the effect of interaction term was not significant [$F = 0.489$ (3.167), $p = 0.690$], indicating a parallel effect of the executive form in learning in the profile groups. Significant differences in adjusted means [$F = 11.416$ (3.170), $p \leq 0.001$] were found between orientation-profile groups even when the executive form in learning was taken into account. When the effect of the executive form in learning was controlled, the effect of orientation-profile groups was still significant. The pairwise comparisons indicated that the adjusted mean of mastery-oriented group of soldiers ($M_{adj} = 5.53$, SE = 0.160) differs significantly from the indifferent group ($M_{adj} = 4.74$, SE = 0.172) and from the avoidance-oriented group ($M_{adj} = 4.18$, SE = 0.177). The success-performance-oriented group ($M_{adj} = 5.06$, SE = 0.157) differed from the avoidance-oriented group. The executive form in learning predicts positively the mastery goal structure.

Finally, regarding the performance goal structure, the effect of interaction term was not significant [$F = 1.178$ (3.166), $p = 0.320$] that indicates a parallel effect of the executive form learning in the profile groups. Significant differences in adjusted means [$F = 3.063$ (3.169), $p = 0.030$] were found between orientation profile groups even when the executive form in learning was controlled. The pairwise comparisons indicated that the adjusted mean of the mastery-oriented group ($M_{adj} = 2.59$, SE = 0.277) differed significantly from the avoidance-oriented group ($M_{adj} = 3.79$, SE = 0.299). The executive form learning predicts negatively classroom mastery structure.

Regarding the perceived strain, the effect of interaction term was not significant [$F = 0.299$ (3.167), $p = 0.826$], indicating a parallel effect of the executive form in learning in the profile groups. The resulting test for equality of the adjusted means

TABLE 3 | Mean differences on achievement goal orientations between goal-orientation groups.

Scale	Mastery-oriented $n = 47$		Success-performance oriented $n = 49$		Indifferent $n = 43$		Avoidance-oriented $n = 38$		*F (df)*	*p*	η^2
	M	SD	M	SD	M	SD	M	SD			
Mastery-Intrinsic orientation$_1$	5.81^{a}	0.900	4.62^{a}	1.34	3.30^{a}	01.01	2.25^{a}	0.992	87.962 (3,173)	<0.001	0.60
Mastery-Extrinsic orientation$_1$	5.83_{a}	0.951	5.41_{b}	0.846	3.90_{ab}	0.903	2.72_{ab}	01.06	97.860 (3,173)	<0.001	0.63
Performance-Approach orientation$_2$	4.76^{a}	1.23	5.24^{b}	0.778	3.65^{ab}	0.961	3.12^{ab}	0.866	67.454 (3,173)	<0.001	0.43
Performance-Avoidance orientation[1]	2.81^{a}	0.992	5.56^{ab}	0.897	2.58^{b}	1.17	3.57^{ab}	1.48	90.818 (3,173)	<0.001	0.54
Work-Avoidance orientation[2]	1.81^{ab}	0.680	2.94^{b}	1.14	2.54^{a}	0.960	5.32^{ab}	1.22	43.355 (3,173)	<0.001	0.61

Range is 1–7. Group means with the same superscript differ from each other at $p < 0.05$.
Post-hoc test [1]Tukey HSD, [2]Games-Howell.

TABLE 4 | Mean differences on self-efficacy, preferred forms of engagement in learning, and classroom goal structures between goal-orientation groups.

Scale	Mastery oriented $n = 47$		Success-performance oriented $n = 49$		Indifferent $n = 43$		Avoidance oriented $n = 38$		*F (df)*	*p*	η^2
	M	SD	M	SD	M	SD	M	SD			
Self-Efficacy[2]	5.92^{ab}	0.64	5.45^{a}	0.71	4.95^{b}	1.20	4.77^{a}	0.97	14.867 (3.173)	<0.001	0.21
Legislative form of engagement in learning[1]	5.48^{ac}	1.02	5.27^{b}	1.11	4.31^{bc}	1.33	4.01^{ab}	1.36	15.144 (3.173)	<0.001	0.21
Executive form of engagement in learning[1]	3.82	1.31	4.25	1.16	3.63	1.2	4.07	1.25	2.217 (3.173)	<0.088	0.04
Mastery goal structure[1]	5.51^{ac}	0.98	4.92^{b}	1.2	4.70^{c}	1.13	4.19^{ab}	1.27	10.944 (3.171)	<0.001	0.16
Performance goal structure[1]	2.59^{a}	1.90	3.45	1.92	3.35	1.74	3.81^{a}	1.91	3.226 (3.171)	<0.024	0.05
Perceived strain[2]	1.66^{a}	1.04	2.16^{b}	1.20	2.15^{c}	1.30	3.34^{abc}	1.52	13.072 (3.171)	<0.001	0.19

Range is 1–7. Group means with the same superscript differ from each other at $p < 0.05$.
Post hoc test [1]Tukey HSD, [2]Games-Howell.

TABLE 5 | Mean differences on self-efficacy, mastery goal structure, performance goal structure, and perceived strain by goal-orientation groups using a legislative form of engagement in learning as a covariate.

Scale	Mastery oriented $n = 47$		Success-performance oriented $n = 49$		Indifferent $n = 43$		Avoidance oriented $n = 38$					Effect of Legislative form of engagement in learning		
	M	SE	M	SE	M	SE	M	SE	*F (df)*	*p*	η^2	*F (df)*	*p*	η^2
Self-Efficacy	5.79^{ab}	0.131	5.37	0.126	5.05^{a}	0.134	4.93^{b}	0.147	7.169 (3)	<0.001	0.11	1.280 (3)	0.283	0.02
Mastery goal structure	5.57^{ab}	0.167	5.14^{c}	0.160	4.65^{a}	0.175	4.11^{bc}	0.188	11.099 (3)	<0.001	0.16	2.607 (3)	0.053	0.05
Performance goal structure	2.71	0.286	3.53	0.272	3.26	0.301	3.65	0.324	2.065 (3)	0.107	0.04	0.065 (3)	0.978	0.01
Perceived strain	1.69^{a}	0.191	2.18^{b}	0.184	2.13^{c}	0.201	3.31^{abc}	0.216	10.442 (3)	<0.001	0.16	1.027 (3)	0.382	0.02

Range is 1–7. Group means with the same superscript differ from each other at $p < 0.05$.

TABLE 6 | Mean differences on self-efficacy, mastery goal structure, performance goal structure, and perceived strain by goal-orientation groups using an executive thinking style as a covariate.

Scale	Mastery oriented $n = 47$		Success-performance oriented $n = 49$		Indifferent n = 43		Avoidance oriented $n = 38$					Effect of executive form of engagement in learning		
	M	SE	M	SE	M	SE	M	SE	*F*	*p*	η^2	*F (df)*	*p*	η^2
Self-Efficacy	5.92^{a}	0.131	5.46^{bc}	0.129	4.94^{ab}	0.138	4.77^{ac}	0.145	14.801 (3)	<0.001	0.21	0.832 (3)	0.478	0.02
Mastery goal structure	5.53^{ab}	0.160	5.06^{c}	0.157	4.74^{a}	0.172	4.18^{bc}	0.177	11.416 (3)	<0.001	0.17	0.489 (3)	0.690	0.01
Performance goal structure	2.59^{a}	0.277	3.42	0.270	3.38	0.299	3.79^{a}	0.299	3.063 (3)	0.030	0.05	1.178 (3)	0.320	0.00
Perceived strain	1.65^{a}	0.185	2.18^{b}	0.182	2.13^{c}	0.198	3.35^{abc}	0.205	13.173 (3)	<0.001	0.19	0.299 (3)	0.826	0.01

Range is 1–7. Group means with the same superscript differ from each other at $p < 0.05$.

found a significant difference [$F = 13.173$ (3.170), $p \leq 0.001$] in perceived strain between orientation-profile groups even when the executive form learning was taken into account. When the effect of the executive form in learning was controlled, the effect of orientation profile groups is still significant. The pairwise comparisons indicated that the adjusted mean of the mastery-oriented group ($M_{adj} = 1.65$, SE = 0.185), the success-performance-orientated group ($M_{adj} = 2.18$, SE = 0.182), and the indifferent group ($M_{adj} = 2.13$, SE = 0.198) differed significantly from the avoidance-oriented group ($M_{adj} = 3.35$, SE = 0.205). The executive form in learning predicts negatively perceived strain.

DISCUSSION

The aim of this study was to examine whether individuals' assessments and beliefs related to their own competence, preferred forms in learning, and evaluations of the learning environment vary as a function of their goal-orientation profiles. It was further explored whether the preferred forms in learning played a separate role in this association.

The goal-orientation-profile groups identified in this study are typical in a sense that they correspond quite well to those found in prior studies, in various age groups, as well as in educational contexts: mastery oriented, i.e. predominantly mastery goal profile; success-performance oriented, i.e., combined mastery and performance-approach goal profile, indifferent, i.e., average- or moderate-goal profile; and avoidance oriented, i.e., avoidant or work-avoidant goal profile (Tuominen-Soini et al., 2011; Niemivirta et al., 2019).

The identified motivational profiles differed in their self-evaluations of competence in a theoretically relevant pattern: mastery focused was related to higher self-efficacy, whereas avoidance focused and/or indifferent profile was maladaptive in this respect. What is more, the success-performance-focused profile was also related to higher self-efficacy, when compared to the avoidance-oriented profile, but not when compared to the indifferent profile, thus indicating that the self-efficacy evaluations in these two groups (success performance/indifferent) were close to one another. This confirms the idea that although the pursuit of performance goals (present in the success profile) may lead to higher achievement (when compared to, for example, mastery focus), this success comes with a price (Harackiewicz et al., 1998; Tuominen-Soini et al., 2008)—in this case, in terms of lower self-efficacy. Lastly, as is suggested also by a prior study (Barron and Harackiewicz, 2003; Ng, 2009), the focus on avoidance forms of performance goals has consistently unfavorable outcomes.

This generic pattern was also confirmed in other aspects. If taken that the legislative form of preferred engagement in learning is the adaptive form in a sense that exercising critical thinking or independent thinking is more desirable than following rules, the mastery-oriented profile appears adaptive. Further, perceiving your learning environment to be promoting understanding and learning—instead of outperforming others or appearing competent—will foster more adaptive motivational outcomes in time, and lastly, as less perceived strain is better than more perceived strain, the pattern described above holds. The mastery focused profile, and—although to lesser extent—success-performance-focused profile are more adaptive than the other two profiles.

However, to take this further, we postulated that perhaps this pattern might partly result also from the person—environment—match, arising from the specific, manneric thinking that the participants have adopted during their prior experience in military training, and may adopt again when returning to this specific educational environment. This, we believe, is indicated by the lack of differences regarding the executive form of preferred engagement. One would expect that the emphasis of legislative form by the mastery- and success-performance oriented should have been mirrored when examining the abiding to rules as in executive form (at least when concerning the mastery oriented—e.g., Senko and Miles, 2008). As this was not observed, it would seem that also those whose motivational disposition fosters preferences of exploration and trying new things also (in the context of military exercise) readily identify the importance and necessity to perform a task as instructed and following set rules.

When taking into account the preference for different types of engagement, we observed both similarities and changes in patterns of between-group differences, that is, when compared between the ANCOVA models and to the results of the series of ANOVAs.

To start with the similarities, the avoidance oriented scored highest in the perceived strain even when the preferred forms were controlled. This indicates that the disposition to strive to avoid effort and challenges is reflected in evaluations of the learning environment in terms of workload and demands by the instructor. Those with strong avoidance tendencies perceive higher strain even independent of their preferences of engagement. Reflecting this to previous studies, it has similarly been found that the avoidance-oriented profile tends to be less adaptive in terms of academic wellbeing and motivation compared to other goal orientation groups (Tuominen-Soini et al., 2012; Tuominen et al., 2020).

Also, the effects of achievement-goal-orientation profiles on the perceptions of mastery-goal structure held regardless of controlling the preferred forms of engagement. Mastery- and success-performance-focused profiles predicted higher perceptions of mastery cues in instruction, when compared with the more maladaptive profiles. Thus, the preferences for different types of instruction and activities do not enter the learners' interpretation of the features in a learning environment that promote learning and development.

Next, regarding the performance-goal structure of the learning environment, the avoidance oriented perceived learning environment to be more performance focused than the mastery oriented, if the executive form was controlled. But if the legislative form was taken into account, this difference was no longer detected. This slight change indicated that the independent effect of preferring looser control or instruction explained partly the perceptions of performance-focused cues in an instruction. We consider this effect to be somewhat small,

all in all, but perhaps the preference for legislative form above the other may lessen the sensitivity of learners to interpret their learning environment with terms of social comparison or appearance. However, the results concerning the performance goal structure need to be interpreted with some caution, given that a single-item scale was used in this.

Finally, what comes to the self-efficacy, the results concerning controlling the legislative form were similar to the "baseline" ANOVA pattern, that is the mastery oriented had the most positive self-evaluations when compared to the indifferent and the avoidance oriented. Similar effects have been found in the previous studies (Coutinho and Neuman, 2008). Then, the controlling of the executive form revealed an additional between-group difference; that is, the success-performance oriented now also differed significantly from the groups of a more maladaptive profile. Now, it is quite common that the predominantly mastery and combined mastery-performance profiles are somewhat similar to each other (*cf.* Niemivirta et al., 2019, p. 578), but it seems that, at least in this special context, again, this similarity is slightly affected by what the learners prefer in an instruction. When the preference for rules and strict instruction was controlled, the success-performance oriented appeared to be closer to the mastery oriented in their self-evaluations of their competences.

In summary, our results testify that the associations between personal-goal-orientation profiles and evaluations of learning environments are robust in a way that is only slightly affected by what way individuals prefer to operate in achievement situations. Learners' general and domain-specific achievement goal preferences are known to be somewhat clearly associated (e.g., Sparfeldt et al., 2015; Michel et al., 2020). Also, learners' motivational goal orientations, self-efficacy, and their tendencies in learning activities and metacognition are intertwined (Coutinho and Neuman, 2008; Soyer and Kirikkanat, 2019), which is, in a sense, visible in relationships between achievement goal preferences and self-efficacy beliefs revealed in our study.

Taking this further, the slight differences found do also point out the role of the environment in motivational outcomes (Lyke and Kelaher Young, 1996; Wolters and Gonzalez, 2008). This idea arises from the needs-press model: the personal needs that in our study are represented by tendencies to choose certain goals and prefer certain kinds of forms of engagement, and the learning environment or the environmental press, may the support or frustrate learners' needs, and learners' have a tendency to adapt, to some extent, to the external influence that is the press (Murray, 1962/1938, p. 38–42; Stern, 1970). To clarify, in this study, we do not assume goal orientations to determine preferred forms of engagement in learning or *vice versa* but rather that these factors are in interaction. Certain types of individual preferences are more probable given certain kinds of motivational patterns, but also that the demands of the environment have some influence in this.

Summarizing from the point of view of achievement goal theory, our findings indicate that the motivational profiles identified in this specific context and selective sample correspond well to prior research (for review, see Niemivirta et al., 2019), indicating that the basic principle that goal orientations are somewhat generalized dispositions is valid even in our circumstances or context. Also, regarding multiple-goal perspective, our findings show that the differential effect of certain goal patterns (e.g., Pintrich, 2000b; Linnenbrink and Pintrich, 2001) may be potentially partly explained by preferences for certain types of activities or patterns of behavior the learners acquire through adaptation to environmental pressures. Moreover, as differentially motivated learners' perceptions of instruction were slightly affected by their preferences for engagement, it seems reasonable to argue cautiously that certain types of preferences are more favorable than others, in terms of interplay between personal and classroom goals (Lau and Nie, 2008).

Regarding practical, instructional implications, we suggest that to start with, the educators need to be aware that across contexts and age groups, common motivational variation can be expected, and that pedagogical delivery and one's own competence are interpreted in different ways that relate to these motivational patterns. What is more, individuals prefer different things in learning context: clear guidance and sets of rules may appear restrictive to some learners, whereas others may perceive degrees of freedom in classwork as lack of instruction. However, the learners may adapt their preferences if exposed to a very strict or rigid instructional climate for a length of time. It can safely be assumed that a learning environment that would be optimal to every student is unrealistic, but identifying relevant features in instruction and trying to balance between guidance and exploration with a purpose of scaffolding responsibility and interest in learning is a sound principle supported by our results.

All in all, some limitations are to be taken into account when considering the findings of our study. First, our data was cross-sectional, so the main effects are not to be taken as evidence of causality as such. Second, the exercises in which we gathered data were relatively short, so the actual dynamics of how and with what mechanism the participants preferences were formed, or in other words, what was the specific influence of the environment, remain to be examined in future studies. Lastly, we also do not have in our data measures to represent actually how the instruction was delivered, but this was only assumed based on general information and first-hand experience from other exercises. Hence, we have no direct information of how the role of the instructors may have varied within or during the training, in terms of authoritative role instructors took, or how direct they were in what comes to interaction with trainees. We recommend that these effects should be studied in the future with longitudinal data and specific measures of the forms of instruction, or perhaps by observing the pedagogical delivery in a field.

To conclude, due to the specific sample and context, we do not suggest that these findings are generalisable to different contexts. Rather, we present that motivational profiles in this selective sample and in a very special context were similar to those observed in more generic environments and populations, and their theoretically relevant main effects were also extended to our context.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because authors are not entitled to share data concerning military personnel without specific application that would be duely processed—according to the instruction at the moment. National Defense University is piloting open data procedures during 2022. Requests to access the datasets should be directed to antti-tuomas.pulkka@mil.fi.

ETHICS STATEMENT

This study was reviewed and approved by National Defense University, Finland. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

A-TP was responsible for the designing of the study and planning of the article, as well as collecting the data. LB was responsible for most of the data analyses of the study, but the A-TP commented on the application of analysis and preliminary results. A-TP and LB were responsible for writing of the article, but the A-TP commented on and made suggestions for editing the text as a whole. Both authors contributed to the article and approved the submitted version.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX

TABLE A1 | Two-factor solution and results of item analysis for preferred forms of engagement in learning.

Factor/Items	α	Factor loading	Corrected item-total correlation	Variance explained
1. Legislative form of engagement in learning	0.801			34.46
I would like to experiment new ways of performing tasks and solving problems in the exercise		0.858	0.671	
There should be field problems in the exercise that could be solved in ways of one's own choosing		0.775	0.671	
2. Executive form of engagement in learning	0.666			25.99
There should be field problems and tasks in the exercise where one can follow a specific routine or given instructions		0.728	0.499	
I would like to follow certain rules or instructions in the tasks of the exercise		0.713	0.499	

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Effects of perceived teacher support on motivation and engagement amongst Chinese college students: Need satisfaction as the mediator

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College students' motivation and engagement are regarded as essential factors to promote their academic development and wellbeing. However, motivation and engagement among college students appear to decline after they enter the university. Guided by the framework of self-determination theory, this study attempted to explore a motivational model of how three dimensions of perceived teacher support (autonomy, structure, and involvement) related to student motivation and class engagement, using need satisfaction as a mediator. Drew on a survey of the perceptions of 705 Chinese university students, the results showed that besides structure, both autonomy support and involvement positively related to students' need satisfaction. Further, need satisfaction was positively associated with autonomous motivation, controlled motivation, and class engagement and negatively linked with amotivation. Yet, only autonomous motivation was positively predicted for class engagement. Need satisfaction and the chain from need satisfaction to autonomous motivation were found to be the significant mediators. The practical implications of educational practices are discussed.

KEYWORDS

teacher support, motivation, class engagement, need satisfaction, self-determination theory, Chinese college students

Introduction

College students' motivation and engagement have a predictive effect on their school success and adaptive development, such as academic performance (Taylor et al., 2014) and subjective wellbeing (Hope et al., 2019). Nonetheless, evidence shows that college students' motivation and class engagement tend to decline after they enter the university (Trolian and Jach, 2020). Autonomous motivation among Chinese college students has

been reported to fall rapidly from year one to year two (Pan and Gauvain, 2012). Hence, it is imperative to identify the predictors for promoting students' motivation and engagement in their college study, especially at the commencement of college, which is the current study's primary objective.

This study draws on self-determination theory (SDT; Deci and Ryan, 2000; Ryan and Deci, 2020) to explore the core factors associated with students' motivation and engagement. As a well-established theory, SDT provides a prominent framework that differentiates between quality and quantity of motivation, and also postulates a model to explain how contextual (e.g., perceived teacher support) and personal (i.e., need satisfaction) factors can jointly contribute to student motivation and engagement. Nevertheless, only few studies applied SDT to examine this full motivational sequence in a single integrated model (e.g., Zhou et al., 2019b; Leo et al., 2022). Grounded on SDT, the present study aims to test how Chinese college students' perceptions of their teachers' support for autonomy, structure, and involvement relate to their need satisfaction and consequently their different types of motivation, which in turn, link to their class engagement.

SDT-based motivational research

Student motivation and class engagement

Students participate in school activities for different reasons (Deci and Ryan, 2000; Guay, 2021). According to the extent of self-determination among these reasons, SDT has distinguished three distinctive but continuous types of motivation, namely intrinsic motivation, extrinsic motivation, and amotivation (Deci and Ryan, 2000; Ryan and Deci, 2020). *Intrinsic motivation* refers to engaging in a learning activity for the sake of curiosity, interest, or enjoyment. It represents the highest level of autonomy or self-determination. *Extrinsic motivation* pertains performing behaviors for instrumental reasons to achieve other benefits, which includes four extrinsic motivation subtypes, namely, external, introjected, identified, and integrated regulations (from low to high level of self-determination) (Deci and Ryan, 2000). In schooling life, external regulation occurs when a student is driven to academic activities by external pressures (e.g., rewards or punishments). Introjected regulation relates to being motivated to learning activities by internal pressures (to obtain self-esteem or to avoid feeling guilt or shame). Identified regulation is exhibited when students are driven to study because they find its value and significance. Integrated regulation occurs when a learning behavior is consistent with students' sense of self. Finally, *amotivation* refers to the absence of any intention and volition to involve in a learning activity (Ryan and Deci, 2020).

Recent meta-analyses have proven the strong intercorrelations among identified regulation, integrated regulation, and intrinsic motivation (Vasconcellos et al., 2020). These three forms of motivation have been combined into autonomous motivation, representing high-quality motivation, whereas external and introjected regulations have typically been conceptualized as controlled motivation, reflecting low-quality motivation (Deci and Ryan, 2000). Indeed, autonomous motivation, controlled motivation, and amotivation have been widely discussed in SDT literature (Vasconcellos et al., 2020; Guay, 2021; Leo et al., 2022). Research has indicated that integrated regulation and intrinsic motivation share conceptual properties, which cause difficulties to differentiate between these two motivation subtypes (Vasconcellos et al., 2020; Bureau et al., 2022). Consequently, integrated regulation is rarely assessed in SDT studies on students whose identity is still developing (Guay, 2021; Bureau et al., 2022). Following prior SDT research (e.g., Amoura et al., 2015; Leo et al., 2022), the current study examined Chinese college students' autonomous motivation, controlled motivation, and amotivation, yet did not include their integrated regulation.

Numerous SDT-based studies have revealed that academic motivation is associated with class engagement, which has been described as behavioral, emotional, and cognitive involvement in the classroom (Fredricks et al., 2004). Autonomous motivation has been found to positively predict engagement across various domains like one specific subject (mainly in physical education, PE; Leo et al., 2022), general classes (e.g., Zhou et al., 2019b), and competitive sports (Pelletier et al., 2001). This effect exists among schooling years from primary schools (e.g., Zhou et al., 2019b), high schools (e.g., Standage et al., 2005), to universities (e.g., Behzadnia et al., 2018). In contrast, controlled motivation and amotivation have been found to negatively predict engagement-related variables (e.g., Sánchez-Oliva et al., 2014). In PE classes, however, controlled motivation has been shown to positively link to high school students' concentration (Maldonado et al., 2019); or it is unable to statistically predict engagement-related variables (Behzadnia et al., 2018; Zamarripa et al., 2021; Leo et al., 2022). Also, amotivation has been found to fail to predict desirable outcomes (e.g., emotional engagement in PE; Standage et al., 2005). These contradicting findings suggest that diverse antecedents may affect students' motivation and engagement, and further investigation is needed for clarifying the associations amongst these variables.

The importance of need satisfaction and need support

SDT proposes that one personal factor, specifically, the satisfaction of three basic needs for autonomy, competence,

and relatedness, can foster students' psychological growth (e.g., motivation and engagement), regardless of students' cultural background (Deci and Ryan, 2000; Ryan and Deci, 2020). *The need for autonomy* is conceptualized as a general feeling of willingness and freedom to perform an activity. *The need for competence* reflects the desire to feel effectiveness, mastery, accomplishment, and achievement. *The need for relatedness* corresponds to the sense of being accepted by significant others, belonging to a group, and connecting with the social world (Ryan and Deci, 2020). Considerable SDT-based research has demonstrated that, within the school context, students who experience high levels of need satisfaction can predict more high-quality motivation and class engagement (e.g., Zhou et al., 2019b). Nevertheless, the pattern of associations between need satisfaction and low-quality motivation was reported differently in the literature (e.g., Vasconcellos et al., 2020). Some scholars identified that the association between need satisfaction and controlled motivation is positive (e.g., Sánchez-Oliva et al., 2014), though some found it is non-significant (e.g., Behzadnia et al., 2018). Inconsistent with SDT, elementary school students' amotivation in PE was not predicted by their need satisfaction (e.g., Sánchez-Oliva et al., 2014). Therefore, further research is required to identify the relations between need satisfaction and low-quality motivation (controlled motivation and amotivation) within SDT sequential model.

As one important social agent in school, teachers can nurture students' three fundamental needs through their teaching practices (Deci and Ryan, 2000; Ryan and Deci, 2020). Within SDT, *teacher support* refers to those supportive teaching behaviors that can satisfy students' basic psychological needs, which includes three interrelated but independent dimensions, namely autonomy support, structure, and involvement (Reeve et al., 2004; Ryan and Deci, 2020). *Autonomy support* points to the teaching behaviors inspiring students' inner motivational resource, which consists of supporting students' interests and preferences, adopting students' perspectives, giving rationales for mandatory learning tasks, encouraging students to make their own decisions, and accepting students' negative emotions. *Structure*, which is seen as competence support, is described as all those teaching strategies to provide a predictable and consistent learning environment, mainly being accomplished by explaining realistic goals and expectations, giving clear instructions, offering appropriate feedback, and providing optimal challenges. Finally, *involvement*, namely relatedness support, is related to students' feeling to bond with their teachers, which is usually practiced by teachers displaying affection toward students, providing inspiration and appreciation, dedicating time and resources, and communicating sympathetically (Reeve et al., 2004; Ryan and Deci, 2020).

Although SDT posits all three dimensions of teacher support that are indispensable for student motivation and engagement, much of the empirical research has solely confirmed the unique effects of overall teacher support (e.g., Leo et al., 2022) or one dimension of teacher support (mainly in autonomy support) (e.g., Zhou et al., 2019b). Only limited SDT research has simultaneously explored the joint effects of all three aspects of teacher support on students' motivational outcomes (Stroet et al., 2013; Hornstra et al., 2021; Olivier et al., 2021). On the one hand, some research has found that all three teacher support dimensions relate positively to motivational outcomes, such as, need satisfaction and motivation in PE among British students with an age mean of 12.81 years (Taylor and Ntoumanis, 2007), reading motivation among Flemish students of 15 years old (De Naeghel et al., 2014), as well as need satisfaction and class engagement among American students in 1st through 12th grade (Tucker et al., 2002). However, conversely, other research has shown that not each of the three teacher support aspects can predict motivational outcomes. For instance, only students' perceived structure and involvement, but not autonomy support, could predict their engagement (Skinner and Belmont, 1993). Except for the positive effects of autonomy support and involvement, teacher-reported structure negatively predicted students' assessed need satisfaction in school (Hornstra et al., 2020). Observed teachers' structure before PE activity could negatively predict students' engagement (González-Peño et al., 2021); whereas students' reported structure in a Dutch language class failed to predict student engagement being measured by student, teacher, and observer (Lietaert et al., 2015). Thus, the current study would assist to clarify the combined contributions of perceived teachers' autonomy support, structure, and involvement to the motivational process of students.

The present study

Overall, the aforementioned findings have supported the SDT-based motivational model of teacher support → need satisfaction → motivation → engagement (Vallerand, 1997; Ryan and Deci, 2020). However, several prior work features limit the possibility to draw a definitive conclusion. Our work contributes to this research field in the following aspects.

Firstly, the bulk of SDT research has focused on autonomy support or considered teacher support as one overall factor. Very little attention has been devoted to the combined roles of autonomy support, structure, and involvement (Hornstra et al., 2021; Olivier et al., 2021). It is recognized, however, that autonomy support, structure, and involvement all should be considered to facilitate motivational processes (Ryan and Deci, 2020). Hence, the present study was designed to identify the role of the three aspects of teacher support, which would extend previous findings.

Secondly, numerous SDT studies have examined the interrelations among several motivational variables, yet only few studies have tested the full sequence of associations within one single integrated model (Leo et al., 2022). So far, the chain of need satisfaction to autonomous motivation has been revealed to mediate the association between overall teacher support and engagement (Standage et al., 2005; Zhang et al., 2011), as well as between teacher autonomy support and engagement-related variables (Leo et al., 2022). As discussed earlier, however, the relations between need satisfaction and low-quality motivation (controlled motivation and amotivation) as well as between the latter and student engagement have been demonstrated to be mixed and inconclusive (Standage et al., 2005; Sánchez-Oliva et al., 2014; Behzadnia et al., 2018; Leo et al., 2022). As such, the application of the full SDT-sequential model would help to clarify the possible mediating role of need satisfaction and different motivation types in the relations between the three aspects of teacher support and students' class engagement.

Thirdly, accumulated evidence in this area has mainly been based on students from Western individualistic contexts (e.g., Standage et al., 2005; Zhang et al., 2011; Leo et al., 2022). Some Chinese researchers questioned that, under the collectivistic context, autonomy appears to be unlikely to contribute to optimal outcomes (e.g., Wu et al., 2014). Consequently, it is worthwhile to investigate the SDT-sequential model according to a sample from China, which is representative of the typically Eastern collectivistic culture (Zhou et al., 2019a). Further, as mentioned above, autonomous motivation was found to dramatically decline between freshmen and sophomores in China. Therefore, we attempted to explore the prerequisite of motivation and engagement among Chinese university students, which has rarely been investigated in SDT research.

Finally, most of the earlier studies have predominantly been conducted only on one subject (mainly in PE) (Vasconcellos et al., 2020). Nevertheless, students can be affected by the teachers in different subjects rather than teachers of one subject. While motivation in one specific subject is more likely to be supported by the teacher who is teaching this subject, motivation in the general learning activities is more likely to be personality-driven (Vallerand, 1997). It is necessary to test the predictive role of need support provided by all of the involved teachers.

In summary, to our knowledge, no existing literature has examined the full SDT-sequential model that simultaneously considers the joint effect of perceived teachers' autonomy support, structure, and involvement on three motivation subtypes and class engagement among Chinese college students. Specifically, grounded on SDT and the past findings, we formulated the following hypotheses: (1) Perceived teachers' autonomy support (Hypothesis 1a), structure (Hypothesis 1b), and involvement (Hypothesis 1c) would all positively relate to students' overall need satisfaction; (2) The latter would be positively associated with autonomous motivation (Hypothesis 2a), controlled motivation (Hypothesis 2b), and class engagement (Hypothesis 2c), whereas negatively related with amotivation (Hypothesis 2d); (3) Class engagement would be predicted by autonomous motivation (positively, Hypothesis 3a), controlled motivation (negatively, Hypothesis 3b), and amotivation (negatively, Hypothesis 3c), irrespectively; (4) The associations between three teacher support dimensions and engagement could be mediated by need satisfaction (Hypothesis 4a) and the chains from need satisfaction to autonomous motivation (Hypothesis 4b), controlled motivation (Hypothesis 4c), and amotivation (Hypothesis 4d).

TABLE 1 Basic characteristics of participants.

Variables		*n* (%)
Age	Mean ± SD	18.45 ± 0.66
Gender	Male	143 (20.28%)
	Female	562 (79.72%)
Grade	Freshman	497 (70.50%)
	Sophomore	208 (29.50%)
Birthplace	Rural areas	490 (69.50%)
	Urban areas	215 (30.50%)
Major	Human sciences	380 (53.90%)
	Natural sciences	325 (46.10%)

Materials and methods

Participants and procedure

By randomized cluster sampling method, 705 students from 22 classrooms were recruited from a university located in southeast China. Of this sample, the mean age was 18.45 years (SD = 0.66, ranging = 17–23 years). The majority of the students were female (79.72%) and freshmen (70.5%). With regards to their major, the students studying human sciences (e.g., English, music, and economy) and natural sciences (e.g., maths, physics, and computer science) accounted for 53.9 and 46.1%, respectively (see Table 1).

The ethical approval was granted by the University of the first author. Consent forms were collected from the participating students who read the information letter that introduced the research purpose, the process of data collection, and the instructions regarding the anonymous, confidential, and voluntary nature of the study. The participating students were told that there were no right or wrong answers, and they were encouraged to respond to each item honestly according to their own experiences. To minimize the honeymoon bias, the

questionnaires were administered at the end of the semester after students had enough communication with their teachers. Data were collected in the classroom. Students spent ∼15 min filling out the questionnaires voluntarily without compensation.

Measures

The main variables of the study including perceived teacher support, need satisfaction, motivation, and class engagement were measured with specific tools. Students rated each item on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Each variable score was calculated by averaging its respective item scores.

Perceived teacher support

To tap students' perceptions of teacher support, we used the shortened version of the Teacher as Social Context scale (TASC; Belmont et al., 1992; Haerens et al., 2013). Each dimension (autonomy support, structure, and involvement) consists of six items. This tool has been proved to be reliable and valid among Chinese students (Zhou, 2016).

In the current study, two items from the autonomy subscale ("My teachers don't explain why what I do in school is important to me") and from the involvement subscale ("I can't depend on my teachers for important things.") reduced the internal consistency of its subscale, thus, these two items were removed. Finally, 16 items were used to assess the perceived autonomy support (five items, e.g., "My teachers listen to my ideas."), structure (five items, e.g., "Teachers show me how to solve problems for myself"), and involvement (six items, e.g., "My teachers like me"), respectively.

Need satisfaction

We used the Activity-Feelings States (AFS; Reeve and Sickenius, 1994) to evaluate the levels of satisfaction of three basic psychological needs. The stem for this scale was "During classes, I feel…". Each subscale consists of three items: autonomy need (e.g., "freedom"), competence need (e.g., "capable"), and relatedness need (e.g., "I belong and the people here care about me"). All items were averaged to represent overall need satisfaction. Previous research has demonstrated the AFS to be reliable and valid in assessing need satisfaction among students in China (e.g., Zhou et al., 2017, 2019b) and other Asian countries (e.g., Japan, Oga-Baldwin et al., 2017).

Motivation

To clarify students' motivation for attending college, the Academic Motivation Scale (AMS; Vallerand et al., 1992) with 28 items was used. Participants responded to the items following the stem, "Why do you go to college?" Autonomous motivation was assessed by 16 items, including 12 items from intrinsic motivation (e.g., "Because for me, college is fun") and four items from identified regulation (e.g., "Because I think that education will help me better prepare for the career that I have chosen"). Controlled motivation was evaluated by eight items, concerning four items each from external regulation (e.g., "In order to obtain a more prestigious job later on") and introjected regulation (e.g., "To show myself that I am an intelligent person"). Finally, amotivation consisted of four items (e.g., "Honestly, I don't know, I really feel that I am wasting my time in college"). The reliability and validity of AMS have been demonstrated by the work of Chen (2007) among Chinese participants.

Class engagement

To capture the general perceptions of class engagement, the Individual Self-Report Engagement scale was used (Jang et al., 2010; Zhou et al., 2019b). The stem for the scale was "During classes, I…". The questionnaire included behavioral engagement (two items; e.g., "paid attention"), cognitive engagement (one item; "tried to learn as much as I could"), and emotional engagement (one item; "enjoyed the lessons").

Data analysis

The preliminary results were calculated in SPSS Statistics 27.0. Research has shown that some socio-demographic factors are associated with motivational variables, such as gender, grade, family site, and college major (e.g., De Naeghel et al., 2014; Maulana et al., 2016; Vasconcellos et al., 2020; Opdenakker, 2021). Accordingly, we tested the bivariate relations between these four socio-demographic factors and the substantive variables. To assure the models' parsimoniousness, only significant socio-demographic factors were included as covariates for the main analyses. Additionally, we also tested the risk of multicollinearity among autonomy support, structure, and involvement. The results of collinearity statistics suggested no potential multicollinearity (tolerance $= 0.651 > 0.50$; variation inflation factor [VIF] $= 1.535 < 2.0$).

The main analyses were performed by Mplus Version 8.3 (Muthén and Muthén, 1998-2018). Due to the nested data (i.e., the students belonging to 22 classrooms), we calculated the intra-class correlations (ICCs). Except for autonomy support and amotivation, the results of ICCs were lower than 0.10 (see Table 2), demonstrating that the substantial variance was at the student level. Further, the number of classrooms ($n = 22$) was not sufficient to test the proposed model at the classroom level. Hence, to account for the nonindependence of observations of the nesting data, we set "classroom" as the clustering variable through the "Type = Complex" option in Mplus. Meanwhile, apart from the dependent variable (i.e.,

TABLE 2 Descriptive statistics, ICC, and correlations among the study variables.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender	1											
2. Grade	−0.08*	1										
3. Family Site	0.05	0.02	1									
4. Major	−0.14**	0.68**	−0.04	1								
5. Autonomy Support	0.09*	−0.08*	0.12**	−0.12**	1							
6. Involvement	0.03	−0.01	0.15**	−0.06	0.62**	1						
7. Structure	0.06	0.02	0.17**	−0.05	0.66**	0.58**	1					
8. Overall Need Satisfaction	0.08*	−0.04	0.05	−0.06	0.44**	0.50**	0.38**	1				
9. Autonomous Motivation	0.18**	−0.11**	0.09*	−0.17**	0.35**	0.38**	0.29**	0.51**	1			
10. Controlled Motivation	0.12**	0.10**	0.08*	0.02	0.14**	0.20**	0.19**	0.30**	0.50**	1		
11. Amotivation	−0.15**	0.21**	−0.11**	0.19**	−0.31**	−0.30**	−0.25**	−0.34**	−0.43**	−0.06	1	
12. Class Engagement	0.18**	−0.03	0.08*	−0.10**	0.39**	0.48**	0.33**	0.55**	0.48**	0.23**	−0.36**	1
Mean					3.16	2.94	2.93	3.47	3.79	3.54	2.21	3.26
SD					0.61	0.66	0.60	0.57	0.54	0.58	0.74	0.66
α					0.74	0.83	0.72	0.82	0.86	0.75	0.70	0.80
ω					0.74	0.83	0.70	0.82	0.86	0.75	0.70	0.79
ICC					0.14	0.07	0.09	0.02	0.06	0.03	0.11	0.06

N = 705; α, Cronbach's alpha; ω, omega value; ICC, Intraclass Correlation Coefficient.
*$p < 0.05$, **$p < 0.01$, the same as below.

class engagement), all study variables were group-mean centered around the classroom mean.

Structural equation modeling analysis (SEM) was conducted to verify the proposed models. So far, the estimation of sample size for SEM is flexible, and there is no rule of thumb that can be applied to all studies (Kyriazos, 2018). In this study, the ratio of the sample size to parameters is 5.83 (with 705 cases for 121 free parameters), which is below the strict ratio recommendation of 20 (Kline, 2016), but still in accord with the minimal five cases per parameter (Bollen, 1989). Due to the sample size, we used the parceling strategy, which was recommended in previous research (Little et al., 2002; Kline, 2016; Zhou et al., 2019b). According to the values of loading items, the latent variables for autonomy support, structure, and involvement were indicated by three parcels each, and autonomous motivation and controlled motivation were indicated by four parcels each. Parceling items are available upon request. Furthermore, the latent construct for overall need satisfaction was represented by its three subscales. In the hypothesized model, amotivation and class engagement were indicated by their four items, independently.

A two-step approach was used to test the presumed model (Anderson and Gerbing, 1988). Firstly, confirmatory factor analysis (CFA) was used to evaluate the measurement model. The proposed measurement model was an eight-factor model consisting of three teacher support dimensions, overall need satisfaction, three motivation subtypes, and class engagement; all eight factors were allowed to correlate with one another. In addition, we also tested a six-factor model which combined nine parcels of three teacher support dimensions into one factor, the rest was the same as the eight-factor model. Secondly, maximum likelihood estimation with robust standard errors (MLR) was conducted to examine the adequacy of the hypothesized model (Model 1). Meanwhile, the "IND" command in Mplus was used to compute the indirect effects. Model 1 was a full mediation model, that is, after controlling for significant demographic covariates, overall need satisfaction, followed by three motivation subtypes, would mediate the links between three teacher support dimensions and class engagement; and the three dimensions of teacher support were intercorrelated with each other, so did the three types of motivation.

Finally, according to SDT and past research, the alternative models were tested.[1] As social support was indicated to link directly to motivation and engagement (Maulana et al., 2016; Olivier et al., 2021; Opdenakker, 2021), we examined a partial mediation model (Model 2). In Model 2, the three teacher support dimensions would directly predict three motivation types and class engagement, and the remaining was the same as Model 1. Moreover, both external regulation

1 Based on the research of Olivier et al. (2021), we tested two alternative models, namely, the synergistic model and the bifactor-CFA global model. The results showed that our data did not support either of these two models because neither of them could converge.

and introjected regulation have been found to uniquely contribute to engagement (e.g., Pelletier et al., 2001), hence, we tested Model 3. Model 3 included four motivation subtypes (autonomous motivation, introjected regulation, external regulation, and amotivation), and the rest was the same as Model 1.

Considering the sample size, an acceptable model fit is indicated by CFI and TLI values equal to or exceeding 0.90 as well as SRMR and RMSEA values lower than 0.08 (Schumacker and Lomax, 1996; Hu and Bentler, 1999; Van de Schoot et al., 2012). Further, a change in CFI values (ΔCFI $>$ 0.01) is considered a significant difference between two nested models (Cheung and Rensvold, 2002).

Results

Preliminary analyses

Table 2 presents the Cronbach's alpha and omega values (ranging from 0.70 to 0.86) for each variable under study, indicating an acceptable internal consistency of each scale (Dunn et al., 2014). We also reported the CFA results of the TASC [χ^2 (98) = 439.91, $p < 0.001$, RMSEA and 90% CI = 0.070(0.064–0.077), SRMR = 0.05, CFI = 0.92, TLI = 0.90], AFS [χ^2 (20) = 68.90, $p < 0.001$, RMSEA and 90% CI = 0.059(0.044–0.074), SRMR= 0.03, CFI = 0.97, TLI = 0.95], and AMS [χ^2 (327) = 1222.50, $p < 0.001$, RMSEA and 90% CI = 0.062(0.059–0.066), SRMR = 0.07, CFI = 0.86, TLI = 0.83], which supported the factorial structure of these scales.

As can be seen in Table 2, all three teacher support dimensions related positively to need satisfaction, autonomous and controlled motivation, and class engagement, but they were all negatively linked to amotivation. Next, need satisfaction was positively related to autonomous motivation, controlled motivation, and class engagement. Lastly, class engagement was positively associated with autonomous and controlled motivation. In general, these findings supported the expected associations among the study variables.

Table 2 also displayed the results of the correlations between the demographic factors and the study variables. We included the significant demographic factors in the models by adding them as predictors of each related latent variable. In addition, we looked at the correlations between each teacher support dimension and each need satisfaction aspect. The values of these interrelations (available upon request) were similar to each other, indicating that the three need satisfaction dimensions could be combined into one overall score to improve model parsimony.

To test the mean differences among the three dimensions of teacher support, we conducted the general linear model repeated measures test [Wilks' Lambda = 0.78, F (2, 703) = 98.06, $p < 0.001$, partial $\eta^2 = 0.22$]. Follow up analyses suggested that students reported a higher level of teacher autonomy support, compared to structure [$p < 0.001$] and involvement [$p < 0.001$].

Primary analyses

The CFA results were displayed in Table 3. Compared to the six-factor model, the eight-factor model was supported (ΔCFI = 0.037 $>$ 0.01). Meanwhile, each observed variable in the eight-factor model strongly loaded on its corresponding latent factor (mean $\lambda = 0.698$).

Furthermore, SEM results showed that both Model 1 and Model 2 yielded acceptable fit indices, except for Model 3 (see Table 3). Compared to the full mediation model (Model 1), however, the partial mediation model (Model 2) did not show a better model fit (ΔCFI = 0.003 $<$ 0.01).

As Figure 1 depicted (Model 1), both autonomy support and involvement were positively related to overall need satisfaction, *which* offered support for hypotheses 1a and 1b. However, different from hypothesis 1c, perceived structure could not statistically predict need satisfaction ($\beta = -0.089$, $p = 0.519$). Aligning with hypotheses 2a, 2b, *2c,* and 2d, need satisfaction was found to be positively linked to autonomous motivation, controlled motivation, and class engagement, whereas negatively related to amotivation. Considering the positive path from autonomous motivation to class engagement, hypothesis 3a was supported; however, SEM results failed to support hypotheses 3b and 3c, because controlled motivation ($\beta = -0.102$, $p = 0.186$) and amotivation ($\beta = -0.005$, $p = 0.961$) did not significantly relate to class engagement.

Table 4 presents the significant indirect effects of Model 1. In support of hypothesis 4a, need satisfaction played a statistically mediating role in the relations between two teacher support aspects (i.e., autonomy support and involvement) and three types of motivation (i.e., autonomous motivation, controlled motivation, and amotivation). However, only the chain of need satisfaction-autonomous motivation significantly mediated the association between perceived involvement and class engagement, supporting hypothesis 4b.

Discussion

SDT has asserted the effects of all three teacher support dimensions on motivational outcomes, however, most SDT-studies have only confirmed the contribution of teacher autonomy support or overall teacher support (Ryan and Deci, 2020). The overarching focus of the present study was to investigate a full sequential model which could help to test the joint effects of all three teacher support dimensions on student motivational outcomes. In general, after accounting for the nested nature of the data and four socio-demographic

TABLE 3 Fit statistics for the models.

Model tested	χ^2	*df*	χ^2/df	*p*	RMSEA and 90% CI	SRMR	TLI	CFI
CFA models								
Six-factor model	1269.30	335	30.79	<0.001	0.063(0.059–0.067)	0.07	0.86	0.879
Eight-factor model	972.91	322	30.02	<0.001	0.054(0.050–0.057)	0.07	0.90	0.916
SEM models								
Model 1	1008.61	425	20.37	<0.001	0.044(0.041–0.048)	0.05	0.90	0.912
Model 2	979.233	413	20.37	< 0.001	0.044(0.041–0.048)	0.05	0.90	0.915
Model 3	3514.44	548	60.41	<0.001	0.088(0.085–0.090)	0.07	0.60	0.645

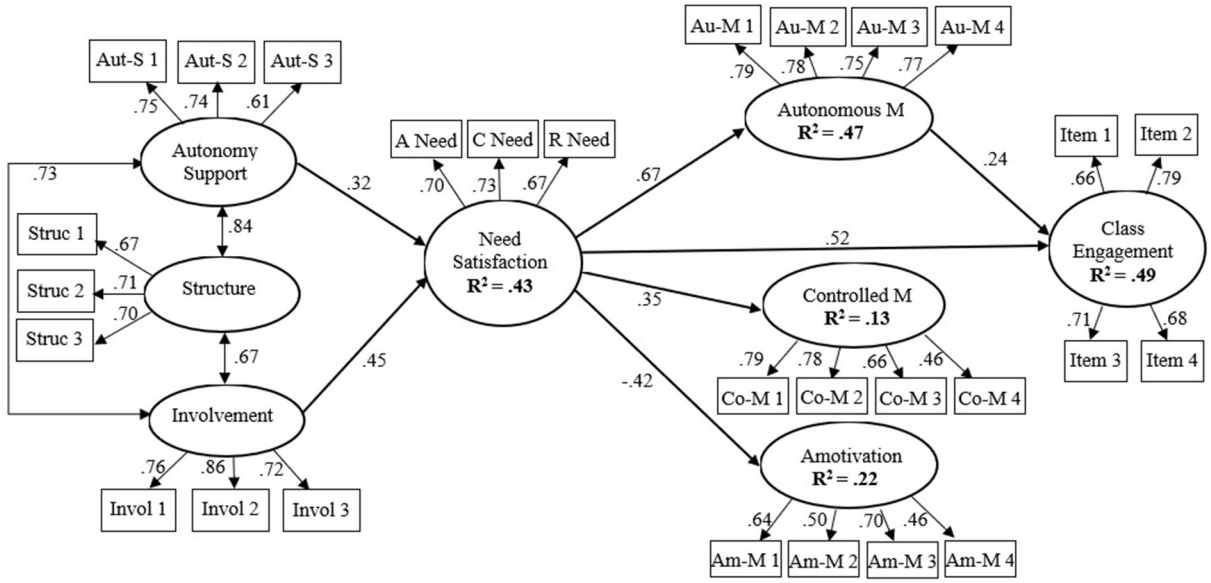

FIGURE 1
The structural model of the relations between teacher support, need satisfaction, motivation, and engagement among Chinese college students. All presented path coefficients are standardized and significant ($p < 0.05$). To avoid cluttering, this figure did not depict the non-significant path coefficients, the correlations between three subtypes of motivation, and the covariates (gender, grade, area, and major). Aut-S 1-3, Invol 1-3, and Struc 1-3 are the parcels for autonomy support, involvement, and structure, respectively. A Need, C Need, and R Need represented the needs for autonomy, competence, and relatedness, respectively. Autonomous M and Controlled M represented autonomous motivation and controlled motivation, respectively. Au-M 1-4, Co-M 1-4, and Am-M 1-4 are the parcels for autonomous motivation, controlled motivation, and amotivation, respectively. Gender, grade, family site, and major were not depicted for clarity, although they were controlled. The correlations of three teacher support dimensions and three motivation subtypes were as follows: $r_{\text{autonomous motivation and controlled motivation}} = 0.43$; $r_{\text{autonomous motivation and amotivation}} = -0.35$; $r_{\text{controlled motivation and amotivation}} = 0.17$.

factors, the results of the present study were in agreement with most SDT hypotheses. That is, both perceived teachers' autonomy support and involvement were positively linked to students' need satisfaction, and the latter was positively associated with autonomous motivation, controlled motivation, and class engagement whereas negatively related to amotivation. However, only autonomous motivation was linked to class engagement. Finally, need satisfaction mediated the links from autonomy support and involvement to three motivational types, yet only the chain of need satisfaction-autonomous motivation statistically mediated the association between involvement support and class engagement.

The SDT-motivation sequence among Chinese college students

Both autonomy support and involvement, but not structure, were found to contribute to Chinese college students' satisfaction of three basic psychological needs, which supported the findings in the research of Lietaert et al. (2015). However, these findings were not in line with the results of research, which has revealed that the influence of teachers' structure can be positive (Tucker et al., 2002; Taylor and Ntoumanis, 2007; De Naeghel et al., 2014), or conversely, negative (Hornstra et al., 2020; González-Peño et al., 2021). One reason for such

TABLE 4 The significant indirect path coefficients in model 1.

Predictors	Mediators	Outcomes	β	SE	p
From teacher support to need to motivation					
Involvement	Need	Autonomous motivation	0.30	0.06	<0.001
Autonomy support	//	//	0.22	0.09	0.023
Involvement	//	Controlled motivation	0.17	0.04	<0.001
Autonomy support	//	//	0.11	0.06	0.022
Involvement	//	Amotivation	−0.19	0.05	<0.001
Autonomy support	//	//	−0.14	0.07	0.043
From teacher support to need to motivation to engagement					
Sum of indirect from involvement to engagement			0.06	0.02	0.009
Involvement	Need-autonomous motivation	Engagement	0.07	0.03	0.015

inconsistent results is perhaps due to the various domains, that is, regarding the context of PE, reading, school activity, or classes in general. Another reason is related to the participants' characteristics. The samples of previous research included primary and high school students in the Western culture (e.g., Taylor and Ntoumanis, 2007), while our work was based on the experiences of Chinese college students. Compared with students in primary and high schools, university students have more opportunities to make choices in their learning programs, courses, and schedules (Ratelle et al., 2007). Indeed, in the present study, college students reported a higher level of teacher autonomy support but a lower level of structure, which might result in the feeling of incompetence and helplessness, and then yield the null relationship between perceived structure and need satisfaction.

As expected (hypotheses 2a, 2b, 2c, and 2d), the present model confirms that need satisfaction is a positive predictor of autonomous motivation, controlled motivation, and class engagement whereas is a negative predictor of amotivation. These results supported SDT-theoretical postulations (Ryan and Deci, 2020) and previous findings in PE class (e.g., Standage et al., 2005; Zamarripa et al., 2021). These findings support the essential importance of need satisfaction to promote student motivation and engagement.

Among the three types of motivation, only autonomous motivation was found to be a predictive factor of class engagement, which was contrary to our hypotheses 3b and 3c but in support of hypothesis 3a. The positive path from autonomous motivation to engagement replicated prior findings (e.g., Zhou et al., 2019b) and reconfirmed the generalizability of SDT postulates (Ryan and Deci, 2020). This finding reinforced that if students participated in the classes due to more self-determined reasons (enjoyment, pleasure, and importance of study), they would display higher levels of class engagement.

As alluded to earlier, the hypothesized paths from controlled motivation and amotivation to engagement-related outcomes tend to be inconsistent (Sánchez-Oliva et al., 2014). Aligned with prior studies (Behzadnia et al., 2018; Zamarripa et al., 2021; Leo et al., 2022), the current study found a non-significant link between controlled motivation and engagement. Notably, the bivariate correlation between these two variables was positive, but in the model, the path coefficient was non-significant. One reason for this result might be explained by the impacts of other antecedents on class engagement (Wu et al., 2014). For our data, when controlling for autonomous motivation, the partial correlation between controlled motivation and engagement was −0.014, which was not statistically significant ($p = 0.710$). The second reason might be related to the cross-sectional design, which was unable to obtain the maladaptive consequences of controlled motivation (Standage et al., 2005).

The path from amotivation to class engagement failed to reach statistical significance, which was not consistent with the SDT hypothesis. Amotivation has been shown to negatively predict engagement in PE class (e.g., Leo et al., 2022). However, this finding was supported by the prior PE research, which has reported the non-significant path from amotivation to emotional engagement (Standage et al., 2005; Sánchez-Oliva et al., 2014). Since Chinese traditional educational cultures stress teachers' authority and students' obedience (Zhou et al., 2019a), it is not surprising that Chinese college students may be accustomed to obeying their teachers' instructions and pretend to engage in classes even when they lack any intention in their learning activities.

Finally, our study highlights concern for the mediators of the relations between three teacher dimensions and class engagement. In line with SDT, need satisfaction was found to be a major mediator. Meanwhile, the chain of need satisfaction to autonomous motivation played a significant mediating role in the association between involvement and class engagement. This mediation chain expanded the results of previous research in the PE domain, concerning the relations between overall teacher support and class engagement (Leo et al., 2022), as well as between autonomy support and positive emotion during PE

classes (Behzadnia et al., 2018). Martin (2009) has suggested that, as for class engagement, need satisfaction is likely to be a causative variable, whereas motivation appears to be more of a proximal variable.

Practical implications, limitations, and future directions

To our knowledge, this is the first study to test simultaneously the combined contributions of all three teacher support dimensions to student motivational variables within an integrated model, which also extended previous SDT findings in a variety of aspects, including culture (Eastern context rather than Western context), domain (classes in general rather than PE class), and grade level (university rather than elementary and/or high school).

Despite the strengths, the present study has several limitations. The first is related to its cross-sectional design in terms of student self-reports. In the future, a longitudinal or experimental design should be conducted, which can provide causal support for our model. As for self-report, we cannot completely control for its common method bias or social desirability response bias, however, it is often the students' subjective experience of teacher support that is one of the strong predictors of motivational variables (Jang et al., 2010; Opdenakker, 2021). Hence, future research could conduct more objective assessments such as teachers' reports or observers' ratings, or assess social desirability bias as a control variable in the analysis.

The second concerns the sample. All the participants came from one university. The sample was predominantly female, although this was consistent with the gender rate in previous research among Chinese college students (Pan and Gauvain, 2012). Future studies with a sufficient sample size (e.g., 20 cases per parameter) with participants from distinct settings would assist in making our findings more generalized. Additionally, future research involving more classes is recommended to separately test the present model at the student and class levels.

The last limitation is about the motivational pathways. Our findings supported that autonomous motivation, controlled motivation, and engagement were predicted positively by students' perceived teacher support and need satisfaction, and they related negatively to amotivation. However, several SDT researchers in education have argued the bright and dark motivational pathways (Vansteenkiste and Ryan, 2013; Vansteenkiste et al., 2020). Specifically, autonomous motivation is primarily and positively predicted by need support context and need satisfaction, whereas controlled motivation and amotivation appear to be primarily and positively predicted by need-thwarting context and need frustration. Therefore, future research should consider the assessment of students' experience of need thwart and need frustration. Moreover, future research needs to expand to measure other aspects of the study variables in the pathway model, such as, need support provided by other social agents (e.g., friends and parents), integrated regulation, and different engagement-related variables (e.g., students' positive and negative emotions, concentration, and performance).

Taking into account the above weaknesses, our results provided tailor-made information about how teachers' supportive practices could foster student motivation and class engagement. Specifically, university teachers could help satisfy students' three psychological needs through autonomy-supportive and involved teaching behaviors, especially for students (freshmen and sophomores) who were exploring a relatively new environment (Amoura et al., 2015). In addition, given the lower levels of structure in our study, it is necessary for Chinese college teachers to create a well-structured learning context. Although perceived structure failed to predict need satisfaction in our model, SDT assumes that only when perceived structure with an abiding sense of autonomy support and involvement can teachers establish the optimal learning context (Ryan and Deci, 2020). Finally, the findings also provide specific implications for teachers' in-service training and university curriculum reform, such as taking into consideration training teachers' need supportive practices through a democratic instructional style (Burgueño et al., 2021).

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Ethics statement

The studies involving human participants were reviewed and approved by Zhejiang International Studies University, China. The patients/participants provided their written informed consent to participate in this study.

Author contributions

LZ and XZ collected and analyzed the data. LZ drafted the manuscript. JH developed the manuscript. LZ, YG, and XT planned the study. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Perceived teacher autonomy support for adolescents' reading achievement: The mediation roles of control-value appraisals and emotions

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Analyzing students' internal cognitive-motivational appraisals and achievement emotions is of pivotal importance for educational outcomes and student individual wellbeing, yet little is shown about their associations with teacher autonomy support. This study investigates the relationship between perceived teacher autonomy support and reading achievement by addressing mediating influences of control and value-related constructs, i.e., reading self-efficacy, meaning in life, and reading enjoyment. Multiple mediation modeling was adopted to test the proposed model with carrying out a total of 12,058 students from 361 schools in China in the Programme for International Student Assessment (PISA) 2018 reading database. The results elucidated that student-perceived teacher autonomy support is significantly positively related to adolescents' reading outcomes by fostering internal control and value appraisals and academic enjoyment. These current findings confirm the positive correlation between teacher autonomy support and adolescents' motivational and emotional factors, providing significant practical implications for educators to adopt various teaching strategies to enhance adolescents' self-efficacy, intrinsic values, and positive emotions.

KEYWORDS

teacher autonomy support, control-value appraisals, achievement emotions, multiple mediation modeling, PISA reading

Introduction

Reading ability is perceived as the pivotal skills for successful integration into modern society (OECD, 2019). Although there are a wide range of factors that might influence adolescents' reading competence, teacher autonomy support have indicated to be the most crucial exogenous factors in learning processes and reading achievement (e.g., Cheon et al., 2018; Quin et al., 2018). Autonomy supportive teachers might relinquish much control of students' learning process, adopt structure and motivating style by providing multiple solution pathways with students for internalizing and externalizing problems

(Vansteenkiste et al., 2012; Bureau et al., 2022a). A cornucopia of studies have confirmed the notion that teacher autonomy support is positively linked to students' personal characteristics (Bureau et al., 2022a), emotional wellbeing (Gilbert et al., 2021), dogged perseverance (Reeve and Cheon, 2021), active learning engagement (Olivier et al., 2020), and educational performance (Guay et al., 2019), whereas teacher highly controlling is linked to students' frustration of psychological needs, disengagement and low learning outcomes (Aelterman et al., 2019).

According to control-value theory (CVT), as an essential component of learning environment, teacher autonomy support is closely related to students' appraisals (Pekrun et al., 2014), including perceived control, e.g., self-efficacy and perceived intrinsic value, e.g., meaning in life, which are acted as the antecedents of achievement emotions (e.g., Wigfield et al., 2015; Roorda et al., 2017). Self-efficacy refers to the belief in an individual capacity to successfully complete a task or execute a specific behavior in a specific domain (Bandura, 1995), reflecting students' perceived control (Skinner, 1996; Pekrun et al., 2014). Additionally, as "the primary motivational force" (Frankl, 1963, p. 121), meaning in life serves as an intrinsic value (Siwek et al., 2017), involves the cognition and behavioral processes to meet the desire, spurring people to search for significance and purposes of their lives (Steger et al., 2008). Specifically, students who perceived more teacher autonomy support tend to have strong cognitive appraisals and show positive emotions during learning activities (Putwain et al., 2021).

Therefore, understanding the mechanism behind teacher autonomy support and whether it has a negative or positive influence on control-value appraisals and emotions, provides valuable insights into adolescents' wellbeing and educational attainment (Ryan and Deci, 2017; Putwain et al., 2021). Despite recent studies shed light on the relationship between teacher autonomy support and student psychological factors, limited evidence has probed into the correlations among teacher autonomy support, students' cognitive appraisals and emotional factors. Nonetheless, studies exploring their correlations mostly concentrated on math or science achievement (e.g., Wang et al., 2017), physical activities (e.g., Zimmermann et al., 2021), scarce studies related these factors to students' reading performance and elucidated that how these relationships can operate in secondary school students in reading activities.

This study aims to fill these lacunas underlying the interrelationships between student-perceived teacher autonomy support, appraisals, achievement emotions, and reading achievement in a sample of 15-year-old students. Specifically, this study examines how control-value appraisals in tandem with subsequent achievement emotions, and their mediating role between teacher autonomy support and reading achievement. Pekrun's control-value theory (CVT) is adopted as theoretical framework in this study. This theory offers an integrative theoretical perspective concerning the non-linear relationship between learning situations and educational outcomes (e.g., Wigfield et al., 2015; Roorda et al., 2017). It highlights that the correlations between person and environment are condensed in various appraisals (e.g., self-efficacy, meaning in life, etc.) and achievement emotions (e.g., Pekrun, 2006; Pekrun and Stephens, 2010; Daniels and Stupnisky, 2012). As such, this theory is consistent with the present study.

Literature review

Teacher autonomy support and reading achievement

Student behavioral, cognitive, and academic development are intimately associated with a supportive learning environment where teachers provide tangible help, guidance, and explanations to support student learning (e.g., Hughes et al., 2012; Pekrun et al., 2014; Wentzel, 2016). In autonomy-supportive environment, teachers try to attract students by using inviting language to provide interesting learning activities, detailed explanations and related them to students' own experience (Wentzel et al., 2010), which offers students a chance to activate their cognition in learning process (Lei et al., 2018; Yu and Hu, 2022). Teachers also allows for students' independent thinking, expressing their perspectives freely and studying in their own peace (Bureau et al., 2022b; Yu et al., 2022). Student-perceived teacher autonomy support refers to how student convinced of teachers providing helps on their learning (Wentzel, 2016; Zimmermann et al., 2021). The more students perceived teacher autonomy support, the more they gain emotional identification and feel fulfillment of their psychological needs (e.g., Quin et al., 2018; Zimmermann et al., 2021; Yang et al., 2022). Thus, they are more likely to get involved in a wide range of learning activities, make free choices based on their own interests (Lazarides and Buchholz, 2019; Preece and Levy, 2020).

Empirical studies provided evidence on the positive relations between teacher autonomy support and students' academic achievement. For instance, Förtsch et al. (2016) revealed that teacher autonomy support such as cognitive activation has a significant positive associations with students' learning outcomes and explain 15% of the variance in academic achievement. In reading context, Olivier et al. (2020) demonstrated that teacher autonomy support might offer students a positive leaning environment, motivate students' reading engagement and enhance their reading achievement. Similarly, Guay et al. (2019) suggested that teacher autonomy support is a positive predictor of student intrinsic motivation and reading achievement in Grade 1 students. However, Kikas et al. (2016) claimed that higher individualized support is negatively related to reading comprehension skills and reading fluency among primary school students.

In light of the previous research, teacher autonomy support is closely linked to students' academic achievement and reading achievement. However, the results are inconsistent with both

the positive and negative relationships of teacher autonomy support with reading achievement. Apart from that, teacher autonomy support in previous studies was evaluated mainly focused on individual help, while this study focused on the students-perceived teacher autonomy support for the whole class instead of specific people.

Teacher autonomy support, control-value appraisals, and reading achievement

According to CVT, control-value appraisals refer to one's competence beliefs, expectancies, and attributional style, and consist of subjective control and subjective values of learning outcomes, which are closely tied with achievement activities (Pekrun and Stephens, 2010). It can be shaped by interactions with learning environment (Pekrun, 2006). Perceived as a pivotal component in learning environment, teacher autonomy support poses an influence on students' appraisals (Luo et al., 2016). Specifically, the way teachers manage the class and teaching strategies they adopted are supposed to empower students to participant in various tasks and make essential learning choices, which affects students' perceived control and intrinsic values (e.g., Wang et al., 2017; Zimmermann et al., 2021).

Despite some studies have examined the relationship between teacher autonomy support and students' appraisals, the internal correlations among student-perceived teacher autonomy support, students' self-efficacy and meaning in life has not been examined in reading context. Although substantial studies have explored the relationship between self-efficacy and reading achievement, the results are inconsistent. Some studies have reported that self-efficacy is positively related to reading performance. That is, when students have a strong sense of their reading competence, they are more likely to work harder and persevere in these difficult reading activities (Linnenbrink and Pintrich, 2003; Peura et al., 2019a), and attain high reading achievement. For instance, Solheim (2011) demonstrated that reading self-efficacy was significantly positively associated with reading comprehension scores. Similar findings were also obtained by Sewasew and Koester (2019), who presented a reciprocal relationship between self-perception of competence and reading achievement and found a positive association of self-efficacy with relevance to reading achievement. However, Peura et al. (2019b) found that the relationship between self-efficacy and reading outcomes varied based on the level of task specificity and the measurement of academic achievement. They elucidated that specific and intermediate self-efficacy had a positive association with reading outcomes, whereas general self-efficacy was not. Moreover, Carroll and Fox (2017) suggested that high reading self-efficacy might not be closely related to high reading performance.

As an internal value construct, meaning in life involves individuals having beliefs about values and purposes. It illustrates how individuals consistently pursue learning goals despite various challenges and difficulties (Steger et al., 2008; Hill et al., 2016). Individuals who have a higher level of meaning in life are rarely suffering existential frustration and psychological problems (Makola, 2014). Previous evidence reported that having meaning in life makes a difference in one's cognition and behaviors and is closely linked to positive outcomes, such as self-esteem (Steger et al., 2006) and enjoyment (Steger et al., 2006), and thus produces a significant influence on relevant educational outcomes (e.g., Steger et al., 2008). Browman et al. (2019) suggested that having meaning in life might activate one's upward mobility and initiative, which might encourage individuals to persevere in pursuing their goals, and is positively related to academic outcomes. Bailey and Phillips (2016) found that college students' intrinsic motivations such as meaning in life has positive associations with their academic performance. Despite the positive influence of meaning in life on academic outcomes having been confirmed, there are limited studies exploring the relationship between meaning in life and reading performance, not even with teacher autonomy support, meaning in life, and reading achievement. Moreover, limited studies have thoroughly researched the mediated relation of control-value appraisals as a whole and its relationship with teacher autonomy support and reading achievement.

Teacher autonomy support, reading enjoyment, and reading achievement

As the central role in CVT, achievement emotions refer to the emotions that students experience in ongoing learning activities or testing contexts (Pekrun, 2000; Mercan, 2020). Among multitudinous achievement emotions, enjoyment is commonly explored and has attracted much research attention due to its positive influence on learning (Simonton and Garn, 2020; Zaccoletti et al., 2020), which are significantly associated with cognitive processes, motivational beliefs, and learning environment factors (Pekrun, 2006; Schunk and Usher, 2019). Empirical studies largely support a close relationship between teacher autonomy support and positive achievement emotions, i.e., reading enjoyment (e.g., Lazarides and Buchholz, 2019; Bureau et al., 2022a). As part of reading motivation factors, reading enjoyment involves the enjoyment or satisfaction of curiosity individuals engaged in reading activities (OECD, 2019). Reading enjoyment has been indicated, to be enhanced by teacher stimulation in engagement, guidance, and informational support (Roorda et al., 2017). Additionally, researchers have identified the role of reading enjoyment among multitudinous predictors in reading achievement and have consistently demonstrated a positive connection (e.g., Taboada et al., 2009;

Wolters et al., 2014). Such evidence has shown that individuals who enjoy reading, are more likely to read and engaged in a wide range of reading tasks (Taboada et al., 2009). Moreover, students with higher level of reading enjoyment tend to choose more challenging reading texts, take the initiative to apply effective reading strategies, or seek support from others more often than individuals with a lower level of reading enjoyment (e.g., Park, 2011; Lim and Jung, 2019). Thus, students with high reading enjoyment exhibit high reading achievement (Morgan and Fuchs, 2007).

However, previous studies have mostly examined the influence of teacher autonomy support and reading enjoyment on reading outcomes among primary school students, few studies have focused on secondary school students. Therefore, this study will examine the mediating role of reading enjoyment in the relationship between perceived teacher autonomy support and reading achievement among adolescents.

The relationship between control-value appraisals and reading enjoyment

The CVT delineates that different achievement emotions arise from different control- and value-related constructs (Pekrun, 2006; Daniels and Stupnisky, 2012). Studies have also noted that the combination of positive control and value appraisals are acted as additive predictors of positive emotions, i.e., enjoyment (e.g., Goetz et al., 2012). For instance, Zimmermann et al. (2021) examined the role of appraisals and achievement emotion in leisure-time physical activities. They found that perceived control, i.e., self-efficacy and intrinsic value are statistically significantly positively related to enjoyment in physical activities. Buhr et al. (2019) highlighted that control and value appraisals generate more enjoyment and less boredom in a massive open online course. Putwain et al. (2021) reported that student-perceived control, i.e., perceptions of self-competence beliefs in math and intrinsic value are significantly positively related to their later math enjoyment. Similarly, Wang et al. (2017) confirmed that math self-efficacy and intrinsic value can be significantly negatively related to negative emotions, i.e., boredom in math. Simonton and Garn (2020) claimed that a student who intrinsically believed him- or herself to be competent or enterprising in learning activities and has own intrinsic values tends to experience positive achievement emotions, e.g., feel enjoyment in the learning process.

Based on the previous literature, it can be seen that most of them are focused on other academic contexts, such as mathematics or leisure activities instead of reading achievement. Additionally, most of the previous studies have regarded intrinsic value as a whole without considering the relationship between meaning in life and emotional factors of adolescents specifically. Therefore, this study explored the relationship between control-value appraisals and academic enjoyment by addressing self-efficacy and meaning in life in a reading classroom.

The present study

Previous theoretical and empirical evidence indicates the potential interrelations between teacher autonomy support and students' learning outcomes. However, despite considerable studies have been conducted on the relationship between autonomy support of teachers and educational attainment, scarce studies have probed into the reading context, and examined how teacher autonomy support interacts with control-value appraisals, and academic enjoyment and thus related to reading achievement. Even so, the findings are incomprehensive and worthy of up-to-date scrutiny, given the increasingly importance of motivational and emotional factors in adolescents' individual development. Explicitly, most of the previous studies shed light on primary school students or college students, scarce evidence concerning secondary school students. Additionally, there are relatively few studies using the international large-scale database, i.e., Programme for International Student Assessment (PISA) (2018), to explore the mediating role of control-value appraisals and reading enjoyment in the relationship between the teacher autonomy support and reading outcomes.

Therefore, this study expands the previous literature by examining the correlations among student-perceived teacher autonomy support, control- and value-related constructs (i.e., self-efficacy in reading, meaning in life), and achievement emotions (i.e., reading enjoyment) proposed in CVT, adopting a sample of secondary school students in PISA 2018 reading assessment. **Figure 1** presents the conceptual framework of this study. Based on the CVT theory, we tested the following hypothesis:

(1) Control-value appraisals (i.e., reading self-efficacy, meaning in life) will be mediated by the student-perceived teacher autonomy support and reading achievement.
(2) Reading enjoyment will be mediated by the student-perceived teacher autonomy support and reading achievement.
(3) Both control-value appraisals (i.e., reading self-efficacy, meaning in life) and reading enjoyment will be mediated by the student-perceived teacher autonomy support and reading achievement.

Materials and methods

Sample

This study used the secondary dataset from the PISA 2018, which was released in December 2019.[1] As one of the most authoritative international large-scale datasets, the

1 https://www.oecd.org/pisa/data/2018database/

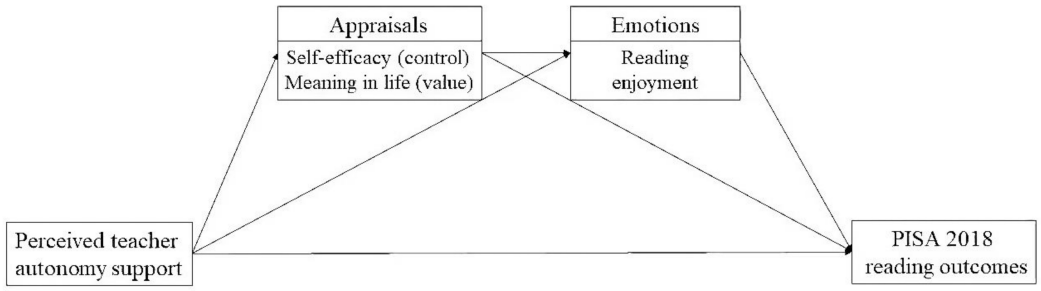

FIGURE 1
The conceptual framework of the current study.

PISA evaluates how well 15-year-old students mastered the compulsory education knowledge of reading, mathematics, and science via real-life scenarios. Additionally, students' ability to fully participate in modern society can be assessed in varieties of learning circumstances and academic settings. Conducted every 3 years, the PISA provides a comprehensive and rigorous benchmark measurement for national educational situations and allows comparisons across countries. In the PISA 2018, the major domain tested was reading achievement. This study analyzed a subset of PISA database, reading achievement, which comprises a total of 12,058 students from 361 schools in China with the proportions of 57.2% for males and 47.8% for females.

Variables

Student-perceived teacher autonomy support

There were four items evaluating student-perceived teacher autonomy support in reading encouragement (e.g., "The teacher encourages students to express their opinion about a text," see **Supplementary materials**). Adolescents were invited to respond to the questionnaire about their perception of teacher autonomy support with a four-point Likert scale ranging from "1 = Never or hardly ever" to "4 = In all lessons." To measure of internal reliability, Cronbach's alpha was adopted in this study. The internal reliability for teacher autonomy support is 0.90.

Control and value appraisals

Reading self-efficacy

This variable evaluates students' self-concept of their competence in reading. This variable was measured by three items on a four-point Likert-type scale (e.g., "I am a good reader."), ranging from "1 = strongly disagree" to "4 = strongly agree." The internal reliability for reading self-efficacy is 0.794.

Meaning in life

This variable evaluates a sense of meaning and purpose that a student might have in terms of their experience. This variable was measured by three items (e.g., "My life has clear meaning or purpose.") and adolescents were asked to complete a four-point Likert-scale questionnaire ranging from "strongly disagree," to "strongly agree." The internal reliability for meaning in life is 0.914.

Reading enjoyment

This variable evaluates students' enjoyment of reading. This variable was measured by five items (e.g., "Reading is one of my favorite hobbies") on a four-point Likert-type scale ranging from "1 = strongly disagree" to "4 = strongly agree." Considering the negatively worded items, reverse-scored Item Response Theory (IRT) scaling was adopted. The internal reliability for reading enjoyment is 0.812.

Reading achievement

According to the PISA 2018 reading assessment, reading achievement is defined as being able to comprehend, analyze and engage with the texts, to build knowledge and accomplish their goals to effectively participant in society (OECD, 2019, p. 28). Specifically, PISA 2018 reading assessment provides correct estimates by addressing the cognitive processes of adolescents, including retrieving and synthesizing information, evaluating and reflecting from manifold text formats, and reading contexts (e.g., novels, personal letters). In the current study, the reading achievement was assessed using one of the plausible values (i.e., PV1 reading) grounded on the item response models (OECD, 2019). The results were normalized on a scale across OECD countries with a mean of 500 (SD = 100).

Control variables

Previous studies revealed that demographic variables (e.g., socioeconomic status, gender) exerted a substantial influence on adolescents' reading achievement (e.g., Korhonen et al., 2016; Ma et al., 2018; Rogiers et al., 2020). Students with higher socioeconomic status (ESCS) tend to be much more proficient in reading than students with lower ESCS. Additionally, gender differences have been consistently revealed to have significant associations with the reading ability (Nalipay et al., 2019). Therefore, this study adopted ESCS and gender as demographic

TABLE 1 Descriptive statistics and correlation matrices among variables.

Variable	M	SD	1	2	3	4	5	6
GENDER	1.52	0.50	–					
ESCS	−0.36	1.08	−0.020*	–				
AUTOSUP	0.63	1.03	−0.072**	0.180**	–			
SCREADCOMP	0.08	0.86	0.049**	0.287**	0.298**	–		
EUDMO	0.09	0.91	−0.011	0.071**	0.255**	0.317**	–	
JOYREAD	0.98	0.84	−0.145**	0.201**	0.319**	0.595**	0.227**	–

*$P < 0.05$, **$P < 0.01$.

control variables. Student gender was coded as 1 for girls and 0 for boys and then transferred into dummy variables. ESCS was measured from a combination of three variables, including parents' occupational status, parents' educational level, and home possessions (OECD, 2021).

Statistical models

This study applied a serial multiple mediation model to examine the relations between teacher autonomy support, control-value appraisals, achievement emotions and reading achievement. According to Preacher and Hayes (2008), multiple mediation model involves several mediators in one model and allows for analyzing the relative magnitudes of the direct and indirect correlations related to mediators. Compared to the simple mediation model with one mediator in several separate models, multiple mediation model can reduce the likelihood of parameter bias and provide reliable standard errors (Preacher and Hayes, 2008; Kenny, 2018).

The hypothesized multiple mediation model was tested using the lavaan package in R (R Core Team, 2020). As for the estimation method, the Maximum likelihood estimation with robust standard errors (MLR) was used. Additionally, model fit was estimated using the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root means square residual (SRMR). Accordingly, the acceptable model fit index is that both the CFI and TLI are above 0.95, RMSEA below 0.08, and SRMR below 0.10 (Kline, 2015). Before conducting the outcome analysis, the missing data were imputed with the expectation-maximization (EM) algorithm across the entire dataset. All continuous variables were converted to the centralized data. It is also worth stressing that student weights were calculated among the measures examined.

Results

Table 1 presents the mean and standard deviation of, and the associations between selected variables. Table 2 presents the results of the model fit. Based on the criteria proposed by Kline (2015), the CFI (0.99) and TLI (0.95) greater than 0.9, whereas the RMSEA and SRMR smaller than 0.08, indicating that the model fit was in an acceptable range.

As Table 2 shown, student-perceived teacher autonomy support is positively associated with students' reading achievement after controlling for students' ESCS and gender

TABLE 2 Fit indices and the parameter estimates of the final model.

PISA 2018 reading assessment (China, n = 12,058)

Model fit				
Metrics	RMSEA mean (SD)	0.078 (0.000)		
	CFI mean (SD)	0.990 (0.000)		
	TLI mean (SD)	0.947 (0.000)		
	SRMR mean (SD)	0.045 (0.000)		
Direct effects		*b*	*SE*	*p*
AUTOSUP	→ APPRAISALS	0.257	0.009	0.000***
	→ JOYREAD	0.051	0.012	0.000***
	→ PVREAD	2.790	1.120	0.0131*
Appraisals	→ PVREAD	−8.870	3.360	0.008**
	→ JOYREAD	0.864	0.031	0.000***
JOYREAD	→ PVREAD	32.700	1.970	0.000***
Indirect effects				
AUTOSUP	→ APPRAISALS → PVREAD	−2.280	0.868	0.009**
	→ JOYREAD→ PVREAD	1.660	0.387	0.000***
	→ APPRAISALS → JOYREAD	0.222	0.012	0.000***
	→ APPRAISALS → JOYREAD → PVREAD	7.270	0.655	0.000***
Total effects				
AUTOSUP	PVREAD	9.430	1.1	0.000***
Control variables				
GENDER	→ APPRAISALS	0.021	0.017	0.212
	→ JOYREAD	−0.262	0.016	0.000***
	→ PVREAD	1.650	1.720	0.339
ESCS	→ APPRAISALS	0.237	0.012	0.000***
	→ JOYREAD	−0.046	0.012	0.000***
	→ PVREAD	14.400	1.430	0.000***

CFI refers to the comparative fit index, TLI refers to the Tucker-Lewis index, RMESA refers to the root mean square error of approximation, and SRMR refers to the standardized root means square residual; *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

(B = 2.79, SE = 1.12, $P < 0.05$), which indicates that the more students believe teacher autonomy support provided, the higher the score of their reading achievement. Meanwhile, student-perceived teacher autonomy support is significantly positively linked to control-value appraisals, i.e., self-efficacy and meaning in life (B = 0.257, SE = 0.009, $P < 0.001$), whereas appraisals are negatively linked to reading performance (B = −8.870, SE = 3.36, $P < 0.05$). Therefore, the control and value appraisals-related constructs are significantly and negatively mediated the relationship between student-perceived teacher autonomy support and reading performance (B = −2.280, SE = 0.868, $P < 0.05$). The results also indicate that reading enjoyment is significantly positively mediates the links between student-perceived teacher autonomy support and reading achievement (B = 1.660, SE = 0.387, $P < 0.001$). Additionally, **Table 2** indicates that student-perceived teacher autonomy support is significantly positively associated with appraisals, i.e., self-efficacy and meaning in life, and have significantly positive relations to subsequent emotions, i.e., reading enjoyment (B = 0.222, SE = 0.012, $P < 0.001$). It elucidates that control- and value- related appraisals and reading enjoyment serially significantly positively mediates the correlation between student-perceived teacher autonomy support and reading achievement (B = 7.270, SE = 0.655, $P < 0.001$). **Figure 2** presents a summary of the detailed model in this study.

Discussion

This study extends the previous literature by identifying the relations among student-perceived teacher autonomy support, control and value appraisals, achievement emotions, and reading performance. The findings revealed that adolescents with higher perceived control and value in the reading assessment are more likely to gain more enjoyment and a real sense of fulfillment in the reading process, and subsequently attain higher reading outcomes. Moreover, based on CVT (Pekrun, 2006), the mediating role of appraisals (i.e., self-efficacy, meaning in life) and achievement emotions (i.e., enjoyment) in the associations between student-perceived teacher autonomy support and reading performance was examined. This study is of pivotal practical significance to CVT. First, the multiple mediation model adopted in this study provides additional evidence addressing the benefits of CVT on reading achievement of adolescents. Second, given that there is little empirical evidence that has thoroughly researched the interrelations of teacher autonomy support and reading performance under the framework of CVT, this study provides new findings by adopting an authoritative large-scale PISA-empirical-based evaluation in the Chinese context.

The mediating role of control-value appraisals between student-perceived teacher autonomy support and reading achievement

Our results indicate that control and value appraisals are mediated by student-perceived teacher autonomy support and reading achievement. Although some studies have begun looking at the control-value appraisals on educational achievement, this study is the first to specifically examine the mediating role of appraisals (i.e., self-efficacy and meaning in life) between teacher autonomy support and reading achievement among secondary school students. Therefore, our results add to the literature by addressing that teacher autonomy support might enhance adolescents' appraisals (i.e., reading self-efficacy and meaning in life) in the reading process, although the improvement of their self-efficacy and intrinsic values might not be positively related to reading achievement in the Chinese context.

Specifically, this finding reveals that control-value appraisals (i.e., self-efficacy and meaning in life) are negatively related to adolescents' reading achievement, which is contradictory

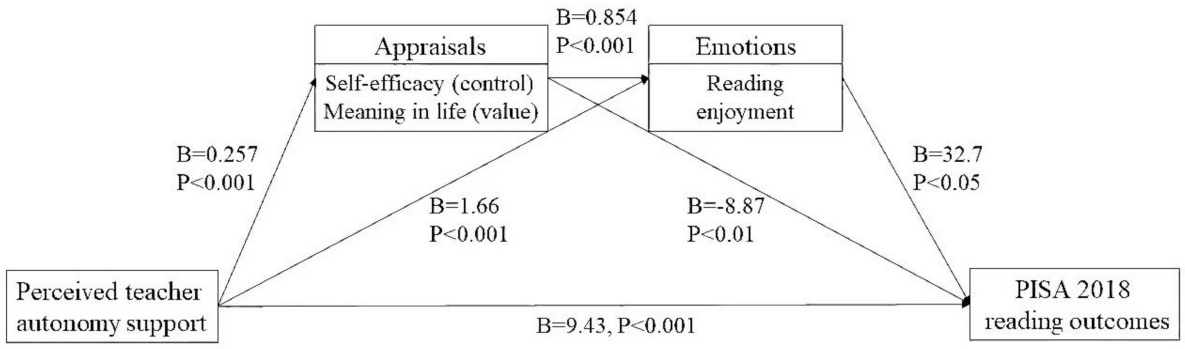

FIGURE 2
Summary of the full model in this study.

with a study conducted by Bailey and Phillips (2016). They hold the idea that intrinsic motivation (e.g., self-efficacy) and meaning in life are positively related to students' academic performance in college. However, this result partly aligns with that of Carroll and Fox (2017), who demonstrated that reading self-efficacy is associated with word reading, but is not linked to reading comprehension. Additionally, as Schunk (1996) claimed that high self-efficacy without the necessary knowledge and abilities does not result in improved literacy, and can result in poor reading performance. These contrary perspectives can be explained as Eccles and Wigfield (2020) demonstrated that student self-concept and intrinsic value were complicated areas and should be situated into contextual factors. Pekrun (2006) and Peura et al. (2019b) further clarified that the differed results might be caused by general-domain and specific-domain ways of control- and value-related constructs.

Furthermore, this study indicates student-perceived teacher autonomy support is significantly positively related to the control-value appraisals, which partly aligns with a study conducted by Zimmermann et al. (2021) that mentioned a positive relationship between teacher autonomy support and control-value appraisals based on leisure physical activity. One potential underlying reason is that teacher autonomy support such as knowledge activation and stimulation for engagements make students be noticed in managing their learning processes; consequently, students might develop their self-efficacy and intrinsic values (Eccles, 2005; Peura et al., 2019a). Therefore, this study might provide an efficient motivating teaching style for educators who seek to cultivate students' reading competence by enhancing their motivational beliefs, and encouraging their engagement in specific reading activities.

The mediating role of reading enjoyment between student-perceived teacher autonomy support and reading achievement

Our findings suggest that the enjoyment of reading, the core component in achievement emotions mediates the links between student-perceived teacher autonomy support and reading performance, which extends the findings of previous studies that considered only the relationship between reading enjoyment and reading achievement. Essentially, this study provides a robust examination of the correlation between enjoyment in reading and reading performance. This study indicates a positive relation between reading enjoyment and reading performance, and dovetails with previous literature (e.g., Rogiers et al., 2020; Zaccoletti et al., 2020; Hu and Wang, 2022), which speculated that reading enjoyment can function as an essential psychological pathway to improvements in a reader's reading fluency and knowledge base (Preece and Levy, 2020; Simonton and Garn, 2020). One possible reason might be that students who enjoy their reading class or assessments are more likely to be cognitively engaged with their courses (Xiao et al., 2019; Mercan, 2020), understand and use more contributory reading strategies, gain a more efficient interpretation of texts, and thus can achieve higher reading achievement (Ryan and Deci, 2020; Chen and Hu, 2021).

This study also suggests that student-perceived teacher autonomy support is significantly positively related to students' enjoyment of reading. According to CVT theory, students' achievement emotions can be developed in positive interactions with the learning environment and a host of learning activities (Pekrun and Stephens, 2010; Van der Beek et al., 2017). Thus, teacher autonomy support can satisfy adolescents' mental requirements of relatedness, competence, and autonomy (Ryan and Deci, 2017; Moè and Katz, 2020). However, few studies have examined the relationship between teacher autonomy support, reading enjoyment, and reading literacy, and most of them are conducted among primary school students or college students, with little empirical evidence for secondary school students. Therefore, these current findings add to the literature by addressing the positive associations of teacher autonomy support with students' reading enjoyment and reading performance. However, due to the lack of information about students' negative emotions (e.g., depression, nervousness) in reading process, the variations between different emotional factors call for further empirical studies; future studies could elucidate whether teacher autonomy support is beneficial for reducing the negative emotions and enhancing student wellbeing.

Control-value appraisals as the antecedent of reading enjoyment

Our findings indicate that the control-value appraisals (i.e., reading self-efficacy, meaning in life) and then subsequent emotions (i.e., reading enjoyment) are positively mediates the relations between teacher autonomy support and reading attainment. In other words, reading self-efficacy and meaning in life are positively related to reading achievement through reading enjoyment. The likely mechanism is that students who have strong motivational beliefs and intrinsic values are more likely to persevere in and overcome potential difficulties, so they tend to have positive emotions in the reading process, i.e., underpin enjoyment in reading, and thus enhance their reading achievement. This result resonates with studies conducted by Pekrun (2006) and Simonton and Garn (2020), which demonstrated that control-value appraisals serves as an antecedent of achievement emotions, such as enjoyment or boredom. Likewise, in a longitudinal study, Putwain et al. (2021) reported that students' perception of their competence and intrinsic value can amplify their enjoyment, and improve their math achievement. However,

this result is contradictory to a study conducted by Guay et al. (2019) that elucidated an opposite direction of the influence pathway. That is, students' self-perception of competence mediates the links between enjoyment and reading achievement. This empirical evidence is varied due to different subjects and different evaluations of assessments (e.g., Peura et al., 2019b). Additionally, different samples adopted in studies also cause different results. That is, Guay et al. (2019) focused on primary school students, while this study investigated secondary school students. From the viewpoint of individual development, children of a young age tend to show interest in reading, thus influencing their self-perception of competence, whereas secondary school adolescents might show a differential direction between self-efficacy and reading enjoyment as they grow up (Ma et al., 2018; Westphal et al., 2018). Therefore, it is essential to emphasize their relationship direction, the antecedent role of the control value, i.e., self-efficacy and meaning in life, in their emotions considering different age groups.

Since the influential patterns of teacher autonomy support on control and value constructs and emotional factors was unknown, further studies could make a comparison of their relationship at different growth stages and identify a pathway through a series of developmental stages.

Conclusion

This study contributes to the previous literature by examining a complicated relationship between teacher autonomy support, control-value appraisals (i.e., self-efficacy, meaning in life), achievement emotions (i.e., reading enjoyment), and reading achievement among 15-year-old adolescents drawing on the sub-dataset of China in the PISA 2018 assessment. To our best knowledge, this is one of the first empirical studies in the educational field to examine the mediation role of control and value appraisals (i.e., reading self-efficacy and meaning in life), achievement emotions (i.e., reading enjoyment) playing between teacher autonomy support and reading achievement based on the control-value theory. Despite the relations between teacher autonomy support and educational attainment has been examined, the mechanism behind them, i.e., how teacher autonomy support works in specific academic settings have not been thoroughly explored. This study yielded three new viewpoints. First, this study offers a comprehensive perspective and probes into the reading classroom by revealing a positive relationship among teacher autonomy support, control-value appraisals, i.e., self-efficacy, meaning in life, and reading enjoyment. Second, this study found that the antecedent role of control and value appraisals in reading enjoyment, that is, the positive influence of self-efficacy and meaning in life on reading enjoyment, suggesting the direction of this relation should be taken into account. Third, since most of the previous studies examined the relationship between teacher autonomy support and reading achievement among primary school students or college students, this study adds to the previous literature by addressing 15-year-old adolescents from a large-scale and authoritative PISA 2018 data set. These findings have crucial implications for researchers, teachers and school policymakers seeking alternative solutions and multiple paths to puzzling adolescents' various learning problems, and provide guidance for teachers to fully utilize the cognitive activation and stimulated strategies to enhance students' different motivational beliefs and provoke their positive emotions, which contribute a lot on students' reading achievement.

Limitations and implications

It is acknowledged that this study has several limitations to highlight. First, with respect to the data variation in the cross-sectional study, the selected sample is limited. Future empirical studies can consider the longitudinal data to detect the dynamic individual development and further elucidate this cause-and-effect correlation. Second, since most of the PISA assessment questionnaires were self-reported by adolescents, it might cause some endogeneity bias. Therefore, it is beneficial to include other measurements such as in-depth observation, the teacher-reported data when assessing teacher autonomy support, to offer more detailed explanations for readers. Third, our test of the correlations of appraisals and achievement emotions was limited to perceived control, intrinsic value and positive emotions due to the characteristics of multiple mediation modeling, other variables like extrinsic value, and negative emotions could be studied in further studies.

Data availability statement

The original contributions presented in this study are included in the article/**Supplementary material**, further inquiries can be directed to the corresponding author.

Ethics statement

The utilization of the sample, data, and data analysis procedure of the present study has been approved by the Medical Ethics Committee of Department of Psychology and Behavioral Sciences, Zhejiang University [ethics approval number: (2021) No. 74] and the authors declare no ethnical violation.

Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

MW: conceptualization, methodology, data analysis, writing, and editing. JH: supervision, methodology, data analysis, writing, reviewing, and editing. Both authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

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Examining the relationship between academic stress and motivation toward physical education within a semester: A two-wave study with Chinese secondary school students

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The present study aimed to investigate the relationship between academic stress and motivation toward physical education (PE) through a longitudinal design with cross-lagged panel analyses. A sample of 556 Chinese secondary school students participated in the research and completed Perceived Locus of Causality Scale and Educational Stress Scale for Adolescents at the beginning of the semester and 3 months later. The results demonstrated that academic stress factors were positively related to less self-determined motivations except that worry about grades was positively related to more self-determined motivations within each time point. In addition, we found that academic stress negatively predicted more self-determined motivations but positively predicted less self-determined motivations, whereas worry about grades negatively predicted amotivation 3 months later. Meanwhile, the influence of amotivation on despondency was also found. These results suggest that academic stress can obstruct students' participation in PE through an impact on self-determined motivation. Our findings also indicate that self-determined students in PE will seek academic achievement as well, which in turn improves students' academic status.

KEYWORDS

academic stress, adolescent, motivation, physical education, self-determination theory

Introduction

Academic stress, which largely comes from work overload, the amount of material to learn, and the need to achieve a high grade, becomes a critical problem during adolescence (Leung et al., 2010). In addition to the direct impact of stress on physical and mental health among adolescents, researchers also suggested the indirect impact

of stress on health through poor health behaviors (Michels et al., 2015). Furthermore, participation in physical education (PE) has been found to be obstructed by the academic burden (Mowling et al., 2004; Back, 2015). Especially in Asian countries, the most important barriers to PE participation come from a prioritized emphasis on academic achievement of principal subjects, like mathematics and literature (Zhu et al., 2017).

Among various types of stress, academic stress may be the most salient for adolescents, which is highly related to competitive academic examinations, such as university entrance examinations and high school entrance examinations (Jun and Choi, 2015). Consistent with the transactional model of psychosocial stress proposed by Lazarus (1966), the level of perceived academic stress is determined not only by the number of academic stressors but also by how students interpret these stressors (Chua et al., 2018). Therefore, Sun et al. (2013) defined academic stress as subjective psychological distress from multiple aspects of academic learning, rather than a sum of stressors. The sources of academic stress can be originated from the heavy burden of homework, negative attitudes toward learning, such as loss of interest and difficulties in learning, etc (e.g., Wunsch et al., 2017). Meanwhile, the academic expectations from students and significant others, like parents and teachers, have also been demonstrated to be important factors of academic stress (Sun et al., 2011). Academic stress occurs when academic demands exceed a student's perceived ability to cope with them (Wilks, 2008). As the burden of academic material varies within a semester, the academic stress may also change over time correspondingly (Xiang et al., 2019).

In previous studies, academic stress is associated with negative psychological consequences such as unpleasant emotional states, depression, tearfulness, even self-harm, and suicidal feelings in some cases (e.g., Lotz and Sparfeldt, 2017; Soares and Woods, 2020). Besides, students with a high level of stress also presented poor academic achievement, low self-efficacy, and low PE participation (Moeini et al., 2008; Park et al., 2020). Meanwhile, some researchers suggested that academic stress may not necessarily result in negative outcomes (Sang et al., 2018; Ye et al., 2019). Students' responses to stress differ by their abilities and beliefs. Therefore, if students view academic challenges as opportunities and exert effort to meet the challenges, the academic stress may result in a positive impact (Sang et al., 2018).

Motivation toward physical education

Regular engagement in Physical activity (PA) has been found to be related to the reduction of stress (Ki et al., 2019). As an important part of school education, one main goal of PE is to provide adolescents with PA during the course (Sallis et al., 2012). Therefore, participation in PE has been proposed as an alternative for reducing the life stress levels of adolescents. Despite the benefits of PE, the common view that PA increases at the cost of decreased time on principal subjects lead to a tendency of low participation in PE as well as a heavy academic burden (Wang, 2017). Nevertheless, several studies showed that PE and other PA programs did not result in negative academic outcomes, but were positively associated with academic outcomes, such as test scores, grades, and reduced academic stress (e.g., Sallis et al., 2012; Back, 2015; Shen, 2017). The influence of participation in PE on academic status may exert through physical and psychological fitness. Such influence may also be explained by the fact that students with high motivation to participate in PE will also be motivated to strive for achievement in academic subjects (Torrijos-Niño et al., 2014).

In order to increase active learning time in PE, Self-Determination Theory (Deci and Ryan, 1985) has been widely employed to explore students' behavior, cognition, and affect in PE. According to Self-Determination Theory (Ryan and Deci, 2017), different forms of motivation situate along a self-determination continuum from more self-determined to less self-determined: intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation. Sheldon and Elliot (1998) further proposed autonomous motivation which consists of more self-determined forms of motivation (i.e., intrinsic motivation and identified regulation), and controlled motivation which consists of less self-determined forms of motivation (i.e., introjected regulation and external regulation). Students with autonomous motivation will experience positive cognitive, affective, and behavioral consequences, such as vitality and enjoyment (e.g., Vlachopoulos, 2012; Gråstén and Watt, 2017). On the other side, controlled motivation and amotivation have been found to be related to negative outcomes, such as boredom, low engagement, and fear of exams (e.g., Haerens et al., 2010; Aelterman et al., 2012).

Academic stress and motivation toward physical education

Various studies have found relationships between academic stress and academic motivation (e.g., Liu, 2015; Rubach and Bonanati, 2021). Academic stress was found to negatively predict academic motivation, while high autonomous academic motivation led to a decrease in academic stress (Rubach and Bonanati, 2021). However, limited research has examined such reciprocal effects of students' stress and motivation across contexts (e.g., Back, 2015). As suggested by Ryan and Deci (2017), students' motivation in certain situations can be generalized to wider school experience. For instance, intrinsic motivation experienced in garden work could improve

TABLE 1 Model fit indices.

Model	χ 2	*df*	CFI	TLI	RMSEA	90% CI RMSEA
Measurement model	4461.66	1959	0.922	0.915	0.049	[0.047, 0.050]
Cross-lagged models						
Model 1 with autoregressive paths	107.95	56	0.972	0.953	0.049	[0.035, 0.062]
Model 2 with autoregressive paths and cross-lagged effects of academic stress on motivation	84.39	41	0.976	0.947	0.052	[0.036, 0.068]
Model 3 with autoregressive paths and cross-lagged effects of motivation on academic stress	83.27	41	0.977	0.948	0.051	[0.035, 0.067]
Model 4 with all autoregressive and cross-lagged effects paths	59.44	26	0.982	0.935	0.057	[0.038, 0.077]

df, degrees of freedom; CFI, Comparative Fit Index; TLI, Tucker–Lewis Index; RMSEA, Root Mean Squared Error of Approximation; CI, Confidence Interval.

students' motivation and experience in regular classroom courses (Skinner et al., 2012). Since PE has been considered to be an effective method to reduce academic stress (Ki et al., 2019), the autonomous motivation toward PE, as a predictor of participation, may also serve as an important factor to relieve academic stress.

Previous studies have found the positive effect of motivation toward PE on students' perceived stress and academic attitudes (Back, 2015; Park et al., 2020). On the other side, a study conducted on student-athletes found that as perceived stress increased, students' motivation for sports participation declined (Holden et al., 2019). In addition, factors related to testing stress, such as performance grading and test criteria, were also found to influence students' autonomous motivation toward PE (Krijgsman et al., 2017; Haerens et al., 2019). Based on the results of these studies, we proposed a reciprocal relationship between stress and motivation across contexts.

Academic stress and physical education in China

Although academic performance is a major source of stress among adolescents worldwide, this phenomenon seems to be more pronounced in Asian countries (Liu and Lu, 2012). Particularly, students from East-Asian countries, such as China, tend to spend more time taking classes and doing homework and perceive more academic stress than students from Western countries do (Ye et al., 2019). Due to highly valued academic achievement in traditional Chinese culture, academic performance has become a concern among Chinese adolescents and their parents as well as educators and administrators, which results in exam-oriented education, excessive stress, orderly school disciplinary climate, and lack of academic motivation (Sun et al., 2013; Ye et al., 2019; Ning, 2020).

A view commonly expressed in China is that sport requires little intellect (Jones, 1999). Although PE is recognized as a necessary part of education with the objective of health and fitness development which requires students to participate in PE and other school exercises for at least 1 hour every day, PE is not a subject of entrance examinations. Hence, considerable emphasis on academic success and university education has resulted in the negligence of PE in middle schools and even in primary schools. In a study of students from Shanghai (Zhu et al., 2017), the academic burden was found to be the primary reason for not having sufficient PA. Those with academic burdens were less likely to meet the PA guidelines but reported longer homework time. Consequently, Chinese adolescents showed increased physical inactivity and sedentary behavior in recent years and more than 85% of them failed to meet the guideline of about 60 min daily PA (Mowling et al., 2004; Lu et al., 2017; Liu et al., 2019).

The present study

In consideration of the fact that Chinese adolescents experience high academic stress and limited participation in PA, we consider that the Chinese educational context could serve as an interesting context to explore how to reduce academic stress levels and promote PA participation. Using data from secondary school students in Shanghai who have one of the highest academic burdens and heaviest homework loads, we aimed to examine how academic stress levels and self-determined motivation toward PE change over time. Because of the lacking research on the relationship between stress and motivation across contexts, we also aimed to examine the relationship between academic stress and motivation toward PE to explore whether the influence of motivation-related factors can be generalized to other contexts. Based on the existing literature, we hypothesized that (1) both academic stress and motivation would change over time, and specifically, academic stress would decrease, and motivation would increase; (2) academic stress would relate negatively to self-determined motivation; (3) academic stress would predict a decrease in self-determined motivation toward PE, while self-determined motivation toward PE would predict a reduction in academic stress. We will test these hypotheses in turn after checking the measurement model for stress and motivation.

Materials and methods

Design

The current study applies a non-experimental longitudinal design. We conducted two evaluations of academic stress and motivation toward PE in single group of secondary school students across 3 months within the semester. Exclusion criteria for participants included the presence of cognitive deficits or significant sociocultural differences.

Participants

A sample of 556 students (47.84% female) from Year 6 to 8 of four schools in average socio-cultural areas in Shanghai, with a mean age of 12.55 years (SD = 0.78, range: 10–15) participated in the study at the beginning of the fall semester and 3 months later. Among them, 463 students completed the questionnaires at both data collections, 34 students were absent at the first data collection, and 49 students were absent at the second data collection.

Instruments

Academic stress

We used Educational Stress Scale for Adolescents (Sun et al., 2011), which was originally developed and administrated among Chinese adolescents, to measure students' academic stress. The scale contains five subscales, 4-item subscale pressure from study (e.g., "I feel a lot of pressure in my daily studying"), 3-item subscale workload (e.g., "I feel there is too much homework"), 3-item subscale worry about grades (e.g., "I feel that I have disappointed my teacher when my test/exam results are not ideal"), 3-item subscale self-expectation (e.g., "I feel stressed when I do not live up to my own standards"), and 3-item subscale despondency (e.g., "I am very dissatisfied with my academic grades"). Students were asked to respond on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). See validity and reliability for the present sample in the Section "Results."

Motivation toward physical education

We administrated the adapted Chinese version of the Perceived Locus of Causality Scale (Goudas et al., 1994; Yang et al., 2019) to assess motivation toward PE. We measured three factors: autonomous motivation, formed by 4-item subscale intrinsic motivation (e.g., "because PE is fun.") and 3-item subscale identified regulation (e.g., "because I want to learn sports skills."), 3-item subscale controlled motivation, formed by introjected regulation (e.g., "because I would feel bad about myself if I didn't.") and 3-item subscale external regulation (e.g., "because that's the rule."), and 4-item subscale amotivation (e.g., "but I really don't know why."). Preceded by the stem "I participate in PE," students were asked to respond on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). See validity and reliability for the present sample in the Section "Results."

Procedure

After obtaining permission from the participating schools and ethical approval from the research ethics committee of the first author' institution, we contacted teachers and/or directors of the PE department to approach the students for participation in the study. We informed students and their parents of the purpose of the research, the confidential procedure, and the voluntary participation to obtain consent from both sides. With the help of school teachers, we administrated the questionnaires before a PE course. Once students decided to participate in the study voluntarily, they began responding to questionnaires, which last between 10 and 25 min. To enable data matching over time without the need for names, we used ID code lists. All the procedures were following the ethical standards of the institutional human research committee.

Data analysis

We examined first the measurement model using the weighted least squares means and variance adjusted estimator and the internal consistency of each subscale with Cronbach's alpha and non-linear reliability coefficients (Green and Yang, 2009; Appelbaum et al., 2018). We used Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) >0.90 and Root Mean Squared Error of Approximation (RMSEA) <0.08, as criteria indicative of an acceptable model fit for quantitative data and CFI and TLI >0.95 and RMSEA <0.06 as criteria indicative of a good model fit (Kline, 2016). Since including all items and factors simultaneously in panel models requires a large sample size to produce stable estimates (Kline, 2016), we used the composite scores of factors for further analyses intended to test the main hypothesis. We compared the factors between two collections with paired t-test to explore the changes in academic stress and motivation toward PE over time and calculated Pearson correlation coefficients to examine the relationship among the factors within each time point.

Finally, we conducted the cross-lagged panel analyses to examine the relationship between academic stress and motivation toward PE over time, using the maximum likelihood estimator (Newsom, 2015). We tested and compared four models: Model 1 with autoregressive paths between two-time points; Model 2 with autoregressive paths and cross-lagged effects of academic stress on motivation; Model 3 with

autoregressive paths and cross-lagged effects of motivation on academic stress; Model 4 with all autoregressive and cross-lagged effects paths. In order to choose the best-fitting model, we compared the models with cross-lagged effects (i.e., Model 2, Model 3, and Model 4) with the stability model with only the autoregressive paths (i.e., Model 1) through the χ^2 difference test.

Results

Missing data were infrequent (3.52% at the first collection; 3.22% at the second collection), which did not require special missing data treatment (Graham, 2009). The values of skewness of all items are between −1.11 and 1.15, and the values of kurtosis of all items are 2.28 and 4.03 which indicated a normal distribution in general. CFI and TLI of the measurement model were above 0.90 and RMSEA was lower than 0.06, which supported the structure of the administrated scales (see the first line in **Table 1**). In addition, Cronbach's alpha coefficients of all subscales were higher than 0.7 as well as most of the non-linear internal consistency coefficients except that of despondency close to 0.7, which supported the internal consistency of the subscales of academic stress and motivation toward PE (Hair et al., 2018). See **Table 2**.

Regarding the difference between the two data collections, pressure from study, workload, controlled motivation and amotivation decreased significantly while despondency and autonomous motivation increased significantly from the first collection to the second collection (see **Table 2**, penultimate column).

Table 3 presents the correlation coefficients between variables at the first time point and the second time point separately. In both data collections, we found positive intercorrelations among academic stress factors. With regards to motivation toward PE, autonomous motivation was negatively related to controlled motivation and amotivation, while controlled motivation and amotivation were positively intercorrelated with each other. In respect of the relationship between academic stress and motivation, pressure from study, workload, and despondency were negatively associated with autonomous motivation and positively associated with controlled motivation and amotivation. Worry about grades was positively related to both autonomous motivation and controlled motivation but not significantly related to amotivation. Self-expectation was positively correlated with controlled motivation and amotivation but not significantly correlated with autonomous motivation.

Table 1 also presents the fit indices of cross-lagged models between two time points. All the models fit well with the data. Model 1 showed high stability of academic stress and motivation toward PE across 3 months with significant standardized autoregression coefficients ranging from 0.30 to 0.46. In Model 2, both the path from despondency to autonomous motivation ($\beta = -0.18$, $p = < 0.001$) and the path from worry about grades to amotivation ($\beta = -0.09$, $p = 0.041$) were significant. In Model 3, only the effect of amotivation on despondency ($\beta = 0.13$, $p = 0.016$) was significant. As can be seen in **Figure 1**, in the reciprocal model, worry about grades negatively predicted amotivation ($\beta = -0.09$, $p = 0.040$), and despondency negatively predicted autonomous motivation ($\beta = -0.18$, $p < 0.001$), while amotivation positively predicted despondency ($\beta = 0.14$, $p = 0.010$). Comparing all the models, Model 4, significantly different from the stability model ($\Delta\chi^2 = 48.518$, $\Delta df = 30$, $p = 0.017$), fit best with the data.

Discussion

In the current study, we examined the changes in academic stress and motivation toward PE among Chinese students and the relationship between these variables across time. Most academic stress factors and controlled motivation toward PE decreased significantly while autonomous motivation increased significantly across time. With regards to their relationship, we found that almost all the academic stress factors were positively related to controlled motivation and amotivation, but only pressure from study, workload, and despondency were negatively related to autonomous motivation. We also found a negative prediction of despondency on autonomous motivation and a positive prediction of amotivation on despondency. However, worry about grades was found to be positively related to autonomous motivation and to negatively predict amotivation.

Contrary to the previous findings on long-term change of motivation (Ullrich-French and Cox, 2014), we found an increase in autonomous motivation and decreases in controlled motivation and amotivation within the semester. According to the Self-Determination Theory, autonomous motivation is related to satisfaction of basic psychological needs, such as autonomy and relatedness (Standage et al., 2012; Ryan and Deci, 2017). The increase in self-determined motivation in a short time may be explained by the fact that students get to know their teacher and classmates which improves the fulfillment of the relatedness needed during the semester.

Consistent with previous literature (Xiang et al., 2019), we found that academic stress factors, like pressure from study and workload, declined within the semester. As suggested by Xiang et al. (2019), at the beginning of the semester, students lack time to adapt well from holiday to school lives and academic activities seem difficult to them. Therefore, as time goes on, students tend to experience less academic stress because of knowledge accumulation and good preparation.

A high level of stress, particularly academic stress, has been found to be related to less intention to participate in PA and PE among adolescents (Back, 2015). Similarly, we also

found a negative relationship between academic stress and self-determined motivation toward PE. In particular, pressure from study, workload, and despondency was negatively associated with autonomous motivation but positively associated with controlled motivation and amotivation. Nevertheless, worry about grades was positively related to both autonomous motivation and controlled motivation. In previous studies (Sun et al., 2011, 2013), worry about grades, unlike other academic stress factors, was not found to be related to negative consequences, such as low efficacy and poor health condition. Therefore, we suggest that worry about grades may function as one positive source of academic stress.

Both academic stress and motivation toward PE were found to influence each other. A previous study of students from Shanghai also showed that academic burden was perceived as the primary reason for insufficient PA and longer homework time (Zhu et al., 2017). In the current study, we found despondency as a negative predictor of autonomous motivation which suggests that the impact of academic stress on participation in PE may come from the reduced self-determined motivation. However, not all academic stress factors were found to be predictors of reduction of self-determined motivation, especially worry about grades was found to be a negative predictor of amotivation. In a previous study on academic stress and PA, Frömel et al. (2020) also found that girls with academic stress presented low participation in PA during school but high participation in PA after school. Thus, we suggest that some academic stress, such as worry about grades, may not necessarily lead to a negative impact on motivation and/or participation in PE. Concerning the influence of motivation toward PE on academic stress, we found that amotivation positively predicted despondency. Previous studies have shown that participation in PE can be related to positive academic outcomes, such as less academic stress and higher test scores (Sallis et al., 2012; Back, 2015; Shen, 2017). The encountered influence of amotivation on academic stress implies that the impact of PE on academic outcomes may function through the motivation toward PE and academic activities (Torrijos-Niño et al., 2014). However, the influence of autonomous motivation on academic stress was not found significant, which suggests that autonomous motivations may not affect directly academic stress.

Implications

Since 2002, the Chinese Ministry of Education has conducted PE curriculum reform with a focus on shifting from sports skills to health and fitness development (Jin, 2013).

TABLE 2 Descriptive statistics and internal consistency coefficients.

	First collection				Second collection					
	M	*SD*	α	ω	*M*	*SD*	α	ω	Δ*M*	Range
Pressure from study	2.84	1.03	0.85	0.83	2.63	1.11	0.91	0.89	−0.21***	1–5
Workload	2.63	1.14	0.90	0.91	2.25	1.06	0.91	0.92	−0.37***	1–5
Worry about grades	3.75	1.01	0.85	0.84	3.70	1.06	0.86	0.86	−0.05	1–5
Self-expectation	2.96	1.02	0.74	0.71	2.88	1.07	0.79	0.76	−0.08	1–5
Despondency	2.34	0.91	0.70	0.67	2.47	0.96	0.71	0.70	0.13**	1–5
Autonomous motivation	3.98	0.90	0.89	0.93	4.10	0.95	0.92	0.95	0.12**	1–5
Controlled motivation	2.67	0.91	0.72	0.79	2.46	0.90	0.73	0.81	−0.21***	1–5
Amotivation	1.89	0.92	0.86	0.84	1.76	0.89	0.87	0.85	−0.13**	1–5

α = Cronbach's alpha coefficient; ω = non-linear reliability coefficient; Δ = change from first collection to second collection. **$p < 0.01$; ***$p < 0.001$.

TABLE 3 Correlations among academic stress and motivation toward physical education (PE) (first collection below diagonal and second collection above diagonal).

	1	2	3	4	5	6	7	8
1. Pressure from study	—	0.77***	0.36***	0.46***	0.65***	−0.19***	0.40***	0.41***
2. Workload	0.71***	—	0.16***	0.31***	0.54***	−0.28***	0.37***	0.41***
3. Worry about grades	0.22***	0.06	—	0.49***	0.30***	0.16***	0.31***	0.08
4. Self-expectation	0.37***	0.20***	0.38***	—	0.46***	−0.01	0.27***	0.19***
5. Despondency	0.48***	0.35***	0.10*	0.31***	—	−0.25***	0.36***	0.48***
6. Autonomous motivation	−0.15**	−0.20***	0.22***	0.08	−0.15**	—	−0.12**	−0.51***
7. Controlled motivation	0.40***	0.37***	0.25***	0.25***	0.18***	−0.06	—	0.45***
8. Amotivation	0.32***	0.32***	−0.09	0.06	0.22***	−0.54***	0.39***	—

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

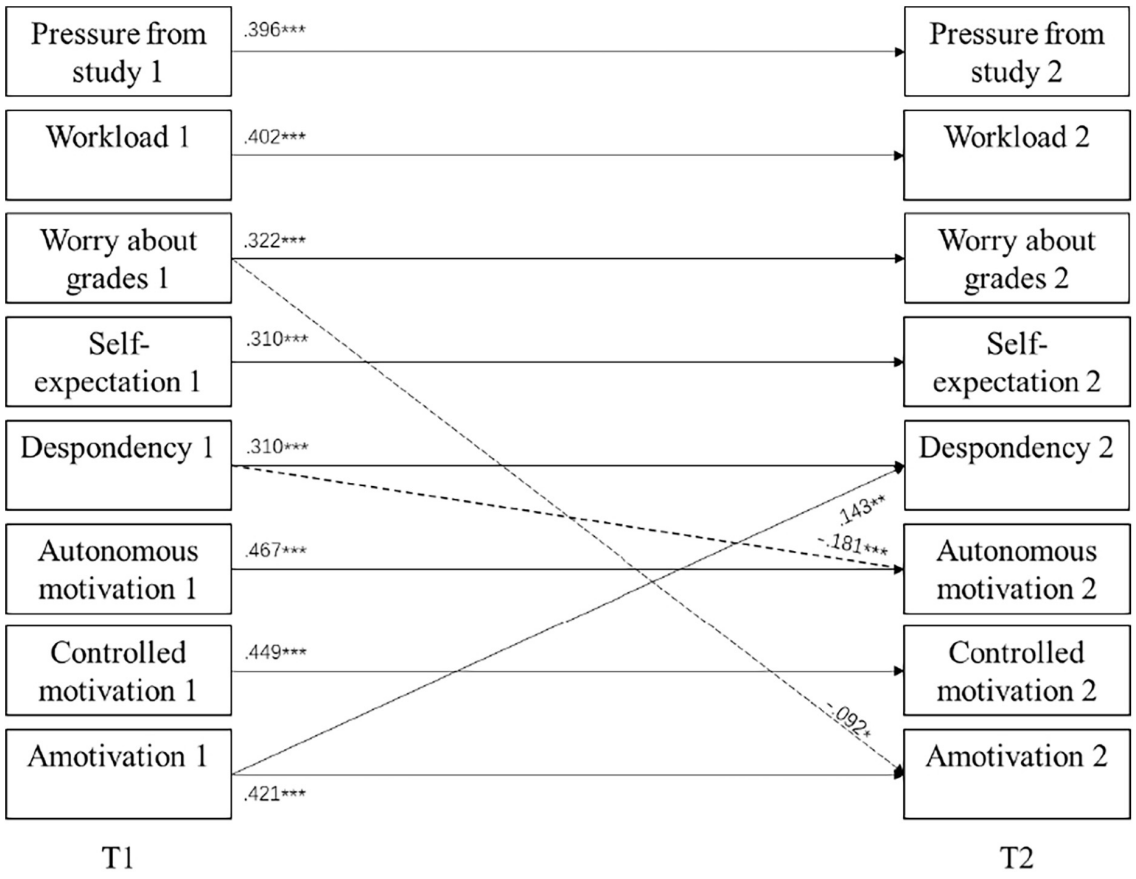

FIGURE 1
Cross-lagged model of the relationship between academic stress and motivation toward physical education (PE). Dashed lines depict the negative regression. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Nevertheless, Chinese adolescents reported increasing physical inactivity and failed to meet the PA guidelines. Prioritized academic achievement over PA in Chinese culture has been one of the barriers to participation in PE (Jones, 1999; Zhu et al., 2017). The influence of academic stress on motivation toward PE found in our study implies that high academic stress levels may reduce participation in PE through decreased self-determined motivation toward PE. On the other side, academic stress has drawn more and more attention from parents, educators, and government, especially in China and other Asian countries (Liu and Lu, 2012). To alleviate stress, PE has been believed to be an effective method (Ki et al., 2019). However, increasing PE sessions does not necessarily guarantee benefits (Resaland et al., 2016). As the traditional PE curriculum in China is designed to promote endurance, strength, flexibility exercises, and circuit training for cardiovascular health, students have little choice in selecting sports during PE courses. The encountered influence of amotivation on academic stress suggests that for students who lack motivation toward PE, being forced to participate in PE may increase rather than decrease academic stress. Taking these together, when designing and administrating interventions to reduce academic stress or to promote PA participation, we recommend taking both principal subjects related to academic factors and PE course into account simultaneously, such as academic burden and quality of PE which have been found to be influential factors of academic stress and PA participation (Zhu et al., 2017; Zhang et al., 2019).

In China, PE is less emphasized at school due to the idea that sports require little intellect and PE is not part of the important entrance examination. A similar view is held by most parents and educators worldwide that the increasing time on PA will be at the expense of decreased time on principal subjects (Wang, 2017). On the contrary, studies have suggested that PE and other PA programs would benefit academic performance (e.g., Sallis et al., 2012; Back, 2015; Shen, 2017). Torrijos-Niño et al. (2014) suggest that the positive impact of PE on the academic achievement of principal subjects may also exert indirectly through motivation. In the current study, academic stress was found to negatively predict motivation toward PE, similar to the negative influence of academic stress on academic motivation found in previous studies (Liu, 2015;

Rubach and Bonanati, 2021). Meanwhile, students who lack motivation toward PE also reported despondency in principal subject learning. The negative impact of academic stress and motivation toward PE on each other provides evidence that the impact of motivation-related factors in a certain situation, such as PE, can be generalized to other academic subjects (Ryan and Deci, 2017).

Although various studies have found a negative influence of academic stress on students' psychological wellbeing and academic performance, academic stress may not always lead to negative consequences. As suggested by some researchers (Sang et al., 2018; You, 2018; Ye et al., 2019), when students view such stress as a challenging opportunity, the academic stress is more likely to result in a positive impact (Sang et al., 2018). Scales et al. (2020) also found that the challenge provided by teachers (high expectations) as an element of developmental relationships had a positive influence on students' academic motivation and sense of belonging. The negative prediction of worry about grades on amotivation toward PE confirms the positive influence of academic stress. When academic stress comes from high expectations which students may perceive as a challenge rather threat, the positive impact of academic stress can also be generalized to other contexts. Accordingly, providing challenges conforming to students' abilities may be an effective method to enhance students' motivation for both principal academic subjects and PE courses.

Limitations and future research

The most important limitation of this study is that we conducted the study in specific Chinese culture, so we need to be cautious when generalizing and interpreting some of the results to other cultures. Although the idea that the increasing time on PE will lead to decreased time on principal subjects and poor academic performance is held by parents and educators worldwide (Wang, 2017), the over-emphasis on academic performance in Chinese culture may make students more sensitive to academic stress and its influence. We suggest conducting similar research in other cultures to examine whether such a reciprocal relationship between academic stress and motivation toward PE is consistent across different cultures.

Second, we only measured academic stress and motivation toward PE within a semester. Previous studies have shown that both academic stress and motivation vary across semesters and grades in different ways (Ullrich-French and Cox, 2014; Barker et al., 2018). Future research will need to measure both variables within and across semesters to investigate how academic stress and motivation toward PE affect each other in both the short term and long term.

Finally, the encountered positive relationship between worry about grades and autonomous motivation reveals that not all academic stress factors have a negative impact on students' participation in PE. To examine the possible positive influence of academic stress on students' wellbeing, it would be useful to include consequent variables, such as intention to participate in PE, PA level during PE, and positive and negative affect, which are highly correlated with academic stress and motivation toward PE (Torrijos-Niño et al., 2014). In addition, as both academic stress and motivation would be influenced by parenting style and teaching styles (e.g., Van Der Kaap-Deeder et al., 2019; Moè et al., 2020), we also recommend including variables such as autonomy support and psychological control to further explore the relationship between academic stress and motivation.

Conclusion

Similar to previous studies on the relationship between academic stress and academic motivation, we found a reciprocal relationship between academic stress and motivation toward PE. The current study provides evidence to support that the influence of motivation-related factors can be generalized to other contexts, as suggested by Ryan and Deci (2017). Specifically, the influences of despondency and self-determined motivation on each other suggest that academic stress may hinder participation in PE through reduction of self-determined motivation while lack of motivation toward PE may lead to an increase of academic stress through the generalized impact of motivation in PE to other educational situations in the school context. Therefore, whether to relieve students' academic stress or to promote PA participation, educators and administrators should take academic factors related to principal subjects and PE courses together. Finally, the positive relationship between worry about grades and self-determined motivation toward PE suggests that providing students adequate challenge as a source of academic stress may enhance their self-determined motivation not only in a principal subject-related academic context but also in a PE context.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://osf.io/dtmnk/?view_only=7b80b0b6fbe349e8aa1f7b0ca149a0fd.

Ethics statement

The studies involving human participants were reviewed and approved by East China Normal University. Written

informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

MY contributed to the data collection. MY and CV analyzed the data and approved the final manuscript. All authors conceived the hypothesis of this study and drafted and/or revised the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The antecedents and consequences of autonomous and controlled motivation: Domain specificity and motivational sequence at the situational level

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The aim of this study was to investigate the level of specificity of the different regulation types described by Self-Determination Theory, and to evaluate its impact on the links with its antecedents and consequences, in an academic context. In line with the school-subject-specificity hypothesis, we postulated that autonomous motivation types (AM types) would be more specific to the situational level than controlled motivation types (CM types). Moreover, we hypothesized that AM types would be, at this level, more strongly associated with its antecedents and consequences than CM types. Three hundred fourteen university students were asked to complete online questionnaires assessing their motivation, motivational antecedents (i.e., autonomy-supportive climate and self-concept) and consequences (i.e., emotions and grades) in various courses. As expected, results from structural equation modeling confirmed that AM types were more specific to the situational level than CM types. Moreover, a higher number of significant correlations were found between motivation and its antecedents and consequences in the corresponding course for AM than for CM types. Educational implications and directions for future research are discussed.

KEYWORDS

self-determination theory, school-subject-specificity hypothesis, autonomy-supportive climate, academic emotions, achievement

Introduction

Self-Determination Theory (SDT; Deci and Ryan, 1985; Ryan and Deci, 2017) provides a framework that enables to understand the mechanisms favoring optimal functioning. Different regulation types have been described, varying in their level of self-determination, from the most autonomous to the most controlled. Moreover, SDT describes how social contexts influence motivation. More specifically, social environments that facilitate the

satisfaction of basic psychological needs promote the most autonomous motivation types (Deci and Ryan, 2000). In contrast, social contexts which thwart satisfaction of these needs yield the most controlled motivation types (Deci and Ryan, 2000). Autonomous motivation types (AM types) have been shown to be associated with greater creativity, enhanced psychological well-being, more persistence and higher performance in activities (Deci and Ryan, 2008) whereas controlled motivation types (CM types) have been associated with lower well-being, poorer mental health and lower performances in activities (see Deci and Ryan, 2000, for a review).

Recently, in the academic domain, the school-subject-specificity hypothesis (Chanal and Guay, 2015) was developed to explain why the differentiation between school subjects was different according to the types of motivation. Specifically, AM and CM types were demonstrated to be not equally specific to the school subject (i.e., the situational level) in which they were assessed. Using a multiple school subjects and multiple level of hierarchy design (i.e., situational and contextual), AM types were found to be more differentiated across school subjects than CM types because AM types were more specific to the situational level than CM types. These results could have serious implications on the relations between antecedents and consequences of AM and CM types in the SDT framework. Indeed, this would imply that antecedents and consequences should be more related to AM than to CM types at the situational level. However, results in studies aimed at exploring relations between antecedents and consequences with AM and CM types at the situational level had never examined a difference in the specificity level of the motivation types. Because most of the SDT research had focused on studies in situational level or in contextual level separately, or combined AM and CM types to operationalize motivation at the situational level (i.e., by using an index) without considering this specificity difference, questions about the consequences of this result on the motivational classsical sequence depicted in SDT are still unanswered.

The aim of this study was to investigate antecedents and consequences of AM and CM types in light of the school-subject-specificity hypothesis. More precisely, we wanted to examine whether the nature and the strength of relations between antecedents and consequences of motivation could depend on the specificity of the motivation types. In this research, we thus considered antecedents (i.e., autonomy-supportive climate, self-concept) and consequences (i.e., emotions and grades) of students' motivation types at the situational level (i.e., toward various university courses) controlling for the level of specificity of the different measures by considering the contextual level (i.e., motivation for studying psychology).

Self-determination theory

Contrary to other motivational theories that have treated motivation as a unitary concept varying only in quantity (e.g., Bandura, 1997), Self-Determination Theory considers motivation as a multidimensional concept that also varies in terms of quality. Indeed, SDT recognizes that there are three types of motivation: Intrinsic motivation, extrinsic motivation and amotivation (Ryan and Deci, 2017). Intrinsic motivation refers to the act of doing an activity for the pleasure and for its inherent satisfaction (Ryan and Deci, 2000a). On the contrary, extrinsic motivation is defined as doing of an activity to attain some separable consequences (Ryan and Deci, 2017). Deci and Ryan (1985) suggest the existence of different types of extrinsic motivation varying in their level of self-determination. Four extrinsic motivations are considered from low to high level of self-determination: External regulation, introjected regulation, identified regulation, and integrated regulation. External regulation involves doing a behavior to satisfy an external demand or reward contingency (Ryan and Deci, 2000b). Introjected regulation is the second type of extrinsic motivation and occurs when behaviors are performed in response to internal pressures, to avoid guilt or anxiety or to attain pride or ego-enhancements (Ryan and Deci, 2000a). Recently, Assor et al. (2009) distinguished between two types of introjected regulation: Introjected approach (or positive introjected) and introjected avoidance (or negative introjected). Introjected approach refers to the act of doing an activity to attain feelings of high self-worth or pride, whereas introjected avoidance refers to the act of doing an activity to avoid feelings of low self-worth, shame or guilt (Assor et al., 2009). According to these authors, introjected approach would be more self-determined than introjected avoidance. A more self-determined form of extrinsic motivation is identified regulation. Identified regulation occurs when people have identified with the personal importance of a behavior and have accepted it as their own (Ryan and Deci, 2017). The behavior is freely chosen but it is performed for instrumental purposes. The most self-determined form of extrinsic motivation is integrated regulation. Integrated regulation occurs when identifications have been evaluated and brought into congruence with individual's values and needs (Ryan and Deci, 2002). As explained by Sheldon et al. (2017), there is a consensus that integrated motivation is problematic to measure. Other than the classical intrinsic/extrinsic one, another distinction occurs in the SDT framework relative to the level of internalization of motivation types. Autonomous motivation types refer to behaviors performed voluntarily and by choice (Vansteenkiste et al., 2006), and comprises intrinsic motivation as well as integrated and identified regulations. In contrast, controlled motivation types refer to behaviors constrained by internal and external pressures (Assor et al., 2009), and comprises introjected and external regulations. Finally, amotivation refers to a lack of intentionality or a lack of motivation (Deci and Ryan, 2008).

Given the multidimensional nature of motivation in the SDT, the level of individuals' motivation has been operationalized in different ways. Some research (e.g., Chanal and Guay, 2015) has considered the motivation types proposed by the SDT separately (i.e., using the subscales as separate variables). Some others (e.g., Black and Deci, 2000) have created composite scores based on

measurements of these motivation types (e.g., the Relative Autonomy Index (RAI) obtained by weighting the scores obtained on the different regulations according to their degree of self-determination[1]). The use of the RAI is justified by the fact that it reflects the continuum structure of motivation. Lastly, some others (e.g., De Naeghel et al., 2012) created a composite score based on autonomous motivation (AM) (e.g., by calculating the average obtained for intrinsic, integrated and identified regulations) and controlled motivation (CM) (e.g., by calculating the average obtained for introjected and external regulations). The use of AM and CM scores is supported by evidence for a second-order factor structure (e.g., Gagné et al., 2015).

Hierarchical model of intrinsic and extrinsic motivation

Within the SDT framework, the Hierarchical Model of Intrinsic and Extrinsic Motivation (HMIEM; Vallerand, 1997) was developed with the aim to propose an integrative model able to describe the mechanisms of antecedents and consequences of motivation at different hierarchical levels. First, the HMIEM takes into consideration the different forms of motivation described by SDT and highlights the motivational sequence between antecedents and consequences of motivation. Second, this model considers that these types of motivation exist at three different hierarchical levels. These levels are described as: The *global*, the *contextual* and the *situational*. The global motivation level is defined as a broad disposition to engage in an activity according to an intrinsic, extrinsic or amotivated way (Vallerand, 2000). It refers to individual differences in motivation and can be seen as a characteristic of personality (Vallerand, 1997). The contextual motivation level refers to "motivational orientations (…) that are specific to various contexts such as education, leisure, and interpersonal relationships" (Vallerand, 2000, p. 313). The contextual motivation may vary drastically from one context to another and is more subject to variations than the global motivation (Vallerand, 1997). The situational motivation level refers to the motivation when people are currently engaging in an activity and corresponds to the here and now of motivation (Vallerand, 1997). According to the model, the motivational sequence also exists at these three hierarchical levels. More precisely, antecedents at a particular hierarchical level are described as influencing motivation at the corresponding level, and motivation at a particular hierarchical level as inducing consequences at that corresponding level. Motivational antecedents refer to social factors, human or nonhuman, found in our social environment (Vallerand, 1997). Note that motivation at a given level of the hierarchy is also influenced by motivation at the higher level (e.g., motivation at the situational level influences motivation at the contextual level) (Vallerand, 2000).

Antecedents of autonomous and controlled motivation

As mentioned above, social factors are considered as antecedents of motivation. More specifically, according to Vallerand (1997) and Deci and Ryan (2008), social factors influence individual's motivation through their impact on the satisfaction of basic psychological needs (i.e., need for autonomy, competence, and relatedness). Indeed, social factors that satisfy people's basic psychological needs, lead to the most autonomous motivation types (Ryan and Deci, 2000b). In contrast, social factors that thwart satisfaction of these needs yield the least autonomous motivation types (Ryan and Deci, 2000b). Many studies in different contexts (e.g., sport, health, work, education) have therefore focused on the environmental conditions that support people's psychological needs. In the academic context, one of the most studied social factors influencing students' motivation is the motivational climate introduced by the teacher in the classroom and especially the teaching style he or she uses (Vallerand and Miquelon, 2016). Teachers' motivational climate is postulated to influence students' motivation by satisfying or thwarting their need for autonomy (Vallerand, 1997; Ryan and Deci, 2017). The need for competence is another psychological need that has often been studied in the academic context. The satisfaction or frustration of this need in students is assumed to influence their academic motivation (Vallerand, 1997; Ryan and Deci, 2017). In many studies, the feelings or perceptions of competence have been studied and operationalized as a more general construct namely the self-concept. In the academic context, these two antecedents (i.e., motivational climate and self-concept) have been studied at the contextual (i.e., toward school in general) and situational levels (i.e., toward a specific school subject or course). These antecedents are discussed in the following sections.

Teachers' motivational climate

Teachers' motivational climate refers to the interpersonal style that teachers adopt in the classroom with their students. These motivational interpersonal styles of teachers range along a continuum that goes from a style conceptualized as controlling to a style conceptualized as autonomy-supportive (Reeve and Jang, 2006; Reeve, 2015). Autonomy-supportive teachers offer choices to students, acknowledge their affects and feelings, and explain the use, value, and importance of school activities (Reeve, 2006). In contrast, controlling teachers provide extrinsic incentives, emphasize external evaluations, use pressuring communications and establish external goals (Reeve and Jang, 2006; Reeve, 2015).

Studies considering a combination of all motivation types into a single composite score consistently showed that the more students felt their autonomy supported by their teacher, the higher

1 The most common formula for RAI is: 2(intrinsic)+1(identified)−1(introjection)−2(external) (Grolnick and Ryan, 1989).

their RAI toward studies at the contextual level (Soenens and Vansteenkiste, 2005; Amoura et al., 2015; Orsini et al., 2017) and at the situational level (Black and Deci, 2000; Filak and Sheldon, 2008). When research considered AM and CM, results showed that autonomy-supportive climate was consistently positively associated with AM at the contextual level (Vansteenkiste et al., 2012; Litalien and Guay, 2015; Orsini et al., 2017) and at the situation level (Haerens et al., 2015; Behzadnia et al., 2018). However, results were less consistent for CM at both levels, showing negative (Litalien and Guay, 2015) or positive relation (Orsini et al., 2017) with autonomy-supportive climate, or no significant association between these constructs (Vansteenkiste et al., 2012). Research considering each motivation type separately were only find at the situational level. The results showed consistent positive associations between autonomy-supportive climate and intrinsic and identified regulations (Guay et al., 2013; Sparks et al., 2016; Behzadnia et al., 2018; Vasconcellos et al., 2020) while the relations between motivational climate and introjected and external regulations were more mixed. Introjected regulation was unrelated to autonomy-supportive climate in some studies (Behzadnia et al., 2018; Vasconcellos et al., 2020), while in other studies positive associations were found (Guay et al., 2013; Sparks et al., 2016). Concerning external regulation, results of studies showed that this regulation was negatively associated with autonomy-supportive climate in some studies (Sparks et al., 2016; Behzadnia et al., 2018) and unrelated in other study (Vasconcellos et al., 2020). Finally, a meta-analysis (Bureau et al., 2022), carried out at the two levels of hierarchy, showed that autonomy support from teacher was positively related to intrinsic motivation, identified, and introjected regulations, and negatively to external regulation.

Student's self-concept

Self-concept can broadly be described as individuals' perceptions of themselves, formed through experience and interpretation of their environment (Shavelson et al., 1976). These perceptions comprise feelings of self-confidence, self-worth, self-acceptance, competence, and ability (Marsh et al., 2017). In the academic context, the self-concept mainly refers to the students' perceptions of their competences in school or in their studies in general (i.e., contextual level) or in a specific school subject or course (i.e., situational level).

Studies using a single composite score showed that academic self-concept was positively associated with RAI at the contextual level (Fortier et al., 1995; Vallerand et al., 1997; Guay et al., 2010b) and at the situational level (Timo et al., 2016). Considering AM and CM separately, results were more mixed whether they were at the contextual or situation level (De Naeghel et al., 2012; Valenzuela et al., 2018). Few studies (Guay et al., 2010a; Chanal and Guay, 2015) examined the links between each motivation type separately and self-concept at school level (Valenzuela et al., 2018) or in various school subjects simultaneously (Guay et al., 2010a; Chanal and Guay, 2015). Results showed consistent evidence that self-concepts were positively associated with intrinsic motivation and identified regulation in a corresponding school subject, whereas relations between self-concepts and introjected and external regulations in a corresponding subject were more mixed showing either no relations or positive ones.

Consequences of autonomous and controlled motivation

Finally, motivation produces important consequences that can be affective (e.g., interest, emotions, satisfaction), cognitive (e.g., concentration, attention, learning) and behavioral (e.g., persistence in the task, performance) (Vallerand, 1997). More importantly, a key idea of SDT and HMIEM is that the different regulation types lead to different consequences. Indeed, they postulate that the more self-determined the motivation is, the more positive the consequences are. In the following sections, we will focus on the studies concerning the consequences in terms of academic achievement and emotions and will present them according to the hierarchical level considered and the operationalization of motivation used.

Student's achievement

All studies using a single composite score at the contextual or situational level demonstrated that the higher the RAI, the higher achievement in general (Grolnick et al., 1991; Fortier et al., 1995; Guay and Vallerand, 1997; Black and Deci, 2000; Ratelle et al., 2005). Research considering AM and CM separately confirmed the positive influence of AM at the contextual (Brunet et al., 2015; Litalien et al., 2015) and situational level (De Naeghel et al., 2012; Jeno et al., 2018; Botnaru et al., 2021) and demonstrated the negative impact of CM on academic achievement except for one study at the situational level (Jeno et al., 2018). However, other studies found no significant relations between achievement and CM (Kusurkar et al., 2013). For studies considering each regulation type separately, results confirmed that academic achievement was positively associated with intrinsic and identified regulations at both levels (Noels et al., 2001; Taylor et al., 2014; Litalien et al., 2015; Leroy and Bressoux, 2016; Lohbeck, 2018; Orsini et al., 2019; Howard et al., 2021, study 1). Concerning CM types, results were more mixed and showed that achievement was negatively associated with introjected and external regulations in some studies (Taylor et al., 2014; Litalien et al., 2015; Leroy and Bressoux, 2016; Lohbeck, 2018, study 1), while in others (Noels et al., 1999; McEown et al., 2014; Orsini et al., 2019; Howard et al., 2021) no significant relations were found for these two regulations.

Student's academic emotions

All studies using a single composite score at the contextual or situational level demonstrated that the higher the students' RAI, the more positive emotions they experienced (Miserandino, 1996; Black and Deci, 2000; Levesque et al., 2004). Research considering AM and CM separately confirmed the positive influence of AM and demonstrated the negative impact of CM on different

affects (Brunet et al., 2015; Litalien et al., 2015) at the contextual level. For studies considering each motivation type separately, research showed that autonomous motivation types were related to the most positive consequences and that external regulation was related to negative outcomes at both level (Noels et al., 1999; Litalien et al., 2015; Howard et al., 2021). Results are mixed for introjected regulations. Some studies showed that introjected regulation was negatively related to positive affective outcomes, and positively related to negative affective outcomes (Noels et al., 1999; Litalien et al., 2015; Howard et al., 2021) but some others found introjected regulation to be positively related to pleasure in school activities (Ryan and Connell, 1989; Howard et al., 2021) and to positive emotions (Vallerand et al., 1989; Bailey and Phillips, 2016; Howard et al., 2021).

In sum, it seems that the links between the different types of motivation and their antecedents and consequences seem to be dependent of the operationalization of the motivation used. Indeed, the results of studies using a single composite score (i.e., RAI) are consistent with each other and with the assumptions of SDT. On the other hand, when the types of motivations are operationalized in two composite scores (i.e., AM and CM) or when the types of motivation are considered separately, the results appear more nuanced and sometimes contradict theoretical assumptions but also each other. Second, in most of the studies presented, the authors assessed motivation, antecedents, and consequences at only one hierarchical level or in one school subject. Indeed, few studies have examined the links between motivation, its antecedents, and consequences at different hierarchical levels or toward several school subjects simultaneously. However, these links also seem to depend on the hierarchical level that is considered. Tables 1, 2 detail the results of studies presented in this article on the relationships between motivation and its antecedents (Table 1) and its consequences (Table 2). It should be noted that given the large number of publications available, the list of studies presented is not completely exhaustive but provides a good overview of the results concerning the links between motivation and its antecedents and consequences in the educational context.

TABLE 1 Synthesis of the links observed in the studies between motivation and its antecedents according to the hierarchical level considered and the operationalization of the motivation used.

	Antecedents			
	Motivational climate		**Self-concept**	
	Contextual	**Situational**	**Contextual**	**Situational**
RAI	*Positive* (Soenens and Vansteenkiste, 2005; Amoura et al., 2015; Orsini et al., 2017)	*Positive* (Black and Deci, 2000; Filak and Sheldon, 2008)	*Positive* (Fortier et al., 1995; Vallerand et al., 1997; Guay et al., 2010a)	*Positive* (Timo et al., 2016)
AM and CM				
AM	*Positive* (Vansteenkiste et al., 2012; Litalien and Guay, 2015; Orsini et al., 2017)	*Positive* (Haerens et al., 2015; Behzadnia et al., 2018)	*NS* (Valenzuela et al., 2018)	*Positive* (De Naeghel et al., 2012)
CM	*Positive* (Orsini et al., 2017) *Negative* (Litalien and Guay, 2015) *NS* (Vansteenkiste et al., 2012)	*NS* (Haerens et al., 2015; Behzadnia et al., 2018)	*Positive* (Valenzuela et al., 2018)	*Negative* (De Naeghel et al., 2012) *Positive* (2/3 SS) (Guay et al., 2010a) *NS* (1/3 SS) (Guay et al., 2010a)
Regulations separately				
Intrinsic		*Positive* (Guay et al., 2013, 2016; Sparks et al., 2016; Behzadnia et al., 2018; Vasconcellos et al., 2020)	*Positive* (Valenzuela et al., 2018)	*Positive* (3/3 SS) (Guay et al., 2010a)
Identified		*Positive* (Guay et al., 2013; Sparks et al., 2016; Behzadnia et al., 2018; Vasconcellos et al., 2020) *NS* (Guay et al., 2016)	*NS* (Valenzuela et al., 2018)	*Positive* (3/3 SS) (Guay et al., 2010a)
Introjected		*Positive* (Guay et al., 2013; Sparks et al., 2016) *NS* (Guay et al., 2016; Behzadnia et al., 2018; Vasconcellos et al., 2020)	*NS* (Valenzuela et al., 2018)	
External		*Positive* (Guay et al., 2013) *Negative* (Vasconcellos et al., 2020) *NS* (Guay et al., 2016; Sparks et al., 2016; Behzadnia et al., 2018)	*Positive* (Valenzuela et al., 2018)	

NS = no significant link. SS = school subject.

TABLE 2 Synthesis of the links observed in the studies between motivation and its consequences according to the hierarchical level considered and the operationalization of the motivation used.

	Consequences					
	Achievement		Positive emotions		Negative emotions	
	Contextual	Situational	Contextual	Situational	Contextual	Situational
RAI	*Positive* (Grolnick et al., 1991; Fortier et al., 1995; Guay and Vallerand, 1997; Ratelle et al., 2005)	*Positive* (Black and Deci, 2000)	*Positive* (Miserandino, 1996; Levesque et al., 2004)	*Positive* (Black and Deci, 2000)		*Negative* (Black and Deci, 2000)
AM and CM						
AM	*Positive* (Brunet et al., 2015; Litalien et al., 2015)	*Positive* (De Naeghel et al., 2012; Jeno et al., 2018; Botnaru et al., 2021)	*Positive* (Brunet et al., 2015; Litalien et al., 2015)		*Negative* (Brunet et al., 2015; Litalien et al., 2015)	
CM	*Positive* (Brunet et al., 2015; Litalien et al., 2015) *NS* (Kusurkar et al., 2013)	*Negative* (De Naeghel et al., 2012; Botnaru et al., 2021) *NS* (Jeno et al., 2018)	*Negative* (Brunet et al., 2015; Litalien et al., 2015)		*Positive* (Brunet et al., 2015; Litalien et al., 2015)	
Regulations separately						
Intrinsic	*Positive* (Taylor et al., 2014; Litalien et al., 2015; Orsini et al., 2019; Howard et al., 2021, study 1)	*Positive* (Noels et al., 2001; Leroy and Bressoux, 2016; Lohbeck, 2018) *NS* (Noels et al., 1999; McEown et al., 2014)	*Positive* (Litalien et al., 2015; Howard et al., 2021)		*Negative* (Litalien et al., 2015)	*Negative* (Noels et al., 1999)
Identified	*Positive* (Taylor et al., 2014; Litalien et al., 2015; Orsini et al., 2019; Howard et al., 2021, study 1) *NS* (Cokley et al., 2001; Fairchild et al., 2005)	*NS* (Noels et al., 1999, 2001; McEown et al., 2014; Leroy and Bressoux, 2016; Lohbeck, 2018)	*Positive* (Litalien et al., 2015; Howard et al., 2021)		*Negative* (Litalien et al., 2015)	*Negative* (Noels et al., 1999)
Introjected	*Negative* (Taylor et al., 2014; Litalien et al., 2015, study 1) *NS* (Cokley et al., 2001; Fairchild et al., 2005; Orsini et al., 2019; Howard et al., 2021)	*NS* (Noels et al., 1999, 2001; McEown et al., 2014; Leroy and Bressoux, 2016; Lohbeck, 2018)	*Negative* (Litalien et al., 2015; Howard et al., 2021) *Positive* (Assor et al., 2009, study1; Vallerand et al., 1989; Bailey and Phillips, 2016; Howard et al., 2021)		*Positive* (Litalien et al., 2015)	*NS* (Noels et al., 1999)
External	*Negative* (Taylor et al., 2014; Litalien et al., 2015, study 1) *Positive* (Taylor et al., 2014, study 4) *NS* (Cokley et al., 2001; Fairchild et al., 2005; Orsini et al., 2019; Howard et al., 2021)	*Negative* (Leroy and Bressoux, 2016; Lohbeck, 2018) *NS* (Noels et al., 1999, 2001; McEown et al., 2014)	*Negative* (Litalien et al., 2015; Howard et al., 2021)		*Positive* (Litalien et al., 2015)	*NS* (Noels et al., 1999)

NS = no significant link.

The school-subject-specificity hypothesis

The school-subject-specificity hypothesis has been developed to explain a non-expected differentiation effect found between school subjects in SDT motivation types. Guay et al. (2010a) investigated variations in motivation across different school subjects (i.e., between school subject differentiation) and demonstrated that the correlations between autonomous motivation for different school subjects were lower than the correlations between controlled motivation for the same school subjects. This differentiated pattern between motivations was not expected nor theoretically conceptualized. Therefore, according to HMIEM, Chanal and Guay (2015) examined primary and secondary students' autonomous and controlled types considering simultaneously two hierarchical levels of the model: The situational level (i.e., motivations for different school subjects) and the contextual level (i.e., motivations toward school in general). These authors investigated the possibility that the differentiation effect found by Guay et al. (2010a) could be related to the degree of specificity of the motivation types with the situational level in which they are measured. The school-subject-specificity-hypothesis states that AM types are more differentiated between school subjects than CM types because AM types are more specific to the situational level. Indeed, AM types would be more school-subject-specific and therefore more differentiated because their regulatory processes are more specific to the characteristics of the activity. The school offers different activities to children, and they discover early those, which give them pleasure and those which give them less (i.e., intrinsic motivation) but also those to which they will more or less identify themselves (i.e., identified regulation). CM types would be less differentiated and therefore less specific because its internal regulatory processes (i.e., introjected regulation) or external regulatory processes (i.e., external regulation) would not be school-subject-specific but could be present in all school subjects. To test their hypothesis, Chanal and Guay (2015) build structural equation models (i.e., correlated trait-correlated method minus one model; CTCM-1) which permitted to distinguish shared variance attributable to the contextual level (i.e., school) and to the situational level (i.e., school subjects). Their results confirmed the school-subject-specificity hypothesis. Indeed, shared variance at the situational level for AM items was higher than for CM items, demonstrating that AM types are more specific than CM types. The school-subject-specificity hypothesis has recently been replicated and extended to more motivation types of the self-determination continuum (Chanal and Paumier, 2020). Chanal and Paumier (2020), using appropriate statistical models that distinguish between contextual and item level variance, demonstrated also that shared variance for CM items were found to be more related to the item level. More importantly, the relations between motivation types and different constructs at the situational level were found to be dependent on the level of specificity of the motivation considered (Chanal and Guay, 2015; Chanal and Paumier, 2020). Indeed, as presented in the previous sections, AM types were more related to self-concept (Chanal and Guay, 2015) and achievement (Chanal and Guay, 2015; Chanal and Paumier, 2020) than CM types.

The present study

In the academic context, the motivational sequence (i.e., "antecedents – motivation – consequences") has mainly been tested either at the contextual level (i.e., academic, or university) or at a situational level (i.e., school subject, or university course). However, research on the school-subject-specificity hypothesis (Chanal and Guay, 2015; Chanal and Paumier, 2020) has shown that the difference in the level of specificity of AM and CM types influenced the existing links with different constructs (i.e., achievement, self-concept). In particular, these studies showed that the most specific motivation types were more strongly associated with constructs than the less specific ones. As a result, the existence of the motivational sequence could depend on the specificity of the motivation type. Considering the specificity hypothesis, this study's main objective was therefore to evaluate the complete motivational sequence (i.e., "antecedents – motivation – consequences") described by the HMIEM (Vallerand, 1997) at the situational level controlling for the shared variance of the measures with the contextual level. More specifically, we investigated the impact of the level of specificity of the AM and CM types in different university courses on the relations between antecedents and consequences and student's motivation. Indeed, the HMIEM model had never considered that motivation types may differ according to their level of specificity. As previously discussed, studies concerning the antecedents and consequences of motivation showed inconsistent results according to the operationalization of motivation used and the hierarchical level considered. The difference in situational specificity level of AM and CM types could explain these inconsistencies. We therefore measured two types of situational antecedents (i.e., self-concept and motivational climate), and two types of situational consequences (i.e., achievement and academic emotions). Our first objective was then to evaluate the repartition of shared variance of motivation types at situational level across multiple sources of variance (i.e., situational, contextual and item levels). More precisely, we postulated that the distribution of the shared variance across these sources would be different for AM and CM types, in confirmation of the school-subject-specificity hypothesis. Following this, our second objective was to evaluate how these differences in distribution of shared variance impact the motivational sequence depicted in HMIEM model at the situational level (i.e., "antecedents – motivation – consequences"). We expected that this motivational sequence at the situational level (i.e., "antecedents – motivation – consequences") would be demonstrated for AM types but not, or less evidently, for CM types.

Our hypotheses were as follows:

> *Hypothesis 1*: According to the school-subject-specificity hypothesis (Chanal and Guay, 2015), we expected that AM would be more specific to the situational level than CM. More specifically, we hypothesized that the quantity of shared variance for items measured at the situational level would be higher for AM than for CM. More specifically, we hypothesized that specificity (i.e., shared variance at the situational level) would be gradually decreasing along the self-determination continuum. In contrast, based on the recent work of Chanal and Paumier (2020), we expected that the quantity of shared variance at the item level would be higher for CM than for AM.
>
> *Hypothesis 2*: We postulated that antecedents (i.e., autonomy-supportive climate, and self-concept) at the situational level would be significantly correlated with AM types but not or less with CM types.
>
> *Hypothesis 3*: We expected that consequences (i.e., academic emotions, and grades) at the situational level would be significantly correlated with AM types but not or less with CM types.

Materials and methods

Participants and procedure

Participants were university students in first year of psychology at University of Geneva, Switzerland. Participants completed online questionnaires using Qualtrics[2] three times during autumn semester: At the beginning (T1: 18–22 October 2017), at the middle (T2: 6–12 November 2017), and the end of the semester (T3: 4–10 December 2017). At time 1, 314 students participated (17.83% male, $M_{age} = 21.71$ years, $SD_{age} = 4.7$ years), 299 at time 2, and 288 at time 3. We address the issue of missing data in the statistical analyses section.

Written consent was required from the participants in order to participate in the study. The ethics commission of the faculty of psychology of the University of Geneva approved this study. The data was obtained and analyzed anonymously. Participants received course credit for their participation.

Measures

Academic motivation

Student's motivation was measured using a scale recently developed and validated by Sheldon et al. (2017). We assessed five subscales measuring five self-determined motivation types, with four items per subscale. The subscales are as follows: Intrinsic motivation (e.g., "because I enjoy …"), identified regulation (e.g., "because I strongly value …"), positive introjected regulation (e.g., "because I want to feel proud of myself"), negative introjected regulation (e.g., "because I would feel guilty if I did not do …"), external regulation (e.g., "because important people (i.e., parents, professors will like me better if I do …"). In their study, carried out on 4 samples, Sheldon et al. (2017) reported Cronbach' alphas between 0.80 and 0.94 for intrinsic motivation subscale, between 0.73 and 0.86 for identified regulation subscale, between 0.68 and 0.82 for positive introjected regulation subscale, between 0.77 and 0.86 for negative introjected regulation subscale, and between 0.61 and 0.88 for external regulation subscale. The scale was adapted to assess student's regulation types at the contextual level (i.e., motivation for studying psychology) and at the situational level (i.e., motivation for five university courses: Statistics, social psychology, cognitive development, psychology of motivation, clinical psychology). These courses were chosen because they are mandatory courses in the first year of psychology studies and therefore taken by all students during the first semester. The same four items were used to assess each motivation type at the contextual and situational levels. The students were asked how much they agreed with each reason "to study psychology" or "to participate in a particular course" on a 7-point Likert scale from 1 (*never*) to 7 (*all the time*). The scale was administered to students at time 2. In our study, the Cronbach' alphas for each subscale were as follows: αs between 0.92 and 0.96 for intrinsic motivation), between 0.81 and 0.86 for identified regulation, between 0.78 and 0.90 for positive introjected regulation, between 0.73 and 0.84 for negative introjected regulation, between 0.48 and 0.69 for external regulation.

Autonomy-supportive climate

Autonomy-supportive climate was measured using the Learning Climate Questionnaire (LCQ; Williams and Deci, 1996). The LCQ measures students' perceptions of autonomy-supportive behaviors of their teachers and contains 15 items (e.g., I feel that my professor provides me choices and options). For each of 15 items, students rate their agreement on a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). In their study (Williams and Deci, 1996), the Cronbach' alpha for this scale was 0.96. The scale was adapted to assess the autonomy-supportive climate in two university courses: In statistics and in social psychology. The scale was administered at time 1. Cronbach's alphas were 0.88 (teacher's autonomy support in statistics) and 0.90 (teacher's autonomy support in social psychology).

Students' self-concept

Six items of the Self-Description Questionnaire (Guérin et al., 2003) were used to assess students' self-concept. In their study, Guérin et al. (2003) reported Cronbach' alphas between 0.85 and 0.95. The scale was adapted to measure self-concept at the contextual level (i.e., self-concept in psychology studies) and at the

2 http://qualtrics.com

situational level (i.e., self-concepts in statistics, social psychology, cognitive development, and psychology of motivation). For each of six items (e.g., "I am doing well in …"), students were asked to rate how much they agreed with each item on a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The same six items were used to assess each self-concept at the contextual and situational levels. The scale was administered at time 1. In our study, Cronbach's alphas for this measure were 0.85 for psychology, 0.91 for statistics, 0.88 for social psychology, 0.85 for cognitive development, and 0.88 for psychology of motivation.

Academic emotions

Students' academic emotions were measured using the Academic Emotions Scale (Govaerts and Grégoire, 2008). The scale assesses seven academic emotions: Enjoyment (4 items, e.g., "I feel great when I study for …"), hope (4 items, e.g., "I feel optimistic about the preparation of the course"), pride (3 items, e.g., "I am proud of the way I am preparing the course"), anxiety (5 items, e.g., "I feel anxious when I study for …"), boredom (3 items, e.g., "I am bored studying for …"), anger (3 items, e.g., "the subjects I have to study irritate me"), shame (4 items, e.g., "I feel ashamed thinking I might have not prepared the course properly"). For each item, students rate their agreement on a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). In their study, Govaerts and Grégoire (2008) reported the following Cronbach's alphas: 0.91 for the anxiety subscale, 0.88 for the frustration subscale, 0.87 for the enjoyment subscale, 0.85 for the hope subscale, 0.73 for the shame subscale, and 0.65 for the pride subscale. The scale was adapted to assess these seven emotions in the different courses: In statistics, social psychology, and clinical psychology. The same items were used to assess each emotion in these three courses. The scale was administered at time 3. In our study, Cronbach's alphas for the various academic emotions subscales across school subjects ranged from 0.83 to 0.86 for enjoyment, from 0.92 to 0.93 for hope, from 0.70 to 0.78 for pride, from 0.90 to 0.92 for anxiety, from 0.85 to 89 for boredom, from 0.84 to 0.92 for anger, and from 0.78 to 0.82 for shame.

Students' final grades

Students' final grades in five courses (statistics, social psychology, cognitive development, psychology of motivation, clinical psychology) were obtained from the university administration at the end of the semester. For statistics, two grades were obtained: The grade for the practical course and for the theoretical course. In Swiss' educational system, grades range from 1 to 6, where 6 represents the highest grade and 1 the lowest grade.

Statistical analyses

Correlated trait-correlated method minus one model

The Correlated trait-correlated method minus one (CTCM-1) model (Eid et al., 2003) appeared to be the most suitable model to investigate the specificity of the motivation types. CTCM-1 model is used in multitrait-multimethod research to distinguish the variance due to methods and traits. As explained by Chanal and Guay (2015), this modeling procedure "has the advantage of combining and disentangling variances in measures attributable to a global (i.e., contextual) trait or to a state or method (i.e., specific) measure" (p. 7). Moreover, this model allows investigating the hierarchical structure of academic motivation by considering various school subjects or courses.

Applied to our study, CTCM-1 model allows distinguishing the variance in autonomous and controlled motivation attributable to the contextual level (i.e., motivation for studying psychology) and to the situational, specific level (i.e., university courses). More precisely, intrinsic motivation at the contextual level (i.e., motivation for studying psychology) is considered as a single trait, whereas intrinsic motivations in different university courses are considered as correlated methods or courses deviations from this global trait. The latent construct for contextual intrinsic motivation influences the items of contextual intrinsic motivation and the items of the five courses. The latent constructs for intrinsic motivations in each course (i.e., specific factors) influence items of the corresponding course (e.g., latent constructs for statistics influences statistics measures) over and above the latent construct for contextual intrinsic motivation (i.e., global factor). Thus, the specific latent factors for each course represent deviations from the global factor by capturing the common but specific variance in course items that is above the common variance at the contextual level. The items, which assess regulation at the contextual level, are influenced only by the global factor but not by a specific factor, representing the method minus one part of the CTCM-1 model. This missing "method factor" allows the model to be identified and a unique solution to be obtained for all model parameters.

For each motivation type (i.e., intrinsic, identified, positive introjected, negative introjected, external), we realized a CTCM-1 model. We realized a CTCM-1 model also for self-concept because self-concept can be considered as a multidimensional and hierarchical construct (see Brunner et al., 2010). For other constructs (i.e., autonomy-supportive climate, and academic emotions) except students' final grades, we conducted confirmatory factor analyses (CFA). Factor scores were calculated for each latent factor and were used in the Pearson correlations analyses to investigate the links between motivation and its antecedents and consequences.

Correlation analysis

In order to analyze the links between motivation types and its antecedents, or between motivation types and its consequences, we calculated Pearson correlations between the factor scores extracted from the models of each of the constructs. Then, Chi-Square Tests of Independence were performed to determine whether the proportion of significant correlation between motivation types and constructs (i.e., antecedents, and

consequences) was different between autonomous motivation types and controlled motivation types.

Missing data

Missing data for CTCM-1 and CFA models

The statistical models (i.e., CTCM-1 and CFA models) were built on all the data collected at each of the 3 measurement times. The models for autonomy-supportive climate and self-concept were built on the sample of participants who completed the scales at time 1 ($N = 314$). The models for each motivation types were built on the sample of participants who completed the scale at time 2 ($N = 299$). The model for academic emotions was built on the sample of participants who completed the scale at time 3 ($N = 288$). For each model performed, there was less than 1% missing data (i.e., missing cells). To account for missing data, full information maximum likelihood (FIML) was performed using Mplus (version 7).

Missing data for correlation analysis

For each correlation analysis, as the number of participants who completed the scales of the different constructs was not the same, we used the pairwise deletion of missing data method. Correlations between antecedents (i.e., autonomy-supportive climate, and self-concept) and motivation types were calculated on 294 participants. The correlations between motivation types and academic emotions were calculated on 282 participants. The correlations between motivation types and grades were calculated on a sample varying between 228 and 266 participants.

Estimation and goodness of Fit

All models were tested with maximum likelihood estimation using robust standard errors (MLR estimation). To evaluate the model fit, we used the chi-square values, the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). CFI and TLI values closed to or above.90 and.95 are deemed acceptable and excellent fit to the data, respectively, (Bollen and Curran, 2006). For RMSEA, values closed to or below.08 are indicative of an adequate fit (Hu and Bentler, 1999; Marsh et al., 2005). A value of 0.08 (or lower) for the SRMR is considered indicative of a good model fit (Hu and Bentler, 1999).

Parallel item

Identical items were used to assess the same regulations toward studies and across school subjects. As Chanal and Paumier (2020), we created an item-specific factor for the same item at the situational and contextual levels (see Figure 1 for CTCM-1 model for intrinsic motivation). Thus, for each regulation, the CTCM-1 model allows distinguishing the variance attributable to the contextual, the situational and the items levels.

Results

Table 3 presents fit indices for each regulation type model. All models show an excellent fit to the data.

The school-subject-specificity hypothesis

Hypothesis 1 was that the more autonomous the motivation types were, the more specific they would be. That is, we expected that the variance of the items shared at the situational level would be greater for the most autonomous motivation types. Table 4 showed the percentage of total variance for each motivation types attributed to the different sources of variance considered (situational, contextual, item, and residual). Results confirmed the school-subject-specificity hypothesis. On average, the percentage of variance shared at the situational level for intrinsic motivation (66% in total variance) and for identified regulation (42% in total variance) were higher than for positive introjected regulation (22% in total variance), negative introjected regulation (26% in total variance) and external regulation (20% in total variance). Moreover, results demonstrated that the percentage of variance shared at the situational level decreased as motivation types become less autonomous except for negative introjected regulation. On average, the percentage of variance shared at the contextual level was higher for intrinsic motivation and identified regulation (14% in total variance) than for positive introjected regulation (1% in total variance), negative introjected regulation (4% in total variance) and external regulation (8% in total variance). More importantly, on average, the percentage of variance shared at the item level was higher for positive introjected regulation (54% in total variance), negative introjected regulation (44% in total variance) and external regulation (38% in total variance) than for intrinsic motivation (4% in total variance) and identified regulation (20% in total variance). These results show that the CM motivation types are more related to the item level than to the contextual level.

Motivation and antecedents at the situational level

The correlations between each motivation type and antecedents at the situational level are presented in Table 5 for autonomy-supportive climate and in Table 6 for self-concept. As expected for hypothesis 2, Chi-Square Test of Independence indicated a significant relationship between significance of correlations with antecedents (i.e., autonomy-supportive climate, and self-concept) and motivation types in a corresponding course (i.e., AM vs. CM), X^2 (1, $N = 30$) = 20.00, $p < 0.001$. Results indicated a higher proportion of significant correlations between antecedents (i.e., autonomy-supportive

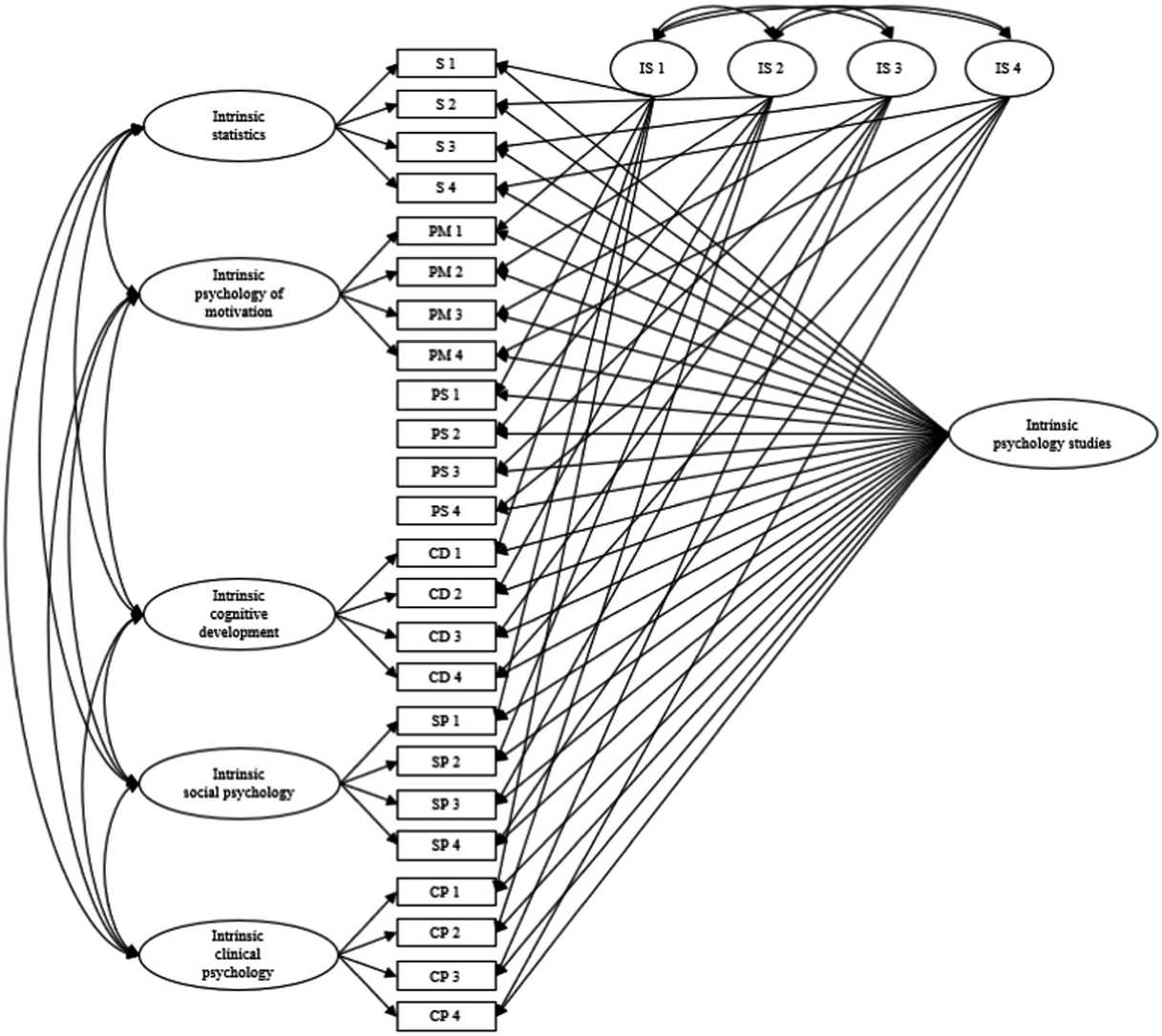

FIGURE 1
CTCM-1 Model for Intrinsic Motivation. 1–4=items for statistics; PM 1–4=items for psychology of motivation; PS 1–4=items for psychology studies; CD 1–4=items for cognitive development; SP 1–4=items for social psychology; CP 1–4=items for clinical psychology; IS 1–4=item-specific factors.

TABLE 3 Fit Indices of the models.

Model	Chi²	df	*Value of p*	RMSEA	CFI	TLI	SRMR
Intrinsic	271.00	192	0.000	0.04	0.98	0.98	0.03
Identified	277.28	192	0.000	0.04	0.98	0.96	0.03
Positive Introjected	242.05	192	0.008	0.03	0.99	0.98	0.03
Negative Introjected	248.89	192	0.004	0.03	0.99	0.98	0.03
External	378.95	192	0.000	0.06	0.94	0.91	0.04

climate, and self-concept) and AM types (12 on 12 = 100%) in a corresponding course than between antecedents and CM types (3 on 18 = 16.67%).

More precisely, concerning the links between motivation and autonomy-supportive climate, a higher proportion of significant correlations were found for AM (4 on 4 = 100%) than for CM types (1 on 6 = 16.67%). In the statistics course, significant and positive correlations were found between autonomy-supportive climate and intrinsic motivation ($r = 0.25$, $p < 0.001$), and between climate and identified regulation ($r = 0.16$, $p = 0.007$). In contrast, no significant correlations were found between autonomy-supportive climate and controlled motivation types in statistics (i.e., positive introjected, negative introjected and external regulations). In the social psychology course, significant and positive correlations were found between autonomy-supportive climate and intrinsic motivation ($r = 0.32$, $p < 0.001$) and between climate and identified regulation ($r = 0.29$, $p < 0.001$). Only one significant correlation was found for controlled motivation types in social psychology:

TABLE 4 Percentage of the variance due to situational (specific), contextual and item levels on average and for each course by motivation type.

Intrinsic	Specific	Contextual	Item	Residual
Statistics	72	7	4	18
Psychology of motivation	67	16	1	15
Cognitive development	65	18	4	13
Social psychology	59	18	6	17
Clinical psychology	68	13	3	15
Average	66	14	4	16
Identified	Specific	Contextual	Item	Residual
Statistics	45	7	16	32
Psychology of motivation	43	14	20	23
Cognitive development	43	14	23	20
Social psychology	45	13	20	21
Clinical psychology	34	21	19	26
Average	42	14	20	24
Positive introjected	Specific	Contextual	Item	Residual
Statistics	20	2	48	30
Psychology of motivation	23	0	53	24
Cognitive development	13	1	67	19
Social psychology	28	1	48	24
Clinical psychology	26	3	52	20
Average	22	1	54	23
Negative introjected	Specific	Contextual	Item	Residual
Statistics	21	2	53	24
Psychology of motivation	27	4	42	27
Cognitive development	32	4	34	30
Social psychology	25	4	45	25
Clinical psychology	23	4	43	30
Average	26	4	44	27
External	Specific	Contextual	Item	Residual
Statistics	17	2	37	44
Psychology of motivation	23	10	37	29
Cognitive development	21	8	43	27
Social psychology	17	9	42	32
Clinical psychology	23	9	33	35
Average	20	8	38	34

between climate and negative introjected regulation ($r = -0.13$, $p = 0.029$).

Concerning correlations between self-concept and motivation types, results showed that self-concept was more related to AM (8 on 8 = 100% of significant correlations) than CM types (2 on 12 = 16.67% of significant correlations). Indeed, for intrinsic motivation, all correlations between students' self-concept and motivation in the corresponding course were significant and positive ($r = 0.46$, $r = 0.42$, $r = 0.38$, and $r = 46$, for statistics, psychology of motivation, cognitive development, and social psychology, respectively, $ps < 0.001$). For identified regulation, all correlations between students' self-concept and motivation in the corresponding course were also significant and positive ($r = 0.33$, $r = 0.30$, $r = 0.34$, and $r = 0.35$, for statistics, psychology of motivation, cognitive development, and social psychology, respectively, $ps < 0.001$). It is important to note that correlations between self-concept in a corresponding course were higher for intrinsic motivation than for identified regulation. This result is in conformity with the school-subject-specificity hypothesis because intrinsic motivation was found to be more specific than identified regulation. In contrast, for CM types, 16.67% of correlations appeared to be significant. These significant correlations were found between students' self-concept and positive introjected regulation in social psychology ($r = 0.15$, $p = 0.009$) and between self-concept and negative introjected regulation in social psychology ($r = -0.17$, $p = 0.003$). However, even in line with previous results (Assor et al., 2009) and with theoretical postulates, these correlations also supported the school-subject-specificity hypothesis because these correlations were lower than those between students' self-concept and AM types.

TABLE 5 Correlations between autonomy-supportive climate and motivation types in corresponding courses (n=294).

Motivation type	Autonomy-supportive climate	
	Statistics	Social psychology
Intrinsic	**0.25**	**0.32**
Identified	**0.16**	**0.29**
Positive introjected	−0.05	0.09
Negative introjected	0.03	**−0.13**
External	−0.08	−0.10

Significant correlations at $p < 0.05$ or less are shown in bold.

TABLE 6 Correlations between self-concept and motivation types in corresponding courses (n=294).

Motivation type	Self-concept
Intrinsic	
Statistics	**0.46**
Psychology of motivation	**0.42**
Cognitive development	**0.38**
Social psychology	**0.46**
Identified	
Statistics	**0.33**
Psychology of motivation	**0.30**
Cognitive development	**0.34**
Social psychology	**0.35**
Positive introjected	
Statistics	0.02
Psychology of motivation	0.03
Cognitive development	0.10
Social psychology	**0.15**
Negative introjected	
Statistics	−0.11
Psychology of motivation	−0.05
Cognitive development	0.08
Social psychology	**−0.17**
External	
Statistics	−0.04
Psychology of motivation	−0.05
Cognitive development	−0.01
Social psychology	−0.11

Significant correlations at $p < 0.05$ or less are shown in bold.

Motivation and consequences at the situational level

The correlations between each motivation type and consequences at the situational level are presented in Table 7 for academic emotions and in Table 8 for grades. As expected for hypothesis 3, Chi-Square Test of Independence between correlations' significance and motivation types was significant (X^2 (1, $N = 135$) = 32.20, $p < 0.001$). Results indicated a higher proportion of significant correlations between consequences (i.e., academic emotions, and grades) and AM types (39 on 54 = 72.22%) in a corresponding course than between consequences and CM types (18 on 81 = 22.22%).

More precisely, concerning the links between motivation and academic emotions, a more important number of significant correlations were found for AM (35 on 42 = 83.33%) than for CM types (17 on 63 = 26.98%). For intrinsic motivation, 85.71% of correlations between this motivation and emotions in a corresponding course, were significant. More specifically, all correlations between intrinsic motivation and positive emotions (i.e., enjoyment, hope, and pride) in the corresponding course were significant and positive ($0.12 < rs < 0.54$, $ps < 0.05$). Correlations between intrinsic motivation and negative emotions (i.e., boredom, anger, anxiety, and shame) in the corresponding course were significant and negative ($-0.54 < rs < -0.19$, $ps < 0.01$), except for shame in social psychology and for shame and anxiety in clinical psychology. For identified regulation, 80.95% of correlations between this regulation and emotions in the corresponding course were significant. Specifically, correlations between identified regulation and positive emotions (i.e., enjoyment, hope, and pride) in the corresponding course were significant and positive ($0.19 < rs < 0.43$, $ps < 0.01$), except for hope in clinical psychology. Correlations between identified regulation and negative emotions (i.e., boredom, anger, anxiety, and shame) in the corresponding course were significant and negative ($-0.45 < rs < -0.15$, $ps < 0.05$), except for shame in social psychology and for anxiety and shame in clinical psychology. Concerning positive introjected regulation, 28.57% of correlations between this regulation and emotions in the corresponding course, were significant. Specifically, positive introjected regulation was positively correlated with pride in statistics ($r = 0.18$, $p = 0.002$), with enjoyment and hope in social psychology ($0.15 < rs < 0.16$, $ps < 0.05$), and with shame in clinical psychology ($r = 0.12$, $p = 0.040$). In social psychology, negative and significant correlations were found between positive introjected regulation and boredom ($r = -0.17$, $p = 0.005$) and anger ($r = -0.16$, $p = 0.008$). Concerning negative introjected regulation, 52.38% of correlations between this regulation and emotions in the corresponding course were significant. More precisely, negative introjected regulation correlated negatively with hope in statistics (−0.13, $p = 0.032$) and with enjoyment and hope in social psychology ($-0.18 < rs < -0.15$, $ps < 0.05$). In contrast, negative introjected regulation correlated positively with shame in all courses ($0.13 < rs < 0.17$, $ps < 0.05$), with anxiety and anger in statistics and in social psychology ($0.14 < rs < 0.21$, $ps < 0.05$), and with boredom in social psychology ($r = 0.17$, $p = 0.003$). Finally, no significant correlation was found between extrinsic regulation and emotions in the corresponding course. In sum, as predicted, a more important number of significant correlations were found between academic emotions and AM types in a

TABLE 7 Correlations between motivation types and academic emotions in corresponding courses (n=282).

	Academic emotion						
Motivation type	**Enjoyment**	**Hope**	**Pride**	**Boredom**	**Anger**	**Anxiety**	**Shame**
Intrinsic							
Statistics	**0.54**	**0.37**	**0.39**	**−0.54**	**−0.53**	**−0.34**	**−0.36**
Social psychology	**0.46**	**0.26**	**0.26**	**−0.51**	**−0.47**	**−0.19**	−0.11
Clinical psychology	**0.30**	**0.12**	**0.22**	**−0.31**	**−0.29**	−0.09	−0.05
Identified							
Statistics	**0.43**	**0.34**	**0.31**	**−0.39**	**−0.42**	**−0.31**	**−0.31**
Social psychology	**0.39**	**0.24**	**0.21**	**−0.45**	**−0.40**	**−0.15**	−0.07
Clinical psychology	**0.19**	0.11	**0.19**	**−0.20**	**−0.17**	−0.05	−0.02
Positive introjected							
Statistics	0.06	0.09	**0.18**	−0.02	−0.02	−0.01	−0.08
Social psychology	**0.16**	**0.15**	0.11	**−0.17**	**−0.16**	−0.01	0.08
Clinical psychology	0.03	0.08	0.06	0.00	0.03	0.07	**0.12**
Negative introjected							
Statistics	−0.11	**−0.13**	−0.06	0.11	**0.14**	**0.18**	**0.13**
Social psychology	**−0.18**	**−0.15**	−0.09	**0.17**	**0.19**	**0.21**	**0.17**
Clinical psychology	0.00	−0.01	−0.04	0.06	0.07	0.11	**0.16**
External							
Statistics	−0.03	0.00	0.02	0.05	0.03	−0.03	0.01
Social psychology	−0.11	0.01	0.00	0.10	0.11	0.06	0.09
Clinical psychology	−0.05	−0.04	−0.03	−0.01	−0.01	0.03	0.07

Significant correlations at $p < 0.05$ or less are shown in **bold**.

TABLE 8 Correlations between motivation types and grades in corresponding courses.

Motivation type	Grade					
	Statistics *T* (*n* = 241)	**Statistics *P* (*n* = 257)**	**Psychology of motivation (*n* = 232)**	**Cognitive development (*n* = 228)**	**Social psychology (*n* = 266)**	**Clinical psychology (*n* = 262)**
Intrinsic	**0.31**	**0.24**	0.04	0.09	0.11	0.08
Identified	**0.27**	**0.22**	0.04	0.06	0.09	0.05
Positive introjected	**0.19**	0.09	0.01	−0.07	0.02	−0.01
Negative introjected	−0.10	0.01	0.05	−0.05	0.08	0.08
External	−0.03	0.00	0.05	0.05	0.02	0.01

Significant correlations at $p < 0.05$ or less are shown in **bold**. Statistics *T* = statistics theoretical course; Statistics *P* = statistics practical course.

corresponding course (83.33% of significant correlations) than between academic emotions and CM types in a corresponding course (26.98% of significant correlations).

Concerning correlations between motivation types and grades, 33.33% of correlations were significant for AM types, whereas 5.56% were significant for CM types. More precisely, intrinsic motivation and identified regulation in statistics were positively related with grade in statistics theoretical course ($r = 0.31$ and $r = 0.27$, respectively, $ps < 0.001$) and with grade in statistics practical course (r =0. 24 and $r = 0.22$, respectively, $ps < 0.001$). Concerning correlations between grades and CM types in a corresponding school subject, only one correlation was found to be significant (5.56%). Indeed, positive introjected regulation in statistics was positively correlated with grade in statistics theoretical course ($r = 0.19$, $p = 0.004$).

Discussion

The purpose of this study was to investigate the impact of the difference in specificity for autonomous and controlled motivation on the motivational sequence described in the HMIEM model (i.e., "antecedents – motivation – consequences"). More precisely, we expected that this motivational sequence would occur more at

the situational level for AM than for CM types, because AM types have been found to be more specific to the situational level than CM types.

Specificity of autonomous and controlled motivation

As previously demonstrated (Chanal and Guay, 2015; Chanal and Paumier, 2020), our research confirmed that AM types were more specific to the situational level than CM types. In addition, we expected that the specificity of the motivations would decrease gradually as motivation becomes less autonomous. Our assumption was partially confirmed. The specificity decreased as motivation types became less autonomous except for the negative introjected regulation one whose specificity was lower than for the positive introjected one. These results mean that university students in psychology may have different levels of autonomous motivations in the courses they have during their studies. Thus, students might be strongly autonomously motivated by the social psychology course but be weakly autonomously motivated by the statistics course. On the contrary, due to their low specificity, the levels of students' controlled motivations would tend to be similar across the different psychology courses. For example, students with strong controlled motivations for social psychology course would also tend to have strong controlled motivations for statistics course. Our results also showed that CM types were not more related to the contextual level but more related to the item level, in accordance with Chanal and Paumier (2020). These results highlight the necessity to investigate the motivation toward various situational (i.e., school subjects or university courses) and contextual (i.e., school or academic) situations simultaneously to better understand the part of the assessment that is really concerned in a particular specific school subject or university course and not on other sources of shared variances. More precisely, it seems crucial to assess AM types simultaneously across various courses or school subjects because AM types have been found to be differentiated between these situational situations.

Antecedents and consequences of autonomous and controlled motivation

Antecedents

Because AM types were found to be more specific than CM types, we hypothesized that we would find a more important number of significant links between antecedents and consequences with AM compared to with CM types. Concerning autonomy-supportive climate, results confirmed our hypothesis. Autonomy-supportive climate was positively and significantly associated with AM types in a corresponding course (i.e., in statistics and in social psychology) and no significant relations were found between autonomy-supportive climate and CM types in a corresponding course, except for negative introjected regulation in social psychology. Note that the only significant relation found for CM types was a negative one between climate and negative introjected regulation in social psychology. This relation can be explained according to our hypothesis by the fact that the negative introjected regulation was almost as specific as AM types on average. This negative relation is also in line with SDT predictions (Ryan and Deci, 2017). Taken together, these results suggest that the relations between climate and motivation depend on the situational specificity of the motivation types. Indeed, because AM types are more specific to the situational level, climate introduced by the teacher in a particular situation (e.g., a statistical course) is related to students' autonomous motivation in this particular course. In contrast, because CM types are less specific to the situational level, climate in a particular situation is not related to the controlled motivation.

Concerning student's self-concept, as expected, a more important number of significant relations were found between self-concept and AM types at the situational level in comparison to between self-concept and CM types. These results indicated that the more students felt competent in a particular course, the more autonomously motivated they were in this course. Globally, our results are in line with studies considering each motivation type separately and carried out at the situational level, that showed that self-concept was positively associated with AM types (Guay et al., 2010a; Chanal and Guay, 2015) but non significantly with CM types (Chanal and Guay, 2015). Moreover, we have to note that the two significant correlations relating CM types and students' self-concept were found for the two types of introjected regulations. More specifically, a positive link was found between self-concept and positive introjected regulation and a negative link was found between self-concept and negative introjected in social psychology. These significant links are not surprising because introjected regulation, focusing on the maintenance or enhancement of self-worth (Assor et al., 2009), is related to one's perceptions of oneself of which the self-concept is a component. However, it is interesting to note that self-concept could play a role in the approach (i.e., positive introjected) or avoidance (i.e., negative introjected) orientations related to introjected regulation. Indeed, the more competent students feel in a course, the more they will participate in this course in order to increase self-esteem and feel proud of themselves (i.e., positive introjected). In contrast, the more competent students feel in a course, the less they will be motivated by guilt and shame in this course (i.e., negative introjected).

Consequences

Concerning academic emotions, as predicted, our results indicated that the relations between motivation and academic emotions depended on the specificity of the motivation types. Indeed, a higher number of significant correlations were found between academic emotions and AM types in a corresponding course (i.e., statistics, social psychology, and clinical psychology), than between academic emotions and CM types. Indeed, 35 significant links on 42 were observed for AM types, whereas only 17 significant links on 63 were found for CM types. More precisely,

AM types (i.e., intrinsic and identified regulations) were positively associated with positive emotions and negatively associated with negative emotions according to other studies whatever the hierarchical level considered and the operationalization of the motivation used (e.g., Miserandino, 1996; Noels et al., 1999; Black and Deci, 2000; Levesque et al., 2004; Litalien et al., 2015; Howard et al., 2021). Our results highlight the positive between AM types and academic affects by showing that the more the students were autonomously motivated in a particular course, the more they experienced enjoyment, hope and pride in this course, and the less they experienced boredom and anxiety in this course. While AM types are associated with emotions in a corresponding course, CM types are less or not associated with emotions in a corresponding course. This result is in line with a previous study at the situational level, which showed no significant link between CM and affects (Noels et al., 1999), but is contrary to results from other studies at the contextual level that found no significant links between CM and affects (Ryan and Connell, 1989; Litalien et al., 2015; Bailey and Phillips, 2016). These mixed results dependent on the hierarchical level considered can be explained by the specificity of the motivation types at the situational level. When evaluated at the situational level, no relations were found, but when CM and affects are measured at the contextual level, significant relations are found. Some significant correlations between CM and academic emotions are worth mentioning. More specifically, differentiated associations with affects also appeared for the different types of introjected regulation. The more students demonstrated positive introjected regulation, the more they experienced positive emotions (e.g., enjoyment in social psychology) and the less they experienced negative emotions (e.g., anger in social psychology). Conversely, the more students demonstrated a negative introjected regulation, the less they experienced positive emotions (e.g., enjoyment in social psychology) and the more they experienced negative emotions (e.g., anger in social psychology). According to Assor et al. (2009), it seems essential to evaluate these two types of introjected regulation in order to examine more precisely the positive or negative impact of introjected regulation. Moreover, the positive or negative orientations of introjected regulation may explain why in some studies, introjected regulation is positively (e.g., Ryan and Connell, 1989) or negatively (Litalien et al., 2015) associated with positive emotions.

Concerning the links between motivation and grades, our hypothesis is partially confirmed. Only one significant link was found for CM types, whereas very few relations were observed for AM types. The lack of links between CM types and grades in a corresponding course is in line with some studies (Noels et al., 1999, 2001; McEown et al., 2014) and consistent with our hypothesis. For AM types, results showed that only AM types in statistics are statistically and positively associated with grades in statistics theoretical and practical courses, but no significant relations were found for the other courses (i.e., psychology of motivation, cognitive development, social psychology, and clinical psychology).

Implications

A key point of the HMIEM concerns the motivational sequence between antecedents and consequences of motivation at different hierarchical levels and for all motivation types described by SDT. This theoretical model had never considered that motivational regulations could differ according to their specificity to the situational level and therefore that the motivational sequence could depend on AM and CM types levels of specificity. Our results demonstrated that the motivational sequence at the situational level is demonstrated for AM but not for CM types. Using RAI in studies investigating the HMIEM and focusing on the situational and contextual level sequences only, previous research was not able to disentangle the true relations that exist between antecedents and consequences of motivation types in a particular situation controlling for shared variance of different motivational constructs assessed together. Therefore, the specificity of regulations should be taken into account in future studies that evaluate the motivational sequence at different levels of generality. In addition, the specificity hypothesis brings into question the use of RAI to operationalize motivation. Indeed, the RAI considers that each of the motivation types coming from the same hierarchical level has the same impact since the coefficients used are moderated only by the level of self-determination of the motivation and not by the level in which the motivation is measured. However, the motivation types were found to be non-equally specific to the level at which they are measured. Therefore, we believe that studies that examine the sequence between motivation and its antecedents and consequences should not use the RAI.

Our results showed that the climate introduced by the teacher in a particular course was associated with the students' autonomous motivation but not with their controlled motivation in this course. This result has an important implication for interventions, which aim to promote autonomy support by teacher. Indeed, because of the specificity of the motivation types, autonomy-supportive interventions in a school subject or in a course could increase intrinsic motivation and identified regulation but could have no impact on controlled motivations (i.e., introjected and external regulations). Our assumption is in line with Guay et al. (2016) results' which showed that an autonomy-supportive intervention for the teacher in the writing class increased only students' intrinsic motivation in writing but had no effect on other motivation types.

Future directions

In future research, antecedents (e.g., climate or basic psychological needs satisfaction) and consequences (e.g., academic emotions) could be assessed at various hierarchical levels (i.e., contextual and situational levels) to better understand the links between motivation and these variables and the links between levels. Indeed, we demonstrated that because AM types were more specific, AM types were strongly related to its antecedents and consequences assessed at the situational level. In

contrast, CM types were less specific and, as a result, were weakly associated with its antecedents and consequences at the situational level. Our results also showed that the proportion of variance shared at the item level for CM types were higher than the ones shared at the contextual and situational levels. In line with this, it would be important to investigate other factors (i.e., antecedents) that influence CM types, and which are the consequences of this motivation. This issue could be examined in future research by measuring consequences at the global level (e.g., need satisfaction at global level, autonomy support in life in general, the tree causality orientations described by SDT, personality).

Limitations

A first limitation is the low values of Cronbach's alphas obtained for the external regulation subscale (α between 0.48 and 0.69). The results obtained for this regulation should be taken with caution. However, these results are in line with Sheldon's validation study, which showed that the Cronbach's alphas, calculated in several samples (i.e., 4 samples), were also lower for external regulation (α between 0.61 and 0.88) than for the other types of motivation (α between.68 and.94). Then, it is possible that the low Cronbach's alphas values obtained for the external regulation subscale are related to the low specificity of the external regulation, because the variance of the items of the external regulation was weakly attributed to the contextual factor and the situational factors. Second, although we assessed antecedents at time 1, motivation types at time 2 and consequences at time 3, our design being non-experimental, the results do not permit us to infer about causality. Third, the results of this study showed that AM types were more related to its antecedents (i.e., autonomy-supportive climate, and self-concept) and consequences (i.e., grades, and academic emotions) than CM types. However, it is important to generalize these results to other motivational antecedents (e.g., need satisfaction) and consequences (e.g., persistence). Finally, as we measured various concepts toward different courses simultaneously, so that the scale would not be too long to complete by the students, we made the choice, for certain scale (i.e., autonomy-supportive climate, academic emotions, self-concept), to assess them in only few courses but not in all courses.

Conclusion

This study examined the links between motivation types and their antecedents and consequences in the light of the school-subject-specificity hypothesis. Our results demonstrate that motivation types are not equally specific to the hierarchical level in which they are assessed. Indeed, autonomous motivation is more specific than controlled motivation. More importantly, the specificity of the regulations has an impact on the motivational sequence (i.e., antecedents – motivation – consequences) described by the HMIEM (Vallerand, 1997). This motivational sequence was observed more often at the situational level for AM than for CM types. In fact, AM types were significantly associated with autonomy-supportive climate and emotions in all corresponding courses. On the contrary, CM types were less significantly associated with autonomy-supportive climate and emotions in a corresponding course. These findings have important implications for research by showing that it is essential to examine AM and CM types of students toward various school subjects or courses simultaneously to get an accurate understanding of the motivational mechanisms at work in the academic context.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by ethics commission of the faculty of psychology of the University of Geneva. The patients/participants provided their written informed consent to participate in this study.

Author contributions

DP and JC conceived and designed the study, acquired data, and conducted statistical analyses and interpretation. DP wrote the article with the approval of JC, who has critically revised the content. All authors read and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Profiles of PhD students' satisfaction and their relationships with demographic characteristics and academic career enthusiasm

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The satisfaction of doctoral students is very important for the quality of higher education. Based on two-factor theory (also known as Herzberg's motivation–hygiene theory), this study used a person-centered approach to examine possible doctoral student satisfaction profiles. In total, 4,964 participants were included in the study, and the results of latent profile analysis showed that they could be classified into four subgroups: (i) the low-motivation–low-hygiene group (700 participants, 14.1% of the sample), (ii) the low-motivation–high-hygiene group (979, 19.7%), (iii) the high-motivation–low-hygiene group (1,554, 31.3%), and (iv) the high-motivation–high-hygiene group (1,731, 34.9%). Analyses showed that the PhD students differed significantly in their satisfaction-profile membership depending on their gender, age, country, study-abroad status, work status, and caring responsibilities. Specifically, male students, younger students, and students studying abroad tended to be more satisfied with both motivation and hygiene factors. Besides, regarding maintaining and stimulating doctoral students' academic career enthusiasm, motivation factors can compensate for the negative impact of the absence of hygiene factors, not the other way around. Therefore, it can be seen that two-factor theory has a certain explanatory power for changes in academic career enthusiasm, but it must be adjusted in a certain way considering the special characteristics of the population.

KEYWORDS

PhD student', satisfaction, academic career enthusiasm, person-centered approach, two-factor theory, latent profile analysis

Introduction

Doctoral education is experiencing rapid expansion worldwide (Gruzdev et al., 2020) and is becoming an increasingly important factor in driving socioeconomic development (Dericks et al., 2019). In this context, the quality of doctoral education is of widespread concern to both governments and society (Byrne et al., 2013). As the key subjects of

doctoral education, the feelings of PhD students about the training process are regarded as an important indicator for evaluating the quality of doctoral education. Setting performance indicators is a management tool to guarantee the quality of higher education, but its market-oriented nature inevitably leads to the commodification of higher education and the consequent transformation of students into "consumers" (Naidoo and Williams, 2014). A study of six European countries partially supports this view, pointing to an increased tendency toward consumerism in higher education policy and practice (Brooks, 2022). It can be concluded that to some extent, PhD students are to doctoral education as consumers are to various other products (Marzo-Navarro et al., 2005). Therefore, as a special commodity, the quality of doctoral education is closely related to the satisfaction of doctoral students with the training process (Cheng et al., 2016). In this context, PhD students' satisfaction (PhD-SS) has been regarded as an effective means of assessing and promoting the quality of doctoral education (Barnes and Randall, 2012). PhD-SS can be defined broadly as feelings or perceptions that are used to express PhD students' responses to whether the doctoral training process meets their expectations (Hartman and Schmidt, 1995; Rowley, 1996; Munteanu et al., 2010; Kahu, 2013). Previous studies of PhD-SS have found that satisfaction with the training process can improve academic performance and contribute to positive organizational behavior (Pike, 1993; Sung and Yang, 2009; Gibbons et al., 2015). Based on that previous research, we can reasonably infer that PhD-SS may inspire PhD students to identify with and be passionate about their academic research careers (Dericks et al., 2019).

Although less abundant than studies on undergraduate student satisfaction, those on PhD-SS have produced some valuable research results, particularly in two main aspects. First, much research effort has gone into providing empirical evidence for the causal relationship between PhD-SS and its outcomes, including positive outcomes (e.g., retention, success) (Fairbanks, 2016; van Rooij et al., 2021) and negative outcomes (e.g., attrition, delay, mental-health problems) (Golde, 2005; Pyhältö et al., 2009). Another body of research on PhD-SS has been focused on identifying its composition and determinants (Dericks et al., 2019; Kulikowski et al., 2019), and most of those studies generally suggested that supervisors play a vital role in PhD-SS (Erichsen et al., 2014; Boyce et al., 2019; Gruzdev et al., 2020). Besides, course quality, team climate, financial support, and future job prospects have also been confirmed to be closely correlated with PhD-SS (Shapiro et al., 2017; Shin et al., 2018). However, those previous studies on PhD-SS relied mainly on a variable-centered approach assuming that all samples were perfectly homogeneous, which is far from reality (Hofmans et al., 2020). Admittedly, the variable-centered approach is useful for examining the relationship between PhD-SS and its antecedents and outcomes, but it misses another core element of PhD-SS, i.e., the PhD students themselves. In other words, satisfaction is an individual's active perception, and the same factor in exactly the same situation may contribute to different levels of satisfaction in different populations. This is because the individual's background, experience, and other personal factors might interact with the external factors to form a "satisfaction" judgment.

Indeed, "satisfaction" consists of various elements that may contradict each other; for example, something that helps students to develop intellectually may be a dissatisfied experience emotionally (Collini, 2012). Therefore, PhD-SS should be understood as a complex process. However, the existing research on PhD-SS has been overly focused on how well institutions and especially supervisors help doctoral students' success (Cheng et al., 2016), trying to study PhD-SS from a variable-centered perspective. However, few studies have acknowledged the heterogeneity in the doctoral student population, meaning that individual differences have been ignored for a long time, thereby leaving this area largely understudied. To fill this research gap, we adopted a person-centered approach in the form of latent profile analysis (LPA). Using the *NATURE PhD SURVEY 2019* dataset, we identified possible profiles of PhD-SS in the training process and explored the related demographics (i.e., gender, age, country, work status, caring responsibilities) that may be the antecedents of the different profiles. In addition to identifying satisfaction profiles, we explored career development process by comparing changes in academic career enthusiasm (ACE) (i.e., decrease, no change, and increase).

Theoretical framework

Developed by Herzberg et al. (1993), two-factor theory is also known as motivation–hygiene theory. According to this theory, the factors that influence the performance of employees can be divided into two categories: (i) motivation factors, which are necessary for individuals' professional growth and self-actualization, leading to positive behavior and attitudes to work when people feel satisfied with these factors, and (ii) hygiene factors, which produce no motivation effects even if satisfied, resulting in negative behavior when people feel unsatisfied with them. Two-factor theory is considered as a breakthrough of Maslow's hierarchy of needs theory and is applied widely in job-satisfaction research (Dion, 2006). Scholars have extended this theory, applying it to research on higher education. Some of them have taken the university student population as their subject, investigating the study motivators and engagement of college students and the persistence of STEM students under two-factor theory (Rizkallah and Seitz, 2017; Gibbs and Wood, 2021; Pedraza and Chen, 2021). The others have paid more attention to teachers working in higher-education institutes. By using Herzberg's two-factor theory, they have explored lecturers' motivations to teach (Bett, 2019) and to take up teaching as a career (Amoako et al., 2020), while Marasi et al. (2022) sought the determining factors influencing teachers' satisfaction with online teaching. Based on previous studies, we propose Herzberg's two-factor theory may serve as a useful conceptual framework to help us identify potential categories of PhD-SS.

According to the two-factor theoretical framework, the factors that may influence a doctoral student's perception of a doctoral program can be summarized into two parts. One is motivation factors, which comes from the attraction of academic research itself, leading to a sense of achievement from academic work. The other is hygiene factors, which comes from the external environment (DeShields et al., 2005), leading to a negative feeling of disgust or resistance to academic career when a PhD student is dissatisfied with those factors. It is almost impossible for every PhD student to be satisfied with all of the above elements of the PhD training process (Collini, 2012). Thus, we assumed that PhD students can be classified into four potential categories based on their satisfaction with motivation and hygiene factors.

Scholars have explored the relationship between demographic characteristics and PhD-SS. Existing studies have shown that satisfaction with doctoral study among female doctoral students is significantly lower than that of men (van Rooij et al., 2021; Wang et al., 2021). A significant difference in satisfaction was also found among students of different nationalities (van Rooij et al., 2021). In addition, Harman (2003) found that international doctoral students were more satisfied overall than were national ones, which was supported by a study from Denmark (Kolmos et al., 2008). Besides, scholars have suggested that doctoral students with parenting responsibilities are more likely to face mental health problems (Levecque et al., 2017), which may impact their satisfaction. Considering that doctoral students of different age and work status may have different expectations of doctoral programs, it is reasonable to suspect that PhD-SS also differs in these two characteristics. Thus, we assumed that sociodemographic characteristics (i.e., gender, age, country, study-abroad status, work status, caring responsibilities) are associated with PhD-SS latent class membership.

ACE refers to the intention and interest of doctoral students in pursuing academic research as a career. The PhD program is an important training phase for doctoral students toward an academic career, where young students become closely connected to academic work. Therefore, satisfaction at this stage may be highly relevant to their eventual career choices. Given the positive association between PhD-SS and ACE (Dericks et al., 2019; van Tienoven et al., 2022), we assumed that the change of students' ACE differs as a function of latent class membership.

The present research

The objective of this study is to investigate the profiles of PhD-SS and its association with demographic variables and the changes in ACE. According to previous study, three hypotheses were proposed, as follows:

> Hypothesis 1: *PhD students can be classified into four potential categories based on their satisfaction with motivation and hygiene factors.*

> Hypothesis 2: *Gender, age, country, study-abroad status, work status, and caring responsibilities are associated with PhD-SS latent class membership.*

> Hypothesis 3: *PhD-SS profiles are associated with the changes in ACE.*

Materials and methods

Participants

The data were selected from the questionnaire responses of a global survey of PhD students (Nature Research, 2019) with a total of 6,812 valid cases. Given that this dataset contains information from all over the world and on various topics related to PhD students, there is no doubt about its representativeness (Li and Horta, 2021). Data on responses to two scales (reported in the Measures Section) were included in this analysis. The data were cleaned according to a seven-point scoring system, and those samples for which either participants failed to respond or the answers were outside the range of 1–7 were excluded from the analysis, leading to a final sample of 4,964 participants. This number of observations is large enough to ensure a good level of statistical power. Among the valid samples, most were studying in Europe (1,677 participants, 33.78% of the sample), Asia (1,469, 29.59%), North America (1,404, 28.28%), and others in Africa, Australasia and South America (414, 8.35%); more specifically, the largest number of cases came from the United States (1,162, 23.41%), followed by China (673, 13.56%), India (398, 8.02%), Germany (341, 6.87%), the United Kingdom (334, 6.73%), and cases from other countries (2056, 41.42%). The gender ratio of those observations was near 1:1, though there are some disparities in gender ratios between countries (i.e., In China, female:male = 0.52:1; in UK, female:male = 1.53:1; in USA, female:male = 1.34:1; in Germany, female:male = 1:1). Also, most cases were between the ages of 25 and 34.

Measures

PhD student satisfaction

To measure PhD-SS, a question that included 18 items was used, namely, "How satisfied are you with each of the following attributes or aspects of your PhD?." The respondents rated the extent to which they agreed with those 18 items using a seven-point scale (reported in Table 1), with higher values indicating higher satisfaction. Exploratory factor analysis (EFA) was conducted to establish the essential structure of those 18 items and synthesize them into a few core factors, and in this way four factors with eigenvalues greater than one were extracted. Factor 1 contained eight items, such as "recognition from supervisor/PI" and "number of publications"; based on its common characteristics, we named it *satisfaction with academic cultivation*

TABLE 1 Results of exploratory factor analysis.

	SAC	SAL	SAI	SWE
Recognition from supervisor/PI	0.842			
Overall relationship with supervisor/PI	0.836			
Guidance received from adviser in lab/research	0.818			
Guidance received from other mentors in lab/research	0.665			
Opportunities to collaborate	0.595			
Career pathway guidance and advice	0.589			
Degree of independence	0.535			
Number of publications	0.427			
Work-life balance		0.778		
Vacation time		0.757		
Hours worked		0.753		
Benefits (health care, leave, etc.)		0.528		
Social environment		0.474		
Ability to present research at conferences			0.895	
Ability to attend meetings and conferences			0.876	
Availability of funding				0.822
Stipend/financial support				0.82
Teaching duties				0.346

SAC, satisfaction with academic cultivation; SAI, satisfaction with academic interaction; SAL, satisfaction with academic life; SWE, satisfaction with economics.

(SAC). Factor 2 contained the two items of "ability to attend meetings and conferences" and "ability to present research at conferences"; we named it *satisfaction with academic interaction* (SAI). Factor 3 contained five items, such as "work–life balance," "vacation time," and "social environment"; we named it *satisfaction with academic life* (SAL). Factor 4 contained three items, such as "availability of funding" and "stipend financial support"; we named it *satisfaction with economics* (SWE). Based on the two-factor theoretical framework, we regard factors 1 and 2 as being motivation factors because they are closely related to the academic research itself, while we regard factors 3 and 4 as being hygiene factors because they are focused more on the external environment, especially on the lives of doctoral students.

Academic career enthusiasm

To measure the changes in ACE of the PhD students, we selected the question "How much more likely are you now to pursue a research career than when you launched your PhD program?" The changes were estimated by means of five options: (i) "equally likely" indicates unchanged ACE during the PhD program, (ii) "much less likely" and (iii) "somewhat less likely" indicate a large decrease and a small decrease, respectively, while (iv) "somewhat more likely" and (v) "much more likely" indicate a small increase and a large increase, respectively.

Demographic variables

General information about the PhD students was reported in this survey, including gender, age, country, study-abroad status, work status, and caring responsibilities.

Statistical analysis

The statistical analysis involved three stages. In the first stage, some preliminary analyses were conducted using Excel and SPSS: Excel was used to exclude cases with missing values, while SPSS 21.0 was used to conduct descriptive statistical analysis and EFA. In the second stage, LPA was conducted to extract PhD-SS profiles using Mplus 8.3: we started with two profiles and then added one more each time, stopping when the fit indices (LMR and BLRT) were no longer significant; other fit indices including AIC, aBIC, and Entropy were used to select the best-fitting model. In the third stage, antecedents and consequences of satisfaction were examined using SPSS 21.0; multiple logistic regression was conducted to explore how the satisfaction profiles differ by demographic variables, while a Chi-square test was conducted to compare the retained profiles' differences in changes of ACE.

Results

Common method bias analysis

Because the data were collected in a self-reported questionnaire, common method bias was a possibility. Therefore, we used Harman single-factor inspection (Zhou and Long, 2004) to examine this possible problem before data analysis. The results showed KMO = 0.877 ($p < 0.001$); four common factors with eigenvalues greater than one were extracted, with the first factor accounting for 36.60% of the variance. Therefore, there was no serious common method bias in this study.

Descriptive statistics and bivariate correlations

Table 2 gives the means, standard deviations, and Pearson correlation coefficients. The means indicate that there is still room

for improvement in both the satisfaction and ACE of doctoral students. In addition, PhD students' ACE is positively associated with their satisfaction, as well as with each dimension of satisfaction.

Latent profile analysis of PhD students' satisfaction

The 18 items of the satisfaction scale were included as indicators to conduct LPA, and the fit indices are given in Table 3.

TABLE 2 Descriptives and correlations (N=4,964).

	M ± SD	1	2	3	4	5
1. Overall	4.46 ± 1.06	1				
2. SAL	4.23 ± 1.32	0.80**	1			
3. SAI	4.93 ± 1.66	0.66**	0.38**	1		
4. SAC	4.52 ± 1.29	0.88**	0.52**	0.51**	1	
5. SWE	4.40 ± 1.39	0.65**	0.52**	0.35**	0.35**	1
6. ACE	3.26 ± 1.25	0.28**	0.18**	0.17**	0.33**	0.05**

**p < 0.01; M ranges from 1 to 5.

As can be seen, the value of LMR is not significant (p = 0.153) when continuing to seven subgroups, indicating that the seven-profile model is not better than the six-profile one (Berlin et al., 2014). Further comparison of the models with two to six profiles shows that the values of AIC, BIC, and aBIC decrease with increasing number of profiles (the lower those fit indices, the better the model fit). However, the decrease becomes slighter between the four-profile and five-profile solutions, and the four-profile one has excellent classification accuracy with a high entropy value (Spurk et al., 2020) of 0.862, which is higher than those of the five-profile (0.853) and six-profile (0.850) solutions. Considering the principle of parsimony, the four-profile model is an interesting alternative. Furthermore, the average class probabilities of the four subcategories range from 0.89 to 0.95, indicating that the classification results of each category are reliable. In summary, the four-profile solution was retained as the best model of PhD-SS (Table 4).

Figure 1 shows the means of the 18 satisfaction indicators for the four-profile model. The four identified profiles are interpreted based on this two-factor theoretical framework. Profile 1 (n = 700, 14.1% of the sample) shows the lowest values in all four

TABLE 3 Model fits for optimal number of profiles in latent profile analysis.

Model	AIC	BIC	aBIC	Entropy	LMR(p)	BLRT(p)	Profile: P	LCP
2C	339216.09	339574.14	339399.36	0.902	0.000	0.000	C1: 0.39	0.96
							C2: 0.61	0.98
3C	334035.06	334516.80	334281.65	0.856	0.000	0.000	C1: 0.43	0.92
							C2: 0.22	0.95
							C3: 0.35	0.94
4C	330778.02	331383.44	331087.92	**0.862**	0.000	0.000	C1: 0.14	0.94
							C2: 0.20	0.89
							C3: 0.31	0.90
							C4: 0.35	0.95
5C	328778.20	329507.32	329151.42	0.853	0.000	0.000	C1: 0.12	0.94
							C2: 0.18	0.89
							C3: 0.13	0.88
							C4: 0.32	0.89
							C5: 0.25	0.92
6C	327392.86	328245.66	327829.39	0.850	0.000	0.000	C1: 0.07	0.92
							C2: 0.12	0.90
							C3: 0.17	0.85
							C4: 0.14	0.89
							C5: 0.26	0.88
							C6: 0.25	0.92
7C	326199.79	327176.28	326699.64	0.853	0.153	0.000	C1: 0.07	0.93
							C2: 0.11	0.82
							C3: 0.10	0.90
							C4: 0.12	0.88
							C5: 0.20	0.87
							C6: 0.14	0.86
							C7: 0.25	0.93

N = 4,964; AIC, Akaike information criterion; BIC, Bayesian information criterion; SaBIC, sample-adjusted Bayesian information criterion; LMR(p), value of p for adjusted Lo–Mendell–Rubin test; BLRT(p), value of p for bootstrapped likelihood ratio test; LCP, average latent class probability for most likely latent class membership.

dimensions of PhD-SS, so it is named the *low-motivation–low-hygiene* group. Profile 2 (979, 19.7%) shows a slightly higher value of SAC than that of profile 1 but lower than those of profiles 3 and 4, and it shows higher values of SAL and SWE than those of profile 3 but lower than those of profile 4, so it is named the *low-motivation–high-hygiene* group. The trend of the line graph for profile 3 (1,554, 31.3%) is opposite to that for profile 2, so we name the former the *high-motivation–low-hygiene* group. Profile 4 (1,731, 34.9%) shows the highest values in all four dimensions, so it is named the *high-motivation–high-hygiene* group and is the largest of the four subgroups.

According to the results of the one-way analysis of variance, these four profiles show significant differences in SAC ($F = 4694.99$, $p < 0.001$), SAI ($F = 843.84$, $p < 0.001$), SAL ($F = 1943.12$, $p < 0.001$), and SWE ($F = 751.70$, $p < 0.001$). In addition, the post-hoc test results show that significant differences are found for all possible pair-wise comparisons.

TABLE 4 Description of latent profiles (N=4,964).

Profiles	SAC	SAI	SAL	SWE
Low–low	2.46 ± 0.71	3.00 ± 1.65	2.66 ± 0.96	3.28 ± 1.37
Low–high	3.59 ± 0.63	4.97 ± 1.36	4.39 ± 0.93	4.65 ± 1.16
High–low	4.69 ± 0.66	4.59 ± 1.52	3.55 ± 0.94	3.72 ± 1.16
High–high	5.69 ± 0.62	5.98 ± 1.04	5.38 ± 0.83	5.29 ± 1.07
F	4964.99***	843.84***	1943.12***	751.70***
Post-hoc	1 < 2 < 3 < 4	1 < 3 < 2 < 4	1 < 3 < 2 < 4	1 < 3 < 2 < 4

***$p < 0.001$; SAC, satisfaction with academic cultivation; SAI, satisfaction with academic interaction; SAL, satisfaction with academic life; SWE, satisfaction with economics. SAC and SAI referred to "motivation factors;" SAL and SWE referred to "hygiene factors."

Differences between latent profiles in demographic variables

In this step of the analysis, logistic regression analysis was conducted to explore the effects of demographic variables on satisfaction. Because a single multinomial logistic model can only compare one group with three other groups, which does not allow for a two-by-two comparison of all types, a binomial logistic regression model is more applicable in this study. The logistic regression was conducted six times so that the results included all pair-wise comparisons, as given in Table 5.

The results show that gender, study-abroad status, age, country, work status, and caring responsibilities all contribute to predicting the PhD-SS profile. Specifically, women were less likely to be classified in the high-motivation–low-hygiene and high-motivation–high-hygiene groups but not the low-motivation–low-hygiene group, while PhD students who studied in their home countries were more likely to be classified in the high-motivation–low-hygiene group than in the low-motivation–low-hygiene and low-motivation–high-hygiene groups. Also, there was no continuity in the differences between age groups, as evidenced by the fact that compared to PhD students older than 35, those aged 18–24 were more likely to be classified in the high-motivation–high-hygiene group than in the low-motivation–low-hygiene group, while those aged 25–34 were more likely to be classified in the low-motivation–high-hygiene group than in the high-motivation–high-hygiene group. Then, compared to PhD students studying in China, those studying in the US, UK, and Germany were more likely to be classified in the high-motivation–high-hygiene group than in the low-motivation–low-hygiene group.

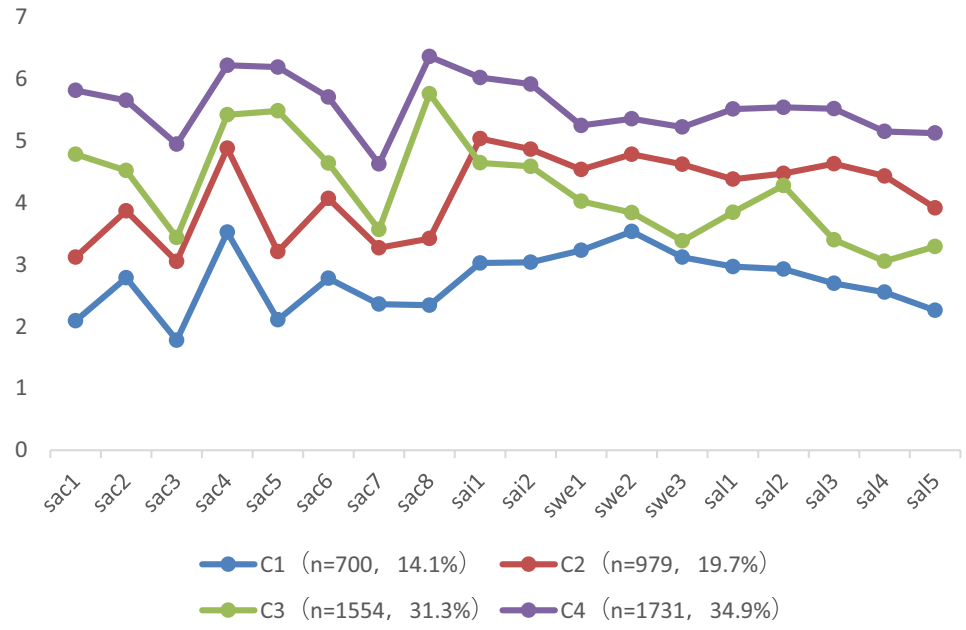

FIGURE 1
Mean scores of indicators for four-profile solution (N=4,964). sac=satisfaction with academic cultivation; sai=satisfaction with academic interaction; swe=satisfaction with economics; sal=satisfaction with academic life.

TABLE 5 Association between profiles and demographic variables.

	Reference	Reference compared with	C1 vs. C2		C1 vs. C3		C1 vs. C4	
			b	*OR*	*b*	*OR*	*b*	*OR*
Gender	Male	Female	0.03	1.03	−0.22*	0.81	−0.43***	0.65
Study abroad	Yes	No	0.15	1.16	0.33**	1.39	−0.01	0.99
Age	35 and above	18–24	0.38	1.47	0.41	1.5	0.67**	1.96
		25–34	0.36	1.43	0.06	1.06	0.02	1.02
Country	China	USA	0.40*	1.49	0.25	1.28	0.85***	2.34
		UK	0.39	1.48	0.07	1.07	0.61**	1.83
		Germany	0.67**	1.95	−0.44	0.65	0.80***	2.21
		India	−0.12	0.89	0.28	1.33	0.4	1.49
		Others	0.37*	1.45	0.35*	1.43	0.83***	2.29
Job	Yes	No	−0.11	0.89	−0.25*	0.78	−0.08	0.93
Caring	Yes	No	0.55***	1.73	0.2	1.22	0.17	1.19
	Reference	**Reference compared with**	**C2 vs. C3**		**C2 vs. C4**		**C3 vs. C4**	
			b	*OR*	*b*	*OR*	*b*	*OR*
Gender	Male	Female	−0.24**	0.79	−0.45***	0.64	−0.21**	0.81
Study abroad	Yes	No	0.19*	1.21	−0.15	0.86	−0.34***	0.71
Age	35 and above	18–24	0.02	1.03	0.29	1.34	0.27	1.31
		25–34	−0.30	0.74	−0.34*	0.71	−0.04	0.96
Country	China	USA	−0.15	0.86	0.45**	1.57	0.60***	1.83
		UK	−0.32	0.73	0.22	1.24	0.54**	1.71
		Germany	−1.10***	0.33	0.13	1.14	1.23***	3.43
		India	0.40*	1.5	0.52**	1.68	0.12	1.12
		Others	−0.02	0.98	0.46***	1.6	0.48***	1.61
Job	Yes	No	−0.14	0.87	0.04	1.04	0.18	1.19
Caring	Yes	No	−0.35**	0.71	−0.37**	0.69	−0.02	0.98

$N = 4{,}740$; OR, odds ratio; the profile before "vs." is the reference group for multiple regression. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Additionally, PhD students who had a job alongside their studies were more likely to be classified in the low-motivation–low-hygiene group than in the high-motivation–low-hygiene group, while PhD students without caring responsibilities were more likely to be classified in the low-motivation–high-hygiene group than in the others.

Relationship between academic career enthusiasm and PhD students' satisfaction profile

Table 6 displays the results of comparing the four profiles in terms of changes in ACE. The results of the Chi-square tests show that the changes differed significantly across the four profiles ($p < 0.001$). On one hand, the results of horizontal comparison find that the proportion of PhD students who experienced a decline (slight or serious) in ACE decreased with increasing satisfaction, with 48.1% of samples in the low-motivation–low-hygiene group and only 15.5% in the high-motivation–high-hygiene group; of these, only 3.8% of PhD students in the high-motivation–high-hygiene group had a serious decrease in ACE. Conversely, the proportion of PhD students who experienced an increase (slight or sharp) in ACE increased with increasing satisfaction, with more than 50% of samples in the high-motivation–high-hygiene group and *ca.* 25% in the low-motivation–low-hygiene group. Besides, the percentage of PhD students with no change in ACE was around 30% in all profiles. On the other hand, some interesting results were found from a vertical perspective. First, in the low-motivation–high-hygiene group, the ratio of decreasing, unchanged, and increasing ACE was close to 1:1:1. Then, in the high-motivation–high-hygiene group, the number of students with increasing ACE was more than three times that with decreasing ACE. Also, there was a mirroring characteristic of the ratio of increasing and decreasing ACE between the low-motivation–low-hygiene and high-motivation–low-hygiene groups; i.e., the proportion with increasing ACE in the low-motivation–low-hygiene group was only half of that with decreasing ACE, whereas the reverse

TABLE 6 Association between profiles and ACE.

ACE	Low–low	Low–high	High–low	High–high
Sharp decrease	177 (27.30%)	134 (14.30%)	123 (8.20%)	64 (3.80%)
Slight decrease	135 (20.80%)	210 (22.40%)	233 (15.60%)	194 (11.70%)
No change	170 (26.20%)	279 (29.80%)	476 (31.90%)	509 (30.60%)
Slight increase	91 (14.00%)	181 (19.30%)	355 (23.80%)	422 (25.40%)
Sharp increase	76 (11.70%)	132 (14.10%)	305 (20.40%)	474 (28.50%)
χ^2	446.839***			

$N = 4{,}740$; ***$p < 0.001$.

was the case in the high-motivation–low-hygiene group. Overall, the ACE of more than half of the PhD students either remained the same or decreased during their doctoral program, with only 42.95% of them reporting an increase.

Conclusion and discussion

The main goal of this research was to identify the unobserved profiles of PhD-SS by focusing on their feelings about various aspects of the PhD training process. Using LPA, we identified four profiles, and referring to two-factor theory, we labeled them as *low-motivation–low-hygiene*, *low-motivation–high-hygiene*, *high-motivation–low-hygiene*, and *high-motivation–high-hygiene*, respectively. Also, we found that the different PhD-SS profiles were closely linked with the demographic characteristics of the PhD students and their changes in ACE.

This is the first empirical study to identify the profiles of PhD-SS using a person-centered approach. Our findings provide initial evidence supporting the heterogeneous characteristics of PhD-SS with various aspects of the doctoral training process. As mentioned above, four groups were found in this study according to the levels of satisfaction in different items, which means that the patterns of PhD-SS can typically be differentiated by the extent to which the training process satisfies students regardless of aspects. Most of the PhD students showed high satisfaction with academic-related factors (76.2% with academic cultivation and 86.1% with academic interaction). These findings do not categorically contradict previous research suggesting that Chinese PhD students have higher satisfaction in mentoring and competency development (Yuan and Li, 2017), indicating that the doctoral training process is at least rewarding in terms of the professional growth of PhD students. In contrast, hygiene factors were not well satisfied, as shown by the low satisfaction with life and financial support, which is highly consistent with the findings of Xiao et al. (2021).

After identifying the four-profile solution, we examined the associations between PhD student demographic characteristics and PhD-SS profiles. The logistic regression found that the four groups differed significantly in gender, age, work status, caring responsibilities, country, and study-abroad status.

When it comes to gender, female PhD students were less likely to be classified in the high-motivation groups. A possible reason for this is that women might be constrained by traditional social values (e.g., cultural expectations of subordinating to male authority) (Carter et al., 2013), leading to the academic path becoming rougher and bumpier for women. Existed studies have found that female PhD students are less likely to receive external funding (Hoffer et al., 2001) and become research assistants (Smith, 1995), and some female PhD students felt upset that they did not encounter a suitable mentor (Maher et al., 2004). All the aforementioned factors may contribute to lower satisfaction with the PhD training process among female students.

In terms of age, younger PhD students were more likely to be classified in the high-motivation–high-hygiene group. This may be because younger PhD students are less likely to be under pressure from financial issues, family responsibilities, etc. As the existing literature suggests, psychological stress has a negative impact on job satisfaction and life satisfaction (Brauchli et al., 2013), which echoes to some extent the differences in satisfaction categories regarding work status and caring responsibilities.

Regarding nationality, the probability of classifying PhD students in the high-motivation–high-hygiene group is significantly higher in the USA, UK, and Germany than in China. Lacking "the same breadth of externally funded scholarship programs as their counterparts have in the West" (Lam, 2011) may be an important reason for this difference. Finally, students studying for a PhD abroad were more likely to be satisfied with both motivation and hygiene factors, which is generally consistent with previous research (Harman, 2003).

Additionally, this study has provided some interesting results about the relationship between satisfaction profile and change in ACE in a population of PhD students. Previous research on early-stage scholars concluded that many factors—such as supervisors and economics—have a great impact on students' decisions about whether to pursue a lifelong academic career (Barrett and Barrett, 2011; Sauermann and Stephan, 2012; Pilbeam et al., 2013; Roumell et al., 2014), which is also supported by the present study. Furthermore, we find that increasing or decreasing ACE is related more closely to motivation factors among PhD students. Even if the hygiene factors are not well satisfied, PhD students may still hold higher ACE if they have higher satisfaction with motivation factors. Conversely, PhD students with higher satisfaction with hygiene factors but lower satisfaction with motivation factors may lose enthusiasm for academia. That is, in the case of maintaining and stimulating ACE, motivation factors can compensate for the negative impact of the absence of hygiene factors, not the other way around. Therefore, it can be seen that two-factor theory has a certain explanatory power for changes in ACE, but it must be adjusted in a certain way considering the special characteristics of the population.

Contributions and limitations

The theoretical and practical value of this study is reflected mainly in the following. First, four subcategories of PhD-SS were

identified by adopting a latent profile analysis, which preserves individual integrity, leading to a more accurate assessment of the students' feelings about the training process. Second, this study examined the differences in satisfaction in terms of the demographic characteristics of each category, thereby enriching the knowledge about the antecedents of PhD-SS. Finally, the significant influence of the training process on PhD students' ACE has also been revealed. To some extent, this study has also verified the application value of Herzberg's two-factor theory in motivating PhD students' ACE.

However, this study still has some limitations. For example, the questionnaire was collected mainly from PhD students who were studying science and technology, so we must be cautious when extending the results to other disciplines; future studies with various PhD student datasets from different disciplines or specialties are needed before drawing general conclusions about different population groups. Also, this study used cross-sectional data from a self-reported technique to identify PhD-SS profiles, and we only compared the proportion of PhD students in different profiles in terms of increasing or decreasing ACE; we cannot make a causal inference about the relationship between PhD-SS and ACE. So, future research could conduct a longitudinal study to find the changes in ACE of PhD candidates at various stages of the PhD program and further find a causal link between these two variables.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the (patients/ participants OR patients/participants legal guardian/ next of kin) was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

YY: conception, conceptualization, theoretical direction, interpretation of the statistical analyses and results, and original draft preparation. JC: supervision and the writing-reviewing of this project. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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"They gotta understand why": Teachers' professional perceptions regarding the stimulation of academic motivation in upper secondary school

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In recognition of the need for more research on teachers' perceptions of motivational work in the classroom, this study explores upper secondary school teachers' perceptions of how to stimulate academic motivation among their students at a school in southwestern Norway. The data were gathered in three steps. The school's primary teachers (n =33) were interviewed by teacher champions (n =17), that is, teachers that were team leaders for each of the school's educational departments that were given a specific role in the research in terms of initial data collection. This was followed by two extended focus groups with the teacher champions and member checks for each group. The data were subjected to conventional content analyses using NVivo 12. Then, a focus group was carried out with teacher coordinators (n =11) aiming to refine preliminary findings. Summative content analyses were carried out, followed by deductive category application. The findings indicate that teachers perceive class management and strategies for supporting students' learning processes as well as key students as crucial for academic motivation. "Three motivational strategies" were developed. However, feedback and differentiated learning tasks, which are central aspects of motivational theories, received less emphasis. Further in-depth studies exploring concrete approaches to and the evaluating of using strategies for stimulating academic motivation are required.

KEYWORDS

academic motivation, teachers' perceptions, upper secondary school, motivational strategies, qualitative study

Introduction

Education is crucial, both for the individual in terms of future employment goals and adult life (Blossfeld et al., 2006; Seiffge-Krenke, 2012) and for society as a whole (OECD, 2020). As such, the completion of upper secondary school is essential. It is thus concerning that academic motivation declines rapidly between primary school and lower secondary

school in parallel with students' motivational climate experiences (Skaalvik and Skaalvik, 2011; Lüftenegger et al., 2012). Research further indicates that motivation decreases from a relatively high level between Grades 8 and 10 (Yeung and McInerney, 2005; Diseth et al., 2020). In the Norwegian context, fewer students express the desire to pursue higher education after upper secondary school (Bakken, 2019) and during the period from primary school *via* lower secondary school to upper secondary school, students may take school more seriously, as they are introduced to grades and subjected to higher academic demands (Skaalvik and Skaalvik, 2011). A WHO-study across European countries and in Canada indicates an increase in school pressure especially among older adolescents (Inchley et al., 2020). While school demands can increase student engagement, sustained high demands may contribute to stress, burnout, and a more cynical attitude toward school (Salmela-Aro, 2017). Research has identified strong links between academic stress and emotional problems (Tharaldsen et al., 2022), and among other adverse outcomes cynicism may in worst-case lead to drop out and depression (Salmela-Aro et al., 2016).

The stimulation of upper secondary school students' academic motivation is critical. Student motivation is influenced by both individual beliefs and the environment (Ames, 1992). Motivational research has long linked learning environment and goals with student motivational outcomes. It has been argued that classroom structures may influence a prominent goal and thus its adoption in the learning environment (Ames, 1992). However, goals are rarely reflected on explicitly by teachers and students in the learning environment and students tend to respond differently to goal messages (Urdan, 2004). Furthermore, both contextual factors, students' self-perception's, goal setting, and various responses to success such as affective and behavioral responses need to be considered regarding conceptualizations of achievement orientations and aims (Urdan and Kaplan, 2020). Hence, the creation of such goals in the classroom has proved challenging (Ames, 1992; Urdan, 2004; Urdan and Kaplan, 2020), and practitioners often struggle to motivate their students (Diseth et al., 2020). The translation of motivational theory into practice may be further challenged by researchers' use of academic language and competing theories of motivation (Anderman, 2020). Several motivational theories and quantitative studies have sought to investigate how motivation can influence learning and academic achievement (Hattie et al., 2020). However, researchers have identified the need for more theory and research on motivational interventions that are appropriate in complex classrooms and schools (Urdan, 2010; Elliot and Hulleman, 2017; Urdan and Kaplan, 2020) in addition to qualitative methods that emphasize a situated perspective (Urdan and Kaplan, 2020). Research regarding teachers' perceptions of how to stimulate academic motivation in upper secondary students is also scarce. This study aims to add knowledge to this research gap by exploring teachers' professional perceptions regarding how academic motivation may be stimulated in the classroom. The study explores teachers' professional perceptions of appropriate strategies that may promote intrinsic academic motivation among upper secondary school students and is guided by the following research question: How do teachers perceive that they can stimulate academic motivation among students in upper secondary school?

The link between a motivational framework and learning environment dimensions

Although motivational frameworks share several commonalities, the notion is rich and diverse (Hattie et al., 2020). Theories emphasize processes that account for goal-oriented activities (Pintrich and Schunk, 2002), identify social–cognitive processes as key sources of motivation, and are frequently used to explain students' activity choices, persistence, help-seeking, engagement, and performance (Meece et al., 2006). Intrinsic and extrinsic motivation is often cited as reasons for engagement in learning behavior (Sansone and Harackiewicz, 2000). Intrinsic motivation causes the individual to perceive learning as rewarding in itself, while under extrinsic motivation; the desired outcomes are the goals of learning activities. However, the two are not necessarily mutually exclusive (Diseth et al., 2020). Macro-level and peer influence may both affect academic motivation, and significant others and contextual factors, such as school, home, and society, should be considered in motivational research (Hufton et al., 2003) along with cultural differences (Diseth et al., 2020). The following section emphasizes three main motivational theories that cover the core aspects of motivation and thus learning environment dimensions.

Motivating academic engagement

Self-determination theory (SDT) emphasizes autonomy, competence, and relatedness as crucial needs that should be supported in the classroom to stimulate intrinsic motivation and holds that teachers play a significant role in satisfying these needs (Niemiec and Ryan, 2009). SDT suggests that teachers' instructional styles range from highly controlling to highly autonomous in terms of support, whereas an autonomy-supportive style stimulates student engagement by adopting the students' perspective in learning activities (Deci et al., 1981). Teacher-provided structure supports students in building skills and competence by allowing the students to exercise their initiative in learning activities based on the students' inner motivational resources through the use of non-controlling informational language that provides students with rationale for learning, and by acknowledging students' perspectives and feelings during learning tasks (Jang et al., 2010). Furthermore, to meet students' needs for relatedness, it is necessary to ensure good relations in the learning environment, both between teachers and students and among peers. However, students may also require assistance in managing their learning experiences by adequately

handling their thoughts, behavior, and emotions. Perceived self-efficacy—that is, an individual's assessment of their own capabilities to organize and perform actions in pursuit of educational goals—may influence coping behavior and thus motivation through perceived competence, including goal setting and self-evaluative reactions (Bandura, 1977). Self-regulated learning (SRL) assists students engaging in actions and learning processes to attain competence by gaining information or skills and adequately managing their thoughts, behaviors, and emotions (Zumbrunn et al., 2011). Goal setting (i.e., analyzing learning tasks and defining necessary goals), self-monitoring (i.e., applying strategies and observing their efficiency), and self-evaluating (i.e., evaluating performance that influences future goal setting and self-regulating processes) are the three main phases of the self-regulation process (Zumbrunn et al., 2011). This process facilitates learning (Schunk and Zimmerman, 2012) and predicts students' achievement trajectories and test scores (Zimmerman and Schunk, 2001).

In line with SDT, achievement goal theory emphasizes that motivation may be achieved through various means and that different types of motivation result in different learning and well-being qualities (Urdan and Kaplan, 2020). According to achievement goal theory, meaning, development, culture, identity, and context are key areas of concern with respect to two main goals: individual development vs. social comparison and competition (Urdan and Kaplan, 2020). Definitions of criteria for success have defined two main types of achievement goal: mastery goals, also called learning or task goals, and performance goals, also called ego or ability goals (Ames, 1992). The theory explores the purpose of engaging in, choosing and persisting in various learning activities (Lüftenegger et al., 2014) by focusing on two learning orientations: mastery orientation and performance orientation (Patrick et al., 2011). Mastery orientation is characterized by its emphasis on the learning process as a means of developing competence through social-comparative performance and through understanding rather than mere memorization as well as by the notion that success results from hard work and personal improvement (Patrick et al., 2011). In classrooms dominated by mastery orientation (i.e., mastery climates), students exhibit higher levels of personal mastery goal orientation, self-efficacy, effort in regards to learning, and more use of adequate learning and coping strategies (Patrick et al., 2011). Mastery climates have been shown to predict intrinsic motivation (Diseth and Samdal, 2015), stimulating motivational patterns that are conducive to long-term, high-quality learning (Ames, 1992; Lüftenegger et al., 2014). They are also positively associated with academic performances (Payne et al., 2007) and reduced academic stress (Tharaldsen et al., 2022). Performance orientation, however, focuses on extrinsic rewards resulting from learning, whereby success is attained by outperforming others (Patrick et al., 2011). Despite its positive association with performance when self-validation is prioritized over performance goals, performance orientation is associated with maladaptive learning behaviors, such as help-avoidance, cheating, procrastination, low achievement and interest, and poor attitude toward school as well as negative academic outcomes, such as loss of self-worth, diminished intrinsic motivation, and lower grades (Grant and Dweck, 2003; Patrick et al., 2011; Lüftenegger et al., 2014; Urdan and Kaplan, 2020). In sum, motivational theories emphasize that the means used to stimulate motivation may influence engagement and thus academic performance. It thus seems appropriate to explore how teachers motivate students' academic engagement.

Materials and methods

This study follows an exploratory qualitative case study design situated within an action research framework. A case study approach is appropriate when the study aims to explore the "how and why" of a phenomenon, when the behavior of participants cannot be manipulated, when contextual conditions must be considered, and when it is challenging to distinguish the phenomenon and context clearly (Yin, 2003). As the current study aims to explore teachers' perceptions of how to stimulate academic motivation within one upper secondary school in which the motivational work is based on the teachers' everyday practices, a qualitative case study design seemed appropriate.

Participants

Purposeful sampling was applied. The sampling strategy is especially useful when the number of persons that can serve as informants is limited due to the research design of the study. The sampling strategy seemed appropriate in the current study as the study has a case study design that explores teachers' perceptions on stimulating academic motivation in one upper secondary school. A vocational school in the researchers' network in southwestern Norway, with approximately 750 students and 200 employees, was invited to participate in the study. The teachers who participated were divided into four categories: *regular teachers* ($n = 100$), *primary teachers* ($n = 33$; 22 female), *teacher champions* ($n = 17$; 11 female), and *teacher coordinators* ($n = 11$, of which eight were female). The *primary teachers* were informants for the teacher champions. The *teacher champions* were all team leaders for each of the school's educational departments and collected data from the primary teachers in their respective teams. Following this, they participated in focus groups representing the perspectives on stimulating academic motivation of the teachers in their respective teams as well as bringing their own perspectives into the group discussion. The role of the *teacher coordinators* was to follow up the school's work on motivation and follow up data collection procedures. Accordingly, they served as informants in a focus group aiming to reflect upon and design strategies for stimulating academic motivation among students based upon findings from the previous interviews with the teacher champions. Hence, the roles of the teacher champions and teacher

coordinators were 2-fold; after an initial role as research assistants, they were informants in focus group interviews.

Data collection and procedure

First, the teachers attended three short seminars that introduced the main principles of SDT, SRL, and achievement goal theory as theoretical perspectives for stimulating academic motivation. The seminars were held in January, March, and August 2021, of which the first and latter constituted seminars with presentation of theories and the seminar in March was carried out as a workshop where teachers more actively engaged in discussions and learning tasks. The teachers were then asked to reflect on important factors for stimulating academic motivation in their students. Data collection was conducted in three steps in October and November 2021 and based on a semi-structured guide for exploring teachers' perceptions of what influences student motivation in the learning environment and what stimulates motivation academically in the individual student and in the learning climate. First, the teacher champions collected data from the primary teachers in their respective teams. The meetings were held at school during work hours. Subsequently, to increase the data's trustworthiness, extended focus groups (Berg et al., 2004) were held. Open-ended, semi-structured interview guides were developed for the interviews. Two focus groups were held with the teacher champions, who, having collected data from their respective teams of primary teachers, reflected on behalf of the primary teachers and themselves. The reason two focus groups were held was to maintain the number of informants within the guidelines for focus groups (Krueger and Casey, 2015). The interviews' main themes were teachers' overall perceptions and experiences of motivating students and creating motivational climates, what they find useful when stimulating academic motivation among their students and why and how they influence students' academic motivation. The focus groups were held in person at school during work hours. Based on findings from these interviews, a focus group with the teacher coordinators was carried out. After an open reflection on how to stimulate academic motivation among students, the teacher coordinators were asked to reflect on the motivational strategies that the teacher champions promoted. Finally, and based on the findings from the interviews with the teacher champions, the teacher coordinators were to design drafts of "three motivational strategies" for use in the classroom. This focus group was held digitally due to restrictions because of the COVID-19 pandemic. As data were gathered in a single context (school) by teacher champions, with some data collected prior to the interviews and extended focus groups and member checks, data saturation (Saunders et al., 2018), and appropriate information power (Malterud et al., 2016) were considered to provide sufficient descriptions of the phenomenon under study.

All interviews were recorded and later transcribed verbatim by the researcher.

Data analysis

The data were analyzed using NVivo 12. First, as the data from the first two focus groups were based on professionals' perceptions rather than pre-existing theory and/or research, conventional content analysis was applied. In line with this approach, labels for codes emerged directly from the text data, which were categorized based on their relatedness and organized into meaningful clusters, and code definitions were developed (Hsieh and Shannon, 2005). Second, summative content analysis is particularly adequate when the goal of the analysis is to validate or conceptually extend preexisting theory or research on a specific topic (Hsieh and Shannon, 2005). As the data from the third focus group (teacher coordinators) were based on findings from the first two focus groups (teacher champions), a summative content analysis was chosen to analyze data from the third focus group. After the conventional content analyses of the data from the focus groups with teacher champions and after the summative content analysis of the focus group with the teacher champions, member checks (Miles et al., 2019) were carried out with the groups to increase trustworthiness of the findings. No feedback was provided that led to changes in the suggested final findings. Following this, and through deductive category application (Mayring, 2004), the relationships between the variables were further analyzed and relationships between codes were identified. Key concepts and operational definitions were determined based on preexisting motivational theory, followed by a final refinement of the final findings, i.e., motivational strategies.

Ethical considerations

The Norwegian Social Science Data Services (NSD) formally approved the study. The participants' voluntary informed consent was obtained prior to data collection.

Findings

Findings from the focus groups with the teacher champions, from which the main dimensions "suggested strategies" and "students as motivators" were identified, are first presented below. Following this, findings from the focus group with the teacher coordinators are presented through the main dimension "three motivational strategies." The deductive category application merged the findings from the two first data collections with central theory on motivation, and was categorized by the names of the final strategies, i.e., "teaching structure," "student collaboration and relations," and "learning process and relevance." To ensure transparency, the findings are supplemented with quotations from participants. The quotations were obtained from as wide a range of informants as possible. To maintain anonymity, the quotations are referenced according to the informant and focus group numbers.

Focus groups with teacher champions

Suggested strategies

During the discussions, the informants reflected on motivational practices across the following seven sub-categories: class management, relational work, tuition planning, student participation, flexibility, goal setting and usefulness, and relevance.

Class management that creates a good learning environment was advocated:

> "*A good learning environment is what I work with most in the beginning. Setting boundaries, so that the class is a safe space (…) That there is an openness in the class and that they dare to ask (…). Many just sit there and do not want to ask anything, but I know that in the courses we teach, it's all new to them and they gotta ask.*" (4.2), and "*As teachers, we do all we can regarding variation, introducing topics, clear classroom structure (…).*" (7.1)

Building good relationships in the learning environment was emphasized as an important basis motivation:

> *"It* [motivation] *builds on good relations from the beginning*"" (6.2) and *"It* [relations] *are very important because we have to motivate different students in different ways. (…) It's important to learn to know them enough to know what their goal is. What do they want?"* (3.2)

Preparation for sessions and the provision of clear introductions to the students were also advocated as a means of stimulating students' motivation:

> *"I gotta have clear goals for the session (…) so I gotta have it planned from when I enter* [the classroom]: *'These are the elements I'm gonna work on in this subject today.*"" (4.1) and "*Good planning. (…) Clear and distinct tasks, giving clear and distinct instructions at the beginning of the session.*" (3.1)

Motivating students by encouraging them to participate in decisions regarding their learning processes—for example, having a say in the topics that they study and how to proceed with learning tasks—were identified as important:

> *"You gotta motivate (…): 'You* [the student] *gotta think through what you want, and you'll get what interests you. If you wanna be a waitress, you'll get loads on that. If you wanna be a meat cutter, you'll get loads on that.' And bring in motivation through their own participation.*" (1.1) and "*In class, the students sit together in groups of four. They wanted to and I said, 'Yes, be my guest.' That's democracy, right? (…). They were making a life cycle analysis (…). I said 'you have got three days.*" *(…). Yes, they* [the students] *are allowed to participate in decision making (…). I just helped them along, and it turned out great! They worked very independently;* [I] *just gave them some supervision every now and then.*" (8.1)

In continuance of this, feedback and assessment were briefly mentioned:

> *"Assessment for learning is also motivating (…) with feedback that motivates further work.*" (3.2) and "*They are motivated by good feedback. If you say 'Now you did a good job,' they are extra happy when they leave school* [that day]." (5.2)

Flexibility was a core tool in encouraging the students' motivation:

> *"Regarding motivation, it's very important to be flexible. I teach language and social science and in language* [classes], *I always bring a toolbox, with novels, for instance. Then, I was in another teacher's class, and it almost went overboard. Then, we just sat down and read a novel about eating disorders. We sat in a circle and had a wonderful session. It was not what I had planned, but I think it's very important to take the temperature on the class and have something up your sleeve.*" (3.2) and "*Variation in the classroom, in the teaching (…), especially how to teach (…), perhaps presentations, that they* [the students] *can use filming, TikTok, podcasts, animations.*" (7.1)

The informants emphasized the importance of awareness and setting clear and realistic goals so that the students know what to do. Additionally, it was important that the teachers knew what the students' goals and wishes were so that they could support them:

> *"Clear goals and also knowing what the individual students' goals are. Motivation is always connected with goals everywhere and in society, motivation and goals are connected. You cannot have one without the other.*" (3.2) and "*Setting sub-goals* [is important]." (5.1)

The teachers reported that it was essential to help the students recognize the usefulness and relevance of the different learning goals:

> *"I know that many struggle with 'Why do I need to learn this?' (…) They gotta understand why.*" (5.2) and "*That what we are doing is close to practice and trustworthy. (…) speaking about theory when we are in the practice field that is very motivating. They* [the students] *think it's very nice when they see the purpose of what we are doing. (…) they see the purpose of the knowledge.*" (6.2)

Students as motivators

The informants' perceived what they called "key students" as crucial in promoting academic motivation. The main reason was

that, by influencing key students, the entire learning environment can be influenced. If used appropriately, key students could influence peers positively:

> *"There's often a king or a queen in a class. (…) teachers have a good dialogue with this* [student] *who everyone follows. We speak with the student more than the rest of the class to get them all on board. It's been of great help for me (…) to motivate the whole group, to get them all along."* (1.1); *"Role models are important. If you get any of them in class and they are popular among circles of friends, of course, they take much of the load if you think that students motivate students."* (1.2); and "*This year, I have discovered how important it is to use the students' own resources in class. It helps a lot."* (6.2)

When asked to describe key students, the informants emphasized that the attributes of key students could vary a lot. Key students were described as academically and/or practically strong, but also curious, helpful, outgoing and responsible students:

> *"Sometimes we have the positive one that gets thing out. And it's not a specific human type, but it's often someone knowledgeable or curious. (…) it can be the calmest one in class (…) and it can be the most outgoing one."* (3.1); *"Students who function better than others love to help those who are weaker, care for them and all that. So, we can use that. And those who receive help really appreciate the support and care"* (1.2); and "*In one class, it was a girl who was a 'smartass' who was funny but not so academically strong, but she was ready to strike and could be motivating as she got the others along. In another class, a student council representative was the key student who had this role and was good to make alliances* [with]. *I have a boy in class who is a bit older than the rest who takes responsibility, and I can lean on him."* (6.2)

The informants further emphasized that the key students may vary not only in terms of their personalities but also across subjects:

> *"It can vary a bit according to who they are and what we are working on"* (4.1) and "*Different students become role models in class."* (4.2)

The informants asserted that it is important to activate key students through positive communication and win them over to the teacher's side. This was achieved either explicitly through conversations or by stimulating them during learning activities:

> *"There's this boy in class that's a bit older than the rest, and everyone looks up to him. He's leader of the student council and they* [the other students] *do everything he says. I often have conversations with him before we start something and say that 'Now we are gonna do this and that and you gotta contribute and pull a long this and this and this* [student]. *Because they bring in a lot of their personal lives into school (…) so try to make them focus here, knowledge, knowledge, knowledge. It's here and now'."* (1.1) and *"I use these students and ask 'work a bit with him', and then you get motivation around in class. (…) And some have been working on it* [the subject] *for a while, and they are role models from early fall. And then I make them talk and suddenly another student has a moment of realization, and he can bring other students with him. It's worked great."* (4.2)

Focus group with teacher coordinators

Findings from the focus group with the teacher coordinators were categorized in the dimension "three motivational strategies."

Three motivational strategies

Regarding the strategies, the informants expressed that the seven strategies from the focus groups with the teacher champions should be compressed and integrated. Reason was that the strategies were complementary:

> "*Other strategies come almost automatically when you use some strategies. 'Cause there will always be elements you just have to, it was not what you planned, so you gotta come up with something new to solve it as you go along. Often other strategies emerge because students are different, they differ regarding motivation."* (1.3)

The strategy "planning tuition and student participation" combined the two strategies with the same initial labels:

> "*We can merge student participation and planning tuition. (…) They* [the students] *often participate in making a test situation, they join in and structure what they find important in their work."* (7.3)

The strategy "structure and relational work" combined "class management" and "relational work":

> "*Class management in combination with relational work is definitely the most important thing if you wanna have a calm enough class to receive attention and that they* [the students] *like you, not only to have respect for you* [the teacher] *as a professional."* (9.3)

The strategy "usefulness and relevance" combined "setting goals," "flexibility," and "usefulness and relevance":

> "*Setting goals is a natural part of trying to motivate when they* [the students] *are going to define their goals or we* [the teachers] *help them in the process."* (5.3)

> "*We gotta be flexible and not follow the same plan year after year but think a bit 'what is relevant for the students that are here and now'."* (6.3)

> *"It is the relevance of the course that is the foundation regarding the final goal."* (5.3)

Deductive category application

Based on the findings above "three motivational strategies" were deduced, of which two were aimed at supporting the teachers and one was directed toward the students.

The strategy "planning tuition and student participation" was further categorized as "planning tuition." This teaching structure strategy works to promote motivation in learning activities. The strategy is based on teachers' practice and competence in motivating promotion in the classroom. It may function as a structured planning tool for the teaching lesson. Structure as part of teacher's instructional style may promote students' engagement by providing concise and adequate information regarding goal expectations and learning processes (Skinner and Belmont, 1993; Skinner et al., 1998), and is supporting autonomy in the classroom (Jang et al., 2010) which is central in the SDT-framework. The strategy was finally labeled "teaching structure." A model of the strategy was developed, which included a checklist for teachers that reminded them to introduce the session clearly (e.g., have and provide a clear structure for the session including purpose, relevance, and goals), adjust the learning activities (e.g., provide choices regarding tasks and use multiple working methods), ensure adequate collaborative learning (e.g., who works in pairs/groups, provide clear guidelines for the work to get the students started), and take a timeout when needed (e.g., play music and do an activity).

The strategy "structure and relational work" was further categorized as "structured relational work." Student collaboration and relationships are an important part of motivation- and mastery-promoting work. Autonomy is also a main principle from the SDT-framework, as is relatedness (Niemiec and Ryan, 2009). Student collaboration and relationships are continuously ongoing work and is based on the teacher's daily practice. This strategy systematized the work and can be used as a starting point for planning, mapping, and implementation of measures related to further development of relationships in the classroom. The strategy was finally labelled as "student collaboration and relations." A model of the strategy was developed, which included a checklist for teachers that reminded them to explore who their students are academically (e.g., ensure that those in need receive help, use key students to promote motivation), socially (e.g., who do they prefer to be with, ensure that they receive social and emotional support), and to use the information appropriately (e.g., put them in pairs, inform other teachers).

The strategy "usefulness and relevance" was further categorized as "goal processes, relevance, and student participation." Through this strategy, the students contribute to identifying assessment goals and evaluate their own progress in relation to the goals. The strategy may thus help students to divide larger learning goals into more meaningful and clearer units, which may be beneficial for the students to stimulate intrinsic academic motivation. This is in line with self-regulated learning (SRL) of which goal-setting, self-monitoring, and self-evaluating are central (Zimmerman and Schunk, 2001) in that it aids students in involving actions and learning processes to obtain competence through gaining knowledge or skills by handling thoughts, behaviors, and emotions appropriately (Zumbrunn et al., 2011). Competence is also a main principle for increasing autonomous engagement in the SDT-framework (Niemiec and Ryan, 2009). The strategy was finally labelled "learning process and relevance." A model of the strategy was developed. The model illustrated a path with the starting point being the student's level of knowledge prior to a learning activity and the final point being the overall learning objective. Then, the student should, with support from the teacher, define subgoals that may lead from the starting point to the final learning goal (Figure 1).

Discussion

This study explored teachers' professional perceptions of how upper secondary school students' academic motivation could be stimulated. The findings suggest that teachers perceived class management and relational work, planning, and tuition—including student participation and flexibility—and supporting students' learning process through goal setting, usefulness, and relevance, as key to motivating academic learning. The findings further indicate that, in addition to teachers, key students are crucial in promoting academic motivation in the learning environment.

Class management and relational work

The findings suggest that, to stimulate academic motivation in the classroom, the teacher must exercise appropriate classroom management and adopt a conscious approach to the students both as individuals and as a group. Behavior management is one means by which student engagement may be stimulated. This entails promoting positive behavior and preventing or eliminating misbehavior in teacher–student interactions (Pianta et al., 2012). Engagement has thus been recognized as a relational process (Pianta et al., 2012). Hence, relationships are central. The creation of a safe and transparent learning environment through the establishment of good classroom relationships may foster a sense of safety. This is important, as social support influences mental health and well-being (Thoits, 2011) and may function as a buffer against perceived academic stress. Emotionally supported students trust their teachers and are confident that their teachers believe in them and care for them (Pianta et al., 2012). This may assist the teacher in grouping students appropriately to facilitate adequate learning processes and stimulate good relationships, both between teachers and students and among peers. This is in line with SDT,

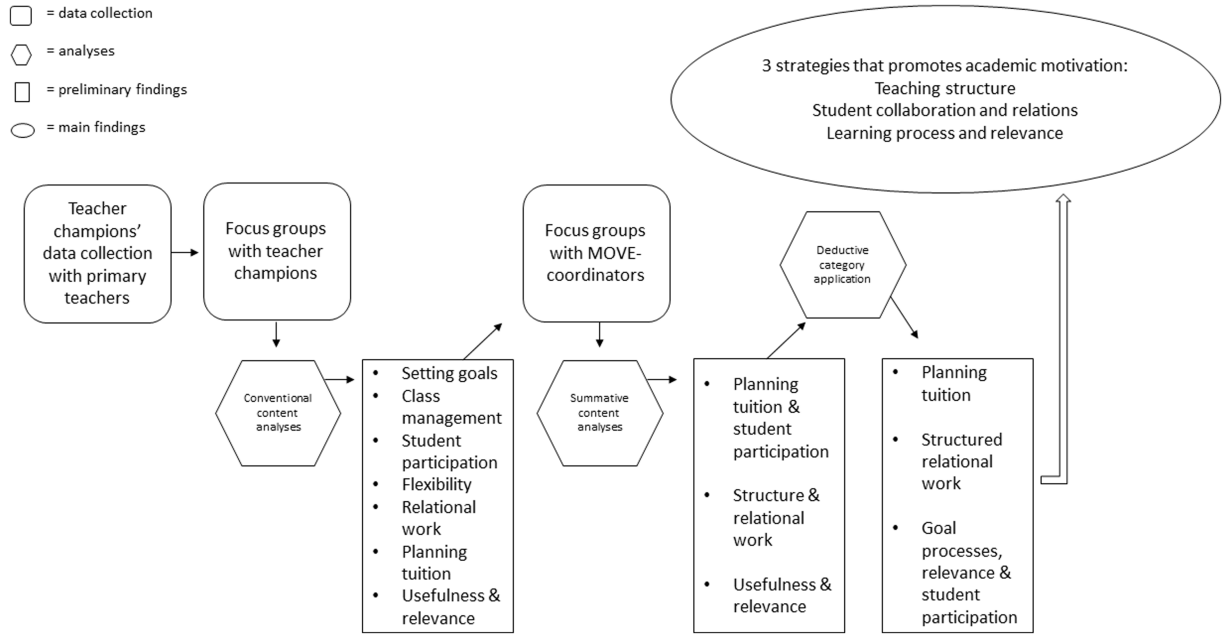

FIGURE 1
presents an overview of the data collection process, analyses, and findings.

which emphasizes relatedness as a key principle of intrinsic motivation (Niemiec and Ryan, 2009). Relatedness can internalize students' motivation and increase autonomous engagement (Niemiec and Ryan, 2009) and can be facilitated by emotional support from the teacher, which is critical in ensuring social and emotional functionality in the learning environment (Niemiec and Ryan, 2009; Pianta and Hamre, 2009). Furthermore, perceived emotional support from the teacher has been negatively associated with intentions to drop out of school, whereas loneliness among peers has been positively associated with intentions to drop out (Tvedt et al., 2021). Relational work thus emerges as important in stimulating academic motivation.

Planning and tuition

Regarding teachers' preparation for lectures, findings indicate that to stimulate academic motivation, it is important that a clear teaching structure is implemented. The teacher should have a clear plan for the lesson, with clear associated instructions. Structure promotes students' engagement by clearly delineating the appropriate amount of information that teachers should relay to students, thus managing expectations, and how educational goals may be efficiently achieved (Skinner and Belmont, 1993; Skinner et al., 1998). Structure may be facilitated by considering students' future behavior, by recommending stepwise approaches to learning activities with clear and logical directions, by guiding ongoing learning activities and affording student's leadership in their learning, and by providing appropriate feedback, thus aiding students in identifying and applying their skills and competences (Jang et al., 2010). As such, planning and tuition support autonomy in the classroom (Jang et al., 2010), which occupies a central position in the SDT framework. Hence, the different methods applied should be alternated so that the students can work in whichever manner they prefer while also experiencing new learning methods. The facilitation of fruitful collaborative learning is an extension of this, as some students prefer to work alone while others favor peer collaboration. School curricula are typically founded on the principle that learning occurs in interaction with others and that the ability to solve tasks through collaboration is a crucial skill of the future (Chalkiadaki, 2018). The facilitation of collaborative learning may thus become central to teaching structure where relevant.

Supporting students' learning processes

The findings indicate that, to stimulate academic motivation, students must learn to identify learning objectives with associated sub-goals and focus on the learning process itself. Breaking larger learning goals into smaller units can contribute to a better overview and more efficient execution of tasks by completing one sub-goal at a time while simultaneously encouraging them to focus on learning as a process. As mastery orientation emphasizes the learning process as a means of developing competence through understanding and regards success as the result of hard work and personal improvement (Patrick et al., 2011), this seems to support this orientation. Additionally, as students often perceive school as irrelevant (Pianta et al., 2012), the relevance of the topic at hand and student participation through autonomous learning processes

are key in stimulating intrinsic motivation. This is in line with identified and integrated regulation, which some regard as a form of external motivation that leans more towards autonomy through its internal perceived locus of causality (Niemiec and Ryan, 2009). Regarding both appropriate psychological and academic functioning, students' internalization of extrinsic motivation is critical and particularly evident in educational activities that students do not naturally regard as compelling (Niemiec and Ryan, 2009). Furthermore, when students have well-internalized extrinsic motivation, they learn more effectively and enjoy better psychological health (Niemiec and Ryan, 2009).

The findings also indicate that one objective of this means of stimulating academic motivation is to assist students in assessing and evaluating their learning processes. This is in line with SRL and its focus on goal setting, self-monitoring, and self-evaluating (Zimmerman and Schunk, 2001) and competence enhancement by handling thoughts, behaviors, and emotions adequately (Zumbrunn et al., 2011). Competence is also crucial for increasing autonomous engagement in accordance with the SDT framework (Niemiec and Ryan, 2009). Evaluation of the learning process may offer a meta-perspective on the students' learning process (Ames, 1992). As stimulating students' needs for autonomy and relatedness can help students to internalize their motivation and increase their autonomous engagement (Niemiec and Ryan, 2009), it is important that these are supported. This may be achieved by reducing evaluative pressure and coercion, ensuring student participation in academic activities, giving a meaningful rationale for the usefulness of a learning activity, and providing the students with optimally challenging learning activities and adequate tools and feedback to ensure that they achieve a sense of mastery (Niemiec and Ryan, 2009). The findings thus indicate that supporting students' learning processes may contribute to the students' experience of independence and autonomy in assessment processes and hence stimulate academic motivation. However, it was somewhat surprising that feedback and differentiated academic tasks, which are central to several motivational theories, were not emphasized. This may be because the study sample comprised teachers with professional backgrounds who may be less concerned with in motivating students in the learning environment and more concerned with teaching their subjects. Further research on this issue is required.

Key students as motivators

The findings indicate that the use of key students is crucial in stimulating academic motivation. This is supported elsewhere (Hufton et al., 2003) and is in line with research emphasizing that cultural contexts should be considered regarding motivation (Diseth et al., 2020). The findings further suggest that the use of key students to motivate peers may be regarded as an aspect of teachers' class management. Regardless, when using key students in the learning environment, teachers should ensure that this practice is in accordance with a mastery orientation perspective aimed at stimulating learning processes and does not promote comparison of academic performance among peers.

Exploring teachers' perceptions of student academic motivation

This study used a case study approach to explore how teachers believe that academic motivation can be stimulated among their students in an adequate manner, and why. Through participating in three seminars the teachers were introduced to the main principles of SDT, SRL, and achievement goal theory as theoretical perspectives for stimulating academic motivation. As such, the seminars gave the teachers some input on how to reflect on own practices regarding motivational work in the learning environment prior to the data collection where their perceptions and reflections were discussed. This approach may have influenced the teachers in their reflections regarding motivational work among their students. For instance, some teachers mentioned the presented theories during the focus group discussions. However, no rigid guidelines on how to explore academic motivation were presented in the seminars, merely central theories on the topic. Hence, the teachers could reflect freely based on own practice together with new knowledge on motivational theories. Other approaches or methods could have provided even more exploratory data. An example could be to explore teachers' perceptions without introducing them to theoretical perspectives on motivation and hence contribute to theory building on motivation through a grounded theory approach. Other methods, such as more quantitatively driven approaches, could have provided more accurate feedback on the degree that the seminars influenced the teachers' perceptions of motivational work as well as to what degree the teachers tried out the suggested strategies before reflecting on them. As such, various methodological approaches may influence the result and is therefore important to reflect on in future studies on stimulating academic motivation among students.

Strengths and limitations

Scholars have argued that teachers' perceptions represent merely partial data and that further explanation and contextualization of such opinions are required (Hufton et al., 2003). This study aimed to do so by exploring teachers' perceptions of the means used to stimulate their students' academic motivation. This approach represents one of the study's strengths.

The sample, which comprised vocational teachers in one upper secondary school, represents a limitation, as the findings may not necessarily be applicable to other teachers and their perceptions of their students' academic motivation. This study's findings should thus be interpreted with caution. Nonetheless, given the paucity of studies exploring teachers' perceptions of how academic motivation may be stimulated, the present study may

be regarded as a step in this direction. Further research on teachers' and students' perceptions of how to stimulate academic motivation is warranted.

Concluding remarks

This study indicates that teachers have many approaches at hand to stimulate their students' academic motivation. The means emphasized align with SDT's focus on autonomy, relatedness, and competence (Niemiec and Ryan, 2009) and with SRL's focus on supporting students' learning processes through monitoring and evaluation (Schunk and Zimmerman, 2012). A mastery orientation perspective (Ames, 1992) also appears relevant here. The findings thus suggest that a more eclectic approach to stimulating academic motivation may be adequate. However, certain aspects of motivational theories were lacking. As motivation is a multidimensional construct determined by both internal and external factors (Hattie et al., 2020), a more contextualized understanding may be warranted. Implications from this study to the field of education is among others that it may increase teachers' awareness regarding how they implement class management and relational work in the learning environment as it seems to be of importance regarding student academic motivation. Furthermore, student participation and flexibility regarding learning activities as well as setting clear goals and explore the usefulness and relevance of subjects and learning tasks should be emphasized by teachers as these seem key to motivating academic learning. Finally, the study implies that teachers should be aware of key students that can be crucial in the learning environment when it comes to promoting academic motivation as such students can either stimulate or in fact reduce academic motivation among their peers. Further studies are required to explore concrete approaches to stimulating academic motivation, and both teachers' and students' perspectives should be foregrounded. This should include various research approaches, different methods, and perhaps also several motivational theories.

Data availability statement

The datasets presented in this article are not readily available because only narratives in the form of transcribed interviews are available. These are not to be distributed as it would involve to share the whole dataset. Requests to access the datasets should be directed to Kjersti Balle Tharaldsen, kjersti.b.tharaldsen@uis.no.

Ethics statement

The studies involving human participants were reviewed and approved by Norwegian Centre for Research Data. The patients/participants provided their written informed consent to participate in this study.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The relationship between basic psychological needs satisfaction and university students' academic engagement: The mediating effect of emotional intelligence

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Introduction: Basic psychological needs satisfaction (BPNS) and Emotional intelligence (EI) have been underscored as helpful psychological constructs in explaining academic engagement. However, the joint interaction of BPNS with EI abilities to explain academic engagement has not been tested. Therefore, the present study aimed to investigate the interactive role of BPNS with EI abilities in the prediction of academic engagement in a sample of Chinese university students.

Methods: A questionnaire survey was administered to a sample of 466 university students. The data were analyzed using the SPSS (version 21.0) software. The first analysis consisted of descriptive statistics (including mean and standard deviation) and Pearson's correlations among BPNS, EI, and academic engagement. Through structural equation modeling (SEM), direct and indirect effects were calculated.

Results: The results showed that BPNS was positively associated with academic engagement and that only the Use of emotion dimension of EI mediated these associations.

Discussion: These results suggest that important interventions incorporated with BPNS and EI abilities, especially the use of emotion ability, may be performed to promote university students' academic engagement.

KEYWORDS

academic engagement, positive psychology, basic psychological needs, emotional intelligence, use of emotion

Introduction

Academic engagement in the current situation

As a psychologically satisfying mental state, academic engagement refers to a persistent affective and cognitive state of contentment toward studying and learning, rather than a momentary and specific condition (Salanova et al., 2010; Casuso-Holgado et al., 2013; Chen et al., 2021). Extensive research literature has indicated that academic engagement is a key

facilitator of higher academic achievements, and also can effectively reduce the levels of dropout rates (e.g., Newmann et al., 1992; Chipchase et al., 2017; Kwon et al., 2018). Recently, facilitating engagement has also been revealed to reduce the adversarial impact of sociodemographic predictors on student performance (Lei et al., 2018). So far, research have showed that both personal variables and social-contextual variables could influence the student' academic engagement (Patrick et al., 2007; Wu et al., 2010; Stoeber et al., 2011; King and Ganotice, 2014; Kilday and Ryan, 2019; MacCann et al., 2020; Virtanen et al., 2020; García-Martínez et al., 2022; Luo and Luo, 2022; Saleem et al., 2022).

Positive psychology, which is a rising field in psychology, has given us new insights into the personal and contextual variables which influenced academic engagement (Carmona-Halty et al., 2021; Dewaele and Li, 2021; Kang et al., 2021; Luthans et al., 2021; Saleem, 2022). Among the scientific existing literature, two theories need to be noticed particularly. One is the self-determination theory (SDT), which emphasizes the importance of organic interaction between internal individual factors and external social-contextual factors (Ryan and Deci, 2017). As such, only if the influence of external social-contextual factors is transformed into individual intrinsic factors through autonomous motivation, academic engagement could be sustainable and effective. The other is the demands-resources theory (JD-R), which concerns the extent to which people apply their personal resources in their everyday life (Schaufeli and Taris, 2014). According to JD-R, some personal psychological resources could influence performance by affecting engagement. For example, adaptability, compassion, mindfulness, psychological capital, self-concept, etc., being personal resources, could create a motivational process leading to academic engagement, and, in turn, improve academic achievement and students' life satisfaction (e.g., Armenteros et al., 2021; Carmona-Halty et al., 2021; Putwain et al., 2021).

Based on these two theories, recently, a growing body of literature has been focusing on the simultaneous effects between the personal and social-contextual factors, such as teacher-student relationship, flourishing, and academic performance (Chamizo-Nieto et al., 2021); academic performance, academic engagement, and psychological capital resources (Martínez et al., 2019); academic buoyancy, adaptability, and engagement (Martin et al., 2017); and achievement goals, achievement emotions, and academic engagement (Putwain et al., 2022). Despite the growing body of literature that indicates a complex interplay between personal and social-contextual factors, however, most of the studies on the influencing factors of academic engagement have been identified and recognized in the outcome variables such as academic achievement, life satisfaction, and mental health. Among them, academic engagement is mainly regarded as an independent variable, a mediating variable, or a moderating variable, and few studies directly consider academic engagement as a dependent variable. Furthermore, the simultaneous effects were found mainly in the field of Primary, Secondary, and high-school contexts, but less attention has been paid to university settings. Thus, there is a need to further investigate whether or not the patterns of relationships found in previous literature are also found at the university level.

In a sample of university students, the present study would take academic engagement as a dependent variable, in line with previous studies from the field of positive psychology, focusing on individual psychological factors that affect academic engagement and its influencing mechanism. Among all these variables, basic psychological needs satisfaction (BPNS) and emotional intelligence (EI) would be examined simultaneously. To the best of our knowledge, the joint interaction of BPNS with EI abilities to explain academic engagement has not been tested in university students. The identification of these associations allows for a more reliable understanding of how the motivational variables and individual psychological resources are related to the academic engagement with university students. This understanding will provide the basis for the implementation of programs that help to improve academic engagement in the university environment.

BPNS and academic engagement

Academic engagement describes the degree to which students engage themselves in learning-related activities. Traditionally, academic engagement is considered a multidimensional construct, comprising behavioral, cognitive, and emotional dimensions (e.g., Fredricks et al., 2004; Appleton et al., 2008; Pietarinen et al., 2014). More recently, some studies have articulated a fourth dimension, i.e., agentic engagement, which highlights student's constructive contribution toward the flow of the instruction he receives (Reeve, 2013).

Due to the following two reasons, the present study used Schaufeli et al.'s definition of engagement, in which academic engagement is described as a "positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption" (Schaufeli et al., 2002, p. 74). The first reason is that the Schaufeli et al.'s model was proposed directly from university students based on their research on employee engagement. The second reason is that, compared with other educational phase, although university students are not formally employed by the university, students' studies are involved in coercive, structured tasks and activities (e.g., attending class, cooperating and competing with others, and submitting assignments), which makes academic engagement in university more similar with work (Walker et al., 2006). For example, Saleem et al. (2022) recently posited that post-graduate student' s educational journey is much different than high-school students in terms of length of the degree, course work, examination, assessment, educational outcomes, teaching methodology, and so on.

According to Schaufeli et al.'s model, academic engagement is a highly motivated and satisfying mental state. Given the motivational nature of academic engagement, a lot of scientific literature in the field of education have investigated the motivational predictors of academic engagement, such as self-efficacy, achievement emotions, and achievement goals (Patrick et al., 2007; Diseth et al., 2012; Song et al., 2015; Stahlberg et al., 2019; Zysberg and Schwabsky, 2021). Among the variables, according to SDT, the fulfillment of the basic psychological needs

(i.e., autonomy, competence, and relatedness) is critical to students intrinsic motivation, as these three basic needs are the necessary conditions for individual psychological growth, internalization, and mental health (Jang et al., 2012). For example, in a sample of 648 university teachers in China, Jin et al. (2022) found that meeting the three types of BPNS correlated positively with work engagement. Furthermore, a large number of empirical studies have shown that the satisfaction of the three psychological basic needs-either separately or in combination-could have a positive and significant impact on learning engagement and academic performance (Hofer and Busch, 2011; Madjar et al., 2013; Carmona-Halty et al., 2019; Martin and Collie, 2019). For example, in a sample of 366 Korean high-school students using a three-wave longitudinal research, Jang et al. (2016) found that students tend toward a semester-long trajectory of rising engagement when they perceive their teachers to be autonomy supportive and need satisfying. Similarly, Carmona-Halty et al. (2019) also found that students whose basic psychological needs are satisfied at school experience more academic psychological capital, which, in turn, leads to better academic performance.

Furthermore, empirical studies have linked discrete psychological needs to learning and achievement. In a study conducted by Gasiewski et al. (2012) with 2,873 students across 15 Colleges and universities, it was indicated that students who reported feeling comfortable asking questions in class and seeking out tutoring, i.e., autonomy need was respected and satisfied, tended to be more engaged in courses where the instructor persistently displayed an openness to student questions. Regarding to the competency need, which concerns the feeling that individuals experience the control of their environment and ability development. Based on competence motivation theory, Wong et al. (2002) identified self-worth as a significant predictor of motivational orientation and academic outcomes. Related need refers to the feelings of being connected to others. Studies have identified that a supportive teacher-student relationship may provide students with a sense of security that promotes their free and active participation in classroom academic activities (Quin, 2017). More recently, a meta-analysis conducted by Roorda et al. (2017), based on 99 studies with preschool to high-school students, has shown that the total effect size for the associations between both positive teacher-student relationships and engagement was $r = 0.39$ ($p < 0.01$) and negative relationships and engagement was $r = -0.32$ ($p < 0.01$).

Considering past empirical research herein described, this study will propose the following hypotheses:

> *Hypothesis 1 (H1)*: BPNS is positively correlated with academic engagement.

The mediating role of EI

Engagement is not only highly motivated state, but also strongly affected by emotions, which are an inherent part of the human existence in any context (Brackett et al., 2021). Thus, while examining intrinsic factors, researchers also have found emotional intelligence (EI) to be an important predictor of academic engagement (e.g., Sinclair et al., 2003; Mavroveli et al., 2009; Durlak et al., 2011; Huang et al., 2022).

In the scientific literature EI was usually defined in two different ways, i.e., ability model and trait model (Zeidner et al., 2008). Both models have been used in many domains, such as nursing, teaching, physical activity, and teleworking (Law et al., 2004; Smitha et al., 2009; Cebrian et al., 2020). In the current study, EI is conceptualized from the ability model developed by Mayer et al. (2008), which is defined as a mental ability for perceiving, understanding, regulating, and using one's own and others' emotions in thinking and action. Research literature suggests that emotionally intelligent people with higher EI also show more positive mood, higher levels of life satisfaction, well-being, flourishing, better psychological adjustment, and lower levels of psychological stress across different samples (e.g., Chu, 2010; Su and Reeve, 2011; Szczygieł and Mikolajczak, 2017; Mérida-López and Extremera, 2020; Karapetyan, 2021).

In the field of education, there is an increasing consensus on the idea that EI is an important skill that teachers and students must develop (Sha et al., 2022). For example, with a total of 702 teachers working at different educational levels in southern Spain, Mérida-López et al. (2020) found that EI and self-efficacy were positively related to teachers' work engagement and negatively related to withdrawal intentions. As to students, as MacCann et al. (2011) suggest that EI is characterized as the third most important predictor after Intelligence and Conscientiousness in academic achievement. Recently, in a study conducted by Estrada et al. (2021) with 550 students from four higher education institutions and one secondary school, it was observed that EI was shown to be positively related to compassion and higher levels of commitment, which, consequently, led to better academic performance.

Furthermore, some previous research also suggested that EI would positively relate to BPNS (Emery et al., 2016). According to the SDT, psychological needs contain both cognitive and affective elements and BPNS appears as an important motivation factor for the development of EI (Raufelder et al., 2016). For example, in a study conducted with 16 Coaches and 171 youth athletes by Watson and Kleinert (2019), it was observed that coaches' EI was related to basic need satisfaction in athletes. More recently, in a sample of 1,332 students in Southwest Spain, Rivera-Pérez et al. (2021) suggested that positive and significant associations were found between cooperative academic and EI in all school stages. The results indicated that people with higher BPNS would tend to develop a better EI.

In addition, the mediating role of EI between individual variables and positive psychological outcomes has been proposed in the field of workplace (e.g., Côté, 2014; De Clercq et al., 2014; Castillo-Gualda et al., 2019). For example, in a sample of 201 Italian workers, Di Fabio et al. (2018) indicated that EI mediated the relationship between personality traits and both hope and optimism. Similarly, the role of individual differences on the strength of implicit motives in the relationship between needs for

relatedness and well-being has also been observed (Di Fabio and Kenny, 2016). For instance, in a study conducted by Callea et al. (2019) with 216 Italian participants, it was observed that those who showed the higher levels of psychological need for relatedness were more positively associated with both happiness and flourishing and that EI mediated these associations.

Taken together, based upon past empirical studies and the current knowledge on the role of EI herein described, the present study will propose the following two hypotheses:

> *Hypothesis 2 (H2)*: BPNS is positively correlated with Emotional intelligence (EI).
>
> *Hypothesis 3 (H3)*: EI plays a mediating role in the relationship between BPNS and academic engagement.

The present study

Based on previous findings, this research aimed to investigate relationships among BPNS, EI, and academic engagement in a sample of university students; specifically, the mediated role of the different dimensions of EI would be examined. The present study may contribute to the literature in two ways. First, no studies have simultaneously considered the relationships of both BPNS and EI on academic engagement. By identifying the indirect effects of BPNS on increasing academic engagement as mediated through EI, our results can contribute to the positive psychology literature. Once the relationships were identified, effective interventions could be designed to improve academic engagement among university students.

Second, although the mediated role of EI between individual variables and positive psychological outcomes had been found in the field of workplace, as to which dimension of EI having the mediated role was still a controversial issue (Extremera et al., 2020). By assessing the independent roles of different dimensions of EI between BPNS and academic engagement, the present study may shed some light on the importance of considering EI skills as potential mediated factors in the associations between academic engagement and its correlates.

Materials and methods

Participants and procedure

The present study conducted a questionnaire survey at a single university in Zhoukou city from middle China. Students were recruited by means of convenience sampling. This research was conducted in accordance with the Declaration of Helsinki, written informed consent was given to all participants and their privacy, feelings, and intentions were fully considered (Goodyear et al., 2007). With necessary guidance and support, participants voluntarily filled in the questionnaire at the classroom. The electronic Questionnaires were distributed on the spot, and questionnaires would not be submitted until all questions had been answered. Thus, there were no uncompleted questionnaires, and a total of 506 questionnaires were collected. The questionnaire took about 15 min, so questionnaires that took too short, i.e., less than 5 min, or significantly inconsistent, were excluded. Finally, we got 466 valid questionnaires for final analysis. While questionnaire survey was collected, as senior students were on an off-campus internship, they were not included in the sample. Among participants, 88 were men (18.9%) and 378 were women (81.1%), with a predominantly female student sample. Overall, there were 332 first-year students (71.2%), 111 s-year students (23.8%), and 23 juniors (4.9%). As to major, there were 308 students (66.1%) in arts and social science, 66 students (14.2%) in science, and 92 students (19.7%) in engineering.

Measures

Academic engagement scale

Academic engagement was assessed by the Work Engagement Student Scale (UWES-SS) created by Schaufeli et al. (2002). The scale consists of 14 items which evaluate three dimensions of academic engagement: (1) vigor, with 5 items (e.g., When studying I feel strong and vigorous); (2) dedication, with 5 items (e.g., My studies inspire me); and (3) absorption, with 4 items (e.g., I can get carried away by my studies). All items were scored on a five-point Likert scale, from 1 (never) to 5 (always). A higher score on this scale indicates a higher level of academic engagement.

Basic psychological needs satisfaction scale

Basic Psychological needs satisfaction was assessed with Basic Psychological Needs Satisfaction scales (BPNSs), proposed by Ryan and Deci (2017). The scale consists of 14 items which evaluate three dimensions of BPNS: (1) Autonomy, with 6 items (e.g., I can try to solve tasks my own way); (2) Competence, with 6 items (e.g., I am considered capable of difficult tasks); and (3) Social relatedness, with 4 items (e.g., I feel accepted by my classmates). This scale adopts a 5-point Likert scoring system, from 1 (strongly disagree) to 5(strongly agree). A higher score on this scale in university students indicates a higher level of the satisfactions of their basic psychological needs.

Emotional intelligence scale

Emotional intelligence was assessed with the Wong and Law Emotional Intelligence Scale (WLEIS). This scale is a self-report measure, composed of 16 items, with a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (completely agree). The Chinese validation (Sha et al., 2022) proposed a factor solution in four dimensions: (1) Self-emotion appraisal (SEA), with 4 items (e.g., I really understand what I feel); (2) Others' emotion appraisal (OEA), with 4 items (e.g., I am a good observer of others' emotions); (3) Use of emotion (UOE), with 4 items (e.g., I am a self-motivated person); and (4) Regulation of emotion (ROE), with 4 items (e.g., I have good control of my own emotions). A higher score on this scale indicates a greater degree of emotional intelligence.

Demographic variables

Participants' demographic data, including information about gender, grade level, and major, were collected with our questionnaire. Previous research showed that those demographic variables may have a direct or mediated effect on basic Psychological needs satisfaction and emotional intelligence (Madjar et al., 2013; Martin and Collie, 2019; Cebrian et al., 2020; Karapetyan, 2021), so they were considered as controls in the present study.

Reliability and validity analysis

To evaluate the measurement model, the following indicators were used in the present study: standardized factor loadings, component reliability (CR), average variance extracted (AVE), Cronbach's alpha coefficients (α), and discriminant validity. The results of reliability and validity analysis are shown in Table 1.

At the beginning, item analysis was used to eliminate inappropriate questions from the questionnaire. There were totally 46 items in the original questionnaire, the items with factor loadings below 0.5 were deleted. After this process, three items in the Basic Psychological Needs Satisfaction Scale (i.e., "we are taught to work independently" in the Autonomy Subscale, "I have already learned a lot with this teacher" and "I feel challenged in class" in the Competence Subscale), and three in the Academic Engagement Scale (i.e., "When I get up in the morning, I feel like going to class" in the Vigor Subscale, "I find my studies challenging" in the Dedication Subscale and "Time flies when I′ m studying" in the Absorption Subscale), the factor loadings of which were below 0.5, were deleted. Finally, 40 items in total remained for further analysis, including 11 for the Academic Engagement scale (i.e., 4 items in the Vigor Subscale, 4 items in the Dedication Subscale, and 3 items in the Absorption Subscale), 16 for the Emotional intelligence scale (i.e., 4 items in the Self-emotion appraisal Subscale, 4 items in the Others' emotion appraisal Subscale, 4 items in the Use of emotion Subscale, and 4 items in the Regulation of emotion Subscale), and 13 for the Basic Psychological Needs Satisfaction scale (i.e., 5 items in the Autonomy Subscale, 4 items in the Competence Subscale, and 4 items in the Social relatedness Subscale). As Table 1 illustrates, the factor loadings of all instrument items were all above 0.5.

In addition, results showed that all CR values were greater than 0.6, and all AVE values, except autonomy and competence items, were greater than 0.5. Even though the AVE is less than 0.5, according to Fornell and Larcker (1981), if the CR value exceeds the criteria of 0.6, the scale's convergent validity is still acceptable. Meanwhile, internal consistency reliability (Cronbach's alpha) exceeded 0.8 for all items, indicating good reliability of this study's constructs.

Finally, the square root of AVE was performed to examine the discriminant validity of all the research instruments. If the square root value of AVE was greater than the correlation coefficient in each dimension (Fornell and Larcker, 1981), the discriminant validity of the constructs was suitable. As shown in Table 2, the results met the criteria for assessing discriminant validity.

Data analysis

The data were analyzed using the SPSS (version 21.0) software. The first analysis consisted of descriptive statistics (including mean and standard deviation) and Pearson's correlations among BPNS, EI, and academic engagement (Hayes, 2013). Then, the SPSS Amos program (version 21.0) was used to evaluate the mediating effect of EI on BPNS and academic engagement. The present study is based on the structural equation modeling (SEM) technique, which is a nominal research analysis approach (Saleem et al., 2022). For the mediation analyses, a bootstrapping method was further used to obtain bias-corrected 95% confidence intervals (95% CI) with 5,000 re-samples. If the 95% CI did not contain zero, an effect was considered significant.

TABLE 1 Results of reliability and validity analysis.

Variables	FL	CR	AVE	Cronbach' α
Basic psychological needs satisfaction				0.860
Autonomy	0.531–0.834	0.793	0.440	
Competence	0.504–0.648	0.677	0.346	
Social relatedness	0.577–0.914	0.844	0.585	
Emotional intelligence				0.830
Self-emotion appraisal	0.508–0.830	0.799	0.507	
Others' emotion appraisal	0.743–0.915	0.893	0.678	
Use of emotion	0.554–0.836	0.807	0.516	
Regulation of emotion	0.717–0.864	0.868	0.623	
Academic engagement				0.899
Vigor	0.703–0.796	0.838	0.565	
Dedication	0.706 –0.817	0.826	0.544	
Social relatedness	0.681–0.779	0.768	0.526	

FL, factor loadings; CR, component reliability; AVE, average variance extracted.

TABLE 2 Discriminant validity of the research instruments.

Variables	BPNS-A	BPNS-C	BPNS-SR	EI-S0E	EI-OEA	EI-UOE	EI-ROE	AE-V	AE-D	AE-A
BPNS-A	**0.664**									
BPNS-C	0.602***	**0.588**								
BPNS-SR	0.345***	0.499***	**0.765**							
EI-SEA	0.235***	0.220***	0.123**	**0.712**						
EI-0EA	0.119*	0.131**	0.145**	0.323***	**0.823**					
EI-UOE	0.339***	0.471***	0.375***	0.264***	0.133**	**0.718**				
EI-ROE	0.153**	0.158**	0.202***	0.233***	0.152**	0.240***	**0.789**			
AE-V	0.281***	0.354***	0.299***	0.135**	0.083	0.445***	0.175***	**0.752**		
AE-D	0.355***	0.400***	0.269***	0.236***	0.085	0.515***	0.137**	0.687***	**0.738**	
AE-A	0.323***	0.354***	0.254***	0.161***	0.096*	0.438***	0.182***	0.579***	0.586***	**0.725**
M	3.517	3.439	3.583	3.701	3.513	3.491	3.334	3.082	3.307	3.137
SD	0.515	0.494	0.576	0.557	0.617	0.608	0.640	0.606	0.690	0.690

***$p < 0.001$. M, mean; SD, standard deviation; BPNS-A, autonomy; BPNS-C, competence; BPNS-SR, Social relatedness; EI-SEA, Self-emotion appraisal; EI-OEA, Others' emotion appraisal; EI-UOE, Use of emotion; EI-ROE, Regulation of emotion; AE-V, vigor; AE-D, dedication; AE-A, absorption. Bolded fonts are AVE square root values.

TABLE 3 Descriptive statistics and correlations among the study variables.

Variables	M	SD	BPNS	SEA	OEA	UOE	ROE	AE
BPNS	3.513	0.425	1					
SEA	3.701	0.557	0.240***	1				
OEA	3.513	0.617	0.163***	0.323***	1			
UOE	3.491	0.608	0.482***	0.264***	0.133**	1		
ROE	3.334	0.640	0.212***	0.233***	0.152**	0.240***	1	
AE	3.179	0.571	0.458***	0.209***	0.101*	0.542***	0.187***	1

***$p < 0.001$. M, mean; SD, standard deviation; BPNS, basic psychological needs satisfaction; SEA, Self-emotion appraisal; OEA, Others' emotion appraisal; UOE, Use of emotion; ROE, Regulation of emotion; AE, academic engagement.

Results

Common method bias

As all variables used in the present study were measured by a self-report questionnaire, there may have a common method deviation. Before analysis, Harman's single-factor test was used (Podsakoff et al., 2003). In the present study, there were 10 factors with feature values greater than 1 extracted. The explanatory variance of the first factor was 23.738%, less than the 50% threshold. Thus, the common method deviation of data in the present study was not serious.

Descriptive statistics and correlation analysis of main variables

Prior to the assessment of the hypotheses, descriptive statistics and Pearson's correlations among variables were conducted. As shown in Table 3, BPNS was positively related with academic engagement ($r = 0.458$). As expected, BPNS correlated significantly with the four dimensions of EI (SEA: $r = 0.240$; OEA: $r = 0.163$; UOE: $r = 0.482$; ROE: $r = 0.212$). In the same way, the four subscales of EI were also positively correlated with academic engagement (SEA: $r = 0.209$; OEA: $r = 0.101$; UOE: $r = 0.542$; ROE: $r = 0.187$). In addition, the correlation coefficients between the variables range from 0.101 to 0.542, less than 0.700, indicating that there is no serious collinearity between the three variables.

Measurement and structural model

We assessed both measurement and structural models for all of the study variables, i.e., BPNS, EI, and academic engagement through different fitness indexes such as absolute, incremental, and parsimonious fit indices (Hu and Bentler, 1999). Per the guidelines, measures like normed chi-square (X^2/df); RMR (root mean residual); RMSEA (root mean square error of approximation); CFI (comparative fit index); GFI (goodness of fit index); TLI (Tucker-Lewis index); IFI (incremental fit index); and SRMR (standardized root mean residual) were utilized (Schweizer, 2010). The measurement model and structural model outcomes are shown in Table 4. While performing a confirmatory factor analysis of the scale, an excessive sample size may cause the increased Chi-square values; therefore, other adaptation indicators were considered the model fit (Hu and Be Ntler, 1998; Hsiao et al., 2015). Overall, the results revealed a good fit of the measurement model for each scale in the present study.

TABLE 4 Measurement model and structural model validity.

	X^2/df	RMR	RMSEA	CFI	GFI	TLI	IFI	SRMR
BPNS	4.587	0.032	0.088	0.904	0.912	0.879	0.904	0.064
EI	2.365	0.021	0.054	0.961	0.939	0.952	0.961	0.039
SEA	6.650	0.015	0.110	0.981	0.986	0.943	0.981	0.031
OEA	4.020	0.007	0.081	0.995	0.991	0.984	0.995	0.014
UOE	6.909	0.016	0.113	0.980	0.985	0.941	0.981	0.030
ROE	28.531	0.025	0.243	0.942	0.938	0.825	0.942	0.044
AE	2.859	0.025	0.063	0.967	0.953	0.956	0.967	0.037
Structural model results	2.511	0.039	0.057	0.936	0.907	0.926	0.936	0.075

X^2/df, normed Chi-square; RMR, root mean residual; RMSEA, root mean square error of approximation; CFI, comparative fit index; GFI, goodness of fit index; TLI, Tucker-Lewis index; IFI, incremental fit index; SRMR, standardized root mean residual; BPNS, basic psychological needs satisfaction; EI, emotional intelligence; SEA, Self-emotion appraisal; OEA, Others' emotion appraisal; UOE, Use of emotion; ROE, Regulation of emotion; AE, academic engagement.

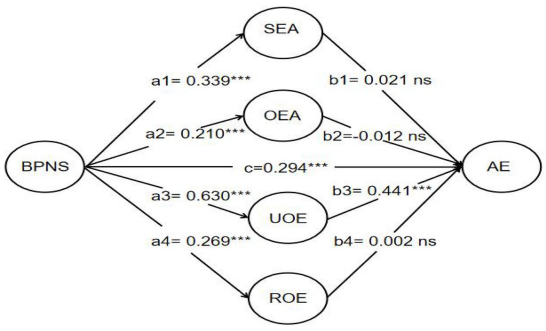

FIGURE 1
Single mediation model shows the effect of BPNS on AE through the dimensions of EI. Standardized coefficients are presented. BPNS, basic psychological needs satisfaction; AE, academic engagement; SEA, Self-emotion appraisal; OEA, Others' emotion appraisal; UOE, Use of emotion; ROE, Regulation of emotion.***p<0.001; ns, non-significant effect.

Hypothesis testing

To analyze the influence of BPNS on academic engagement and the role of EI, SEM approach was used, the results are listed in Figure 1. Specifically, these results showed that university students' BPNS significantly predicted academic engagement ($\beta = 0.294$, $p < 0.001$). Therefore, the research hypothesis H1 was supported. The second hypothesis H2 (BPNS is positively correlated with Emotional intelligence on EI) also was observed. The standardized coefficient of BPNS on SEA was $\beta = 0.339$ ($p < 0.001$), on OEA was $\beta = 0.210$ ($p < 0.001$), on UOE was $\beta = 0.630$ ($p < 0.001$), and on ROE was $\beta = 0.269$ ($p < 0.001$). That is, the research hypothesis H2 was supported. We also tested the mediated effect of four dimensions of EI between BPNS and academic engagement, the results showed BPNS still has a significant positive effect on academic engagement. However, three of the mediators, i.e., SEA, OEA, and ROE, had non-significant effects on academic engagement, only one dimension of EI, that is UOE, had a significant positive effect on academic engagement ($\beta = 0.441$, $p < 0.001$). Therefore, the research hypothesis H3 was supported, i.e., it was the UOE dimension of EI that played a partially mediating role in the relationship between BPNS and academic engagement.

Test of mediation

In order to further test the mediating effect, the bootstrap method was used in a procedure of 5,000 re-samples to analyze the mediating effects *via* the SPSS Amos program. In this process, a 95% confidence interval (95% CI) would be generated to test the significance of the indirect effect between BPNS and academic engagement through mediating roles of the four dimensions of EI. If zero does not exist between the lower and upper confidence intervals, the direct effects would be identified as significant. Table 5 shows the Bootstrapping analysis results.

As shown in Table 5, the direct effect value of BPNS on academic engagement was 0.294, accounting for 50.95% of the total effect, and the 95% CI was [0.128, 0.455], indicating that the direct effect was significant. After including the four dimensions of EI as mediators in the process, the total indirect effect was still significant, but only the dimension of UOE served as a significant mediating variable. The indirect effect value of UOE on BPNS and academic engagement was 0.283, accounting for 49.04% of the total effect, with a 95% CI [0.183, 0.411]. Therefore, these results indicated that not all dimensions of EI, but only UOE dimension, played a partially mediating role in the effect of BPNS on academic engagement.

Discussion

Main findings

This research aimed to determine the BPNS-academic engagement association in university students and the mediating effects of EI abilities. The results of the present study showed that BPNS could positively affect academic engagement through EI abilities.

TABLE 5 Test of multiply mediation effects.

The path	Effect of value	Bootstrap 95% CI	
		Lower limit	Upper limit
Standardized direct effect			
BPNS→SEA	0.339*	0.216	0.459
BPNS→OEA	0.210*	0.088	0.326
BPNS→UOE	0.630*	0.521	0.724
BPNS→ROE	0.269*	0.143	0.388
BPNS→AE	0.294*	0.128	0.455
SEA→AE	0.021	−0.084	0.130
OEA → AE	−0.012	−0.122	0.099
UOE → AE	0.441*	0.278	0.602
ROE→AE	0.002	−0.097	0.106
Standardized Indirect effect			
BPNS→UOE → AE	0.283*	0.183	0.411
Standardized total effect			
BPNS→AE	0.577*	0.479	0.674

Bootstrapping random sampling 5,000 times. CI; confidence interval; BPNS, basic psychological needs satisfaction; EI, emotional intelligence; AE, academic engagement; SEA, Self-emotion appraisal; OEA, Others' emotion appraisal; UOE, Use of emotion; ROE, Regulation of emotion.

Firstly, consistent with findings in previous psychology studies, the correlation suggested that both basic psychological needs and emotional intelligence positively related to university students' academic engagement. On the one hand, this finding is consistent with self-determination theory, i.e., satisfying all three needs is critical for psychological well-being, in turn, promoting mental health and significantly impacting engagement. As previous studies suggest, when students report a high perception of autonomy support from teachers, they view their class activities as volitional and self-determined and engage in class willing and eagerly (e.g., Madjar et al., 2013; Martin and Collie, 2019). The positive effects associated with BPNS allow university students to be more energized, proactive, and motivated, and these positive mental states as resources could enhance the higher levels of engagement. On the other hand, the correlation results are also in line with the JD-R theory, previous research mainly focused on the relationship between EI abilities and individual and work-related well-being domains, such as job and life satisfaction in teachers, in nurses, and in healthcare (e.g., Law et al., 2004; Smitha et al., 2009; Cebrian et al., 2020). In line with this, this study further extended the model to university students.

In this sense, our study is coherent with the need to return to a more humanistic education that incorporates a new language and new content. Added to this perspective is the need to incorporate emotions into the teaching-academic process and give them a greater role by establishing the relationship between emotional factors and motivational reasons as an additional way of strengthening and developing the individual academic variables. When the needs of students are satisfied or fulfilled with contextual support, students also show higher levels of EI, and these interpersonal and psychological reciprocal effects could positively predict the engagement.

Secondly, the results showed that Hypothesis 2 was supported, stating that BPNS would positively relate to EI, which would add new light on the relationship between motivational systems and EI (Bechter et al., 2021). Despite the mediated role of motivational variables and individual psychological resources had been examined, respectively, in current scientific literature, the explicit role of emotions in the motivation-generative mechanism was still poorly investigated. Recently, some research had explored the issue among different populations. For example, Watson and Kleinert (2019) showed that coaches' EI was related to basic need satisfaction in athletes. More recently, in a study conducted by Callea et al. (2019) with 216 Italian participants, suggested that the need for relatedness would positively relate to EI.

In line with those studies, the results obtained from this study could support a new evidence in the relationship between BPNS and EI, indicating that people with higher levels of BPNS will tend to develop a better EI. Thus, it is possible to envisage that the most emotionally intelligent people who are satisfied in basic psychological needs display higher levels of individual well-being. That is, university students who show higher levels of BPNS are not only more motivated and full of energy, but also more emotionally intelligent. In turn, being more emotionally intelligent did increase the levels of academic engagement.

Finally, the present study also seemed to support Hypothesis 3, which stated that the contribution of BPNS to academic engagement would be mediated by EI abilities, but only through the UOE dimension of EI abilities among Chinese university students. These findings are consistent with previous work that show the mediating effect of EI between personal resources and work engagement/outcomes. However, as to which dimension of EI abilities may work in enhancing positive mental state within the JD-R theory still remains unclear. Among these, the often mentioned dimension of EI was Emotion regulation ability (ERA) and/or UOE. For example, a study conducted by Mérida-López and Extremera (2020), with 190 teachers in Spain, found that only ERA was significantly associated with work engagement, job satisfaction, and life satisfaction. Other studies found both ERA and UOE of EI could play the mediated role. In a study with 380 Chinese adults, Bao et al. (2015) showed that mindfulness was positively associated with four components of EI abilities, and negatively associated with perceived stress. Additionally, the regulation and use of emotion components of EI could act as mediators of the association between mindfulness and perceived stress.

Notwithstanding this, the present study did not provide evidence to consider the dimension of ROE as a mediator in the link to EI performance. Compared with other dimensions, the results suggested that only the dimension of UOE could play a significant mediating role between BPNS and academic engagement. The finding was in line with a study more recently carried out by Parent-Lamarche (2022). Based on a sample of 254 Canadian employees from 18 small and medium organizations during the COVID-19 pandemic, Parent-Lamarche (2022) found that except for skill utilization and recognition, use of emotion

could appear to be key considerations for organizations that wish to increase work engagement and decrease intention to quit.

The reason why it was UOE not ROE that played the mediating role in relationships between BPNS and academic engagement may be inferred from the essential characteristics of both. Judging from the essential characteristics of ROE, it emphasizes the capability to control and regulate emotions, which is conductive to relieving and mitigating one's psychological distress, recovering from negative situations, and adjusting their emotions flexibly (Cheung and Ng, 2019). However, judging from the essential characteristics of UOE, it mainly focuses on using and maximizing existing individual psychological resources, and it is of importance to enhancing one's psychological functionings and well-being, which is crucial for improving positive state and outcomes (Chen et al., 2020). From the perspective of positive psychology, once the basic psychological needs were satisfied, several beneficial academic outcomes, such as the achievement of positive emotions at school (e.g., joy, interest, contentment, and school satisfaction), and more effort would be activated. These emotions, based on the broaden-and-build theory (Fredrickson, 2001), may further broaden students' momentary thought-action repertoires and build their enduring personal resources. In this respect, using the emotions produced from BPNS could help students to open their minds to different thoughts and problem-solving approaches, and, in turn, enhance academic engagement.

Like other research, the results from here are not conclusive; hence, the need for more research should be added up so as to understand this issue.

Limitations and future research

Some potential limitations should be mentioned in this study. First, the present research used a cross-sectional questionnaire, so the findings may have been affected by unpredictable social interactions, which prevents us from drawing causal conclusions. In order to fully disentangle reciprocal causal relations, an additional, longitudinal design study is required in the future. Second, there is a limitation directly connected to how EI is measured. In this study, the WLEIS is a self-report instrument. Although the scale has been shown to be both reliable and valid, it is recommended to use both self-reports and performance tests to measure EI (Brackett et al., 2006). Third, the sample included only university students in China, so the results cannot be generalized. To further test the findings, future studies should incorporate participants from other cultures and other countries to form a bigger and more representative sample.

Practical implications

Despite these limitations, the present results have crucial implications for teachers and university administrators. First, considering the direct effect of BPNS on academic engagement, autonomy-supportive learning environments are of great significance of teachers to foster students' positive mental state. For instance, teachers should carry out certain instructional behavior, such as attending to the students' perspective, vitalizing inner motivational resources, appreciating and accepting negative affect, and displaying patience (Diseth et al., 2018). More recently, one intervention named Peer Assisted Study Sessions (PASS), a structured peer-led study group where students collectively share knowledge and solve course-related tasks, both cross-sectional and longitudinal analyses showed its positive outcomings to academic engagement and performance (Rivera-Pérez et al., 2021).

Second, although scholars and administrators acknowledge the importance of EI to academic engagement and achievement, a lot of intervention techniques aimed at improving the students' EI have been designed (Vesely et al., 2013; Mérida-López et al., 2021), most training programs were mainly focused on developing the emotional skills of students, especially the abilities of emotional regulation and management, so as to cope with the problems of academic burnout, pressure and test anxiety. All these measures are necessary to improve students' academic engagement, but not sufficient, at least when positive psychological resources already exist. The results from this study suggested that when students basic psychological needs were satisfied, it was the UOE dimension not ROE dimension of EI that enhanced higher levels of academic engagement. Therefore, EI training programs should aim not only to develop the abilities of emotional regulation and management, but also to improve the awareness of one's emotion, to be an active interest in using and exploring of one's positive emotions.

Conclusion

To the best of our knowledge, our study is the first to explore the means by which EI potentiates the power of basic psychological needs satisfaction to enhance academic engagement among university students. That is, university students who showed higher levels of BPNS were more emotionally intelligent. In turn, being more emotionally intelligent would enhance the levels of academic engagement. In sum, the present study paves the way for future research on the importance of EI as a mediator in the relationship between BPNS and academic engagement in the perspective of positive psychology of sustainable development.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by The Ethics Review Committee of Zhoukou

Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/ next of kin.

Author contributions

MZ and HC: conceptualization, methodology, software, investigation, data curation, writing-original draft preparation, writing—review and editing, and informed consent statement. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Disentangling motivation and engagement: Exploring the role of effort in promoting greater conceptual and methodological clarity

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Conflation over motivation and engagement has historically impeded research and practice. One reason for this is because definition and measurement have often been too general or diffuse—especially in the case of engagement. Recently conceptual advances aimed at disentangling facets of engagement and motivation have highlighted a need for better psychometric precision—particularly in the case of engagement. To the extent that engagement is inadequately assessed, motivation research involving engagement continues to be hampered. The present study investigates multidimensional effort (a specific facet of engagement) and how it relates to motivation. In particular, we examine the associations between specific positive and negative motivation factors and dimensions of effort, thereby shedding further insight into how different types of motivation interplay with different types of engagement. Drawing on data from a sample of 946 Australian high school students in 59 mathematics classrooms at five schools, this study hypothesized a tripartite model of academic effort in terms of operative, cognitive, and social–emotional dimensions. A novel nine-item self-report Effort Scale measuring each of the three factors was developed and tested for internal and external validity—including its relationship with multidimensional motivation. Multilevel confirmatory factor analyses were conducted to test the factor structure and validity of multidimensional effort. Additionally, doubly-latent multilevel structural equation models were conducted to explore the hypothesized motivation → engagement (effort) process, and the role of student- and classroom-level background attributes as predictors of both motivation and effort. Results supported the hypothesized model of tripartite effort and its distinctiveness from motivation, and showed that key dimensions of motivation predicted effort at student- and classroom-levels. This study provides implications and suggestions for future motivation research and theorizing by (1) establishing evidence for the validity of a novel engagement framework (multidimensional effort), and (2) supporting future measurement and practice in academic engagement juxtaposed with multidimensional motivation—critical for better understanding engagement, and motivation itself.

KEYWORDS

motivation, effort, engagement, academic development, validity, multilevel

Introduction

Motivation and engagement are two intertwined constructs that have a history of conflation by researchers and practitioners. This has at times impeded advances in theoretical clarity, research, and practice relevant to both constructs (Reschly and Christenson, 2012). For example, it has been highlighted that inappropriately conflating motivation and engagement can create theoretical ambiguity, introduce validity challenges for measurement and research, and lay a shaky foundation for educational intervention (Martin, 2012; Reschly and Christenson, 2012; Martin et al., 2017). In recent years, much theorizing and research has been conducted into the multidimensionality of motivation (e.g., Martin, 1999–2022) and engagement (e.g., Fredricks et al., 2004). However, the basic demarcation of motivation as intent, and engagement as action, has thus far limited a more nuanced understanding of unique associations between their various dimensions, particularly with respect to non-observable dimensions of engagement. Whereas reliable scales have been developed and extensively tested for the measurement of motivation's key dimensions, there has been much less focus on theoretically-informed measurement of multidimensional engagement, especially its internal aspects. By harnessing such a measurement scale, motivation and engagement can be further disentangled by examining the relation between adaptive and maladaptive motivation factors and specific dimensions of effort, thereby shedding further insight into the interplay of different motivation and engagement types.

Effort (as a specific form of engagement) is an illustrative case in point of the blurred conceptual and empirical terrain relevant to engagement. Despite appearing ubiquitously throughout the engagement literature, it is as yet a largely untapped and undefined construct that warrants further attention and definition. In this study, we therefore closely considered effort from a conceptual perspective and harnessed this conceptual foundation to develop a multidimensional measure of it—the Effort Scale. In particular, it was anticipated that this novel tool would enable demarcation between individual motivation dimensions and their unique associations with different types of effort. Mathematics was chosen as a specific subject area of focus, due to well-documented declines in motivation and engagement highlighted by recent research (see Collie et al., 2019), together with continued declines in students' mathematics achievement, especially in Australia (e.g., Thomson et al., 2016, 2019).

Utilizing a multilevel approach, we tested the measurement properties of the Effort Scale at student- and classroom-levels in mathematics to determine its psychometric properties and its associations with multidimensional motivation *via* bivariate correlations at both levels. We then employed structural equation modelling to examine the role of multidimensional motivation in predicting multidimensional effort at student- and classroom-levels (as shown in Figure 1). Through these conceptual and empirical processes, we shed further light on the unique and shared variance between motivation and engagement (by way of effort) and provide a foundation for greater clarity and coherence for educational researchers and practitioners in their future work aimed at optimizing students' academic outcomes.

Motivation and engagement

To foreground our study of motivation and engagement, we first briefly summarize some key features of motivation and engagement, some broad dimensions that distinguish them, and the multidimensional motivation framework we harness as a means to better understand how motivation and engagement interrelate.

Where have we been? Where are we now? Where are we going?

Motivation and engagement are significant areas of interest in educational psychology, seen as drivers of proximal and long-term academic (and other) success and accomplishment (Reschly and Christenson, 2012). Out of the two, motivation has received far more focused theorizing and research, as indicated by the numerous major theories that have been developed in the past five decades (e.g., social cognitive theory, Bandura, 2012; goal theory, Elliot, 2005; need achievement theory, McClelland, 1961; self-worth theory, Covington, 2000; self-determination theory, Ryan and Deci, 2017; [situated] expectancy-value theory, Wigfield and Eccles, 2000; Eccles and Wigfield, 2020; etc.). By contrast, there are few theories about engagement, and relatively little work on clarifying its measurement and theoretical grounding. However, in the past 2 decades, there has been an uptick in attention being given to engagement.

There is now broad consensus that engagement is multidimensional, comprising components of behavior, cognition, and emotion/affect (Fredricks et al., 2004), but there remain differing ideas about how these dimensions are defined and where they reside within an overarching "engagement" construct (Christenson et al., 2012). In their review of student engagement, Reschly and Christenson (2012) identified three main channels of engagement literature: one driven by reducing school dropout, one emanating from a school reform perspective, and one emerging from motivation theory and research. Especially in relation to the latter, there has been conflation with motivation theory, definitions, and measurement. Given the lack of consensus on definitions of engagement and its association with/distinction from motivation, Reschly and Christenson (2012) argued there is a need for theoretical and psychometric advancement of engagement that can then be implemented in motivation research in order to better understand the two. They encouraged new expositions of engagement to advance the field, and to test the convergent and divergent validity of these expositions in relation to motivation. With a focus on multidimensional effort, the present study offers one approach toward a new exposition of

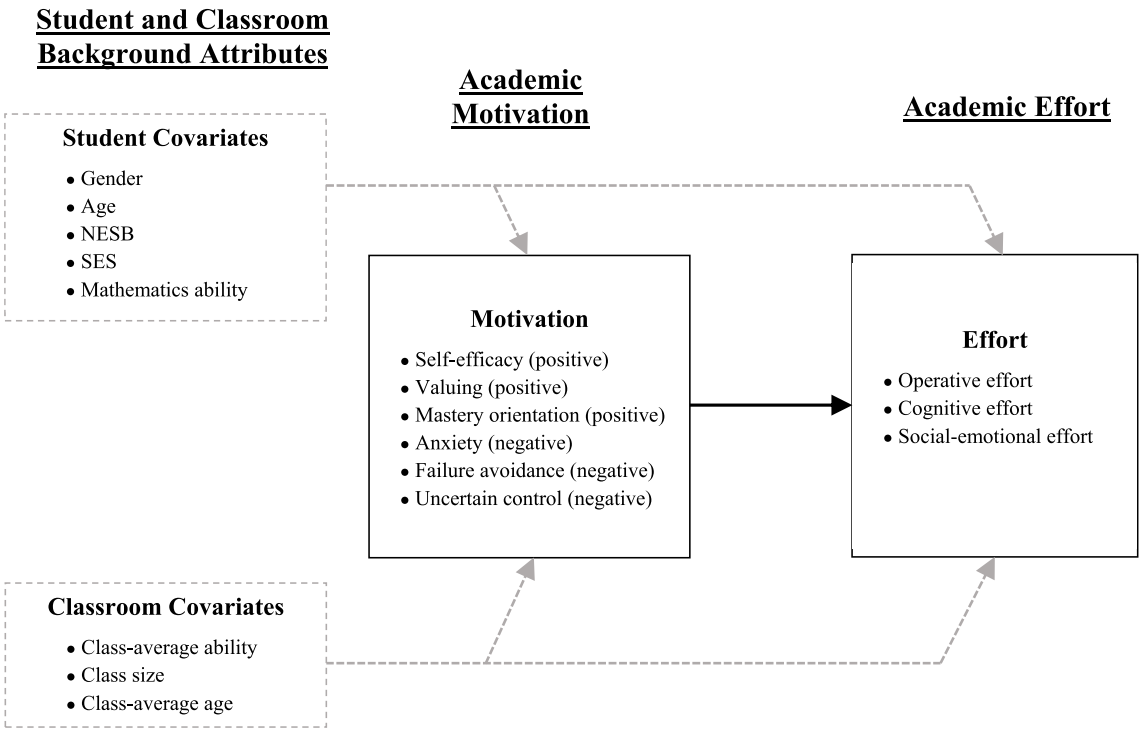

FIGURE 1
Hypothesized full process model (processes are estimated at student- and classroom-levels). SES, Social-economic status indicator; NESB, Non-English speaking background indicator.

multidimensional engagement, and its alignments and differences from motivation. The envisaged yields are 2-fold: better understanding and measurement of engagement (*via* a novel multidimensional effort framework and measurement tool) that affords a better understanding of the unique associations between motivation's and engagement's individual dimensions.

Differentiating motivation and engagement

As noted, in the past 2 decades, researchers have attended more closely to the distinctions and alignments between motivation and engagement. In his commentary on major researchers' perspectives on motivation and engagement, Martin (2012) (see also Martin, 2022) observed that at a fundamental level, motivation and engagement may be demarcated into internal and external dimensions. For example: Reeve (2012) suggested motivation comprises "private, unobservable, psychological, neural, and biological" factors, while engagement constitutes "publicly observable behavior" (p. 151); Ainley (2012) identified motivation in terms of inner psychological factors, whereas engagement reflected more outward involvement; and, Voelkl (2012) suggested that motivation aligns with internal affective states and engagement with behavioral factors. All this being the case, motivation has been defined as the inclination, energy, emotion, and drive to learn, work effectively, and achieve—and engagement as the more externally-evident factors reflecting the internal motivational phenomena (e.g., Martin et al., 2017). However, although helpful in clearly differentiating between these two constructs, this basic demarcation of motivation as internal, versus engagement as external, is not intended as a prescriptive or definitive distinction.

Many researchers illustrate the blurred edges to this internal/external classification, referring to internal facets of engagement, typically characterized by cognitive and affective/emotional dimensions (e.g., Fredricks et al., 2004; Appleton et al., 2006; Cleary and Zimmerman, 2012; Wang and Eccles, 2012; Morgan et al., 2022). Indeed, Reschly and Christenson (2012) specifically highlight conflation over these internal facets of engagement and aspects of motivation, such as self-regulation. They point out that defining motivation as intent (internal), and engagement as action (external), implies that engagement is always behavioral and so observable, whereas it is clear that cognitive and affective engagement are largely internal processes, and so apparently indistinguishable from motivation using this distinction.

As such, we draw on the definitions of motivation and engagement in Martin et al. (2017) and extend them for this study, with motivation being the inclination and drive to learn, work effectively, and achieve—and engagement as the expression of this inclination and drive to learn *via* either external (e.g., behaviors) or internal (e.g., cognitive and affective) processes. In this study,

we aim to expand this distinction between the two constructs by capturing a more comprehensive engagement characterization (targeting effort as a specific active form of engagement). Our study encompasses both internal and external dimensions of engagement, and specifically distinguishes between its internal aspects (e.g., cognitive and social–emotional) and motivation.

In addition to motivation being considered as an internal process, and engagement as both internal and external, there is tentative agreement about the ordering of the process in which they manifest, with motivation generally considered to lead to engagement. For example, Schunk and Mullen (2012) used social-cognitive theory as the basis for explaining how motivation and engagement inter-relate, with self-efficacy (a motivation factor) influencing behavioral engagement. In another conceptualization, Cleary and Zimmerman (2012) employed self-regulation theory to describe how self-efficacy (motivation) leads to changes in engagement (encompassing strategizing and self-regulatory processes). There is thus some agreement that "motivation is a basis for subsequent engagement" (Martin, 2012, p. 305). This hypothesized ordering of motivation and engagement is important in the present study as it is a means to examine how motivation and engagement inter-relate and is thus a way to better understand both constructs. Specifically, we investigated the extent to which multidimensional motivation predicted a novel engagement (effort) construct (see Figure 1).

Multidimensional motivation

The Motivation and Engagement Wheel (Martin, 1999–2022) has been developed to capture multidimensional motivation as proposed by seminal motivation theorizing. It is the framework harnessed in the present study as the means to better understand how motivation and engagement (by way of multidimensional effort) interrelate. The Wheel comprises six (first order) motivation factors that can also be integrated to form two higher-order factors (positive/adaptive and negative/maladaptive motivation). Positive motivation consists of: self-efficacy (the belief and confidence in one's ability to learn), valuing (the belief in the importance, usefulness, and relevance of one's academic work), and mastery orientation (the orientation to develop one's learning and task mastery). Negative motivation comprises: anxiety (the tendency to feel anxious about one's academic work), failure avoidance (the inclination to work in order to avoid doing poorly), and uncertain control (the lack of agency in effecting positive academic outcomes). Positive motivation factors reflect students' positive attitudes and orientations to academic learning, whereas negative motivation factors represent students' attitudes and orientations that inhibit learning. As noted, these six factors emanate from foundational motivation theories. Self-efficacy is very much based on the work of Bandura (2001) and reflects students' task-specific competence beliefs. Valuing draws on (situated) expectancy-value theory (Wigfield and Eccles, 2000; Eccles and Wigfield, 2020) that underscores the motivational boost students experience if they value a task in one or more ways (e.g., in terms of utility and importance). Mastery orientation is underpinned by goal theory (Elliot, 2005), which reflects students' goal orientation towards achieving academic success *via* effort, skill development, and learning. Anxiety and failure avoidance draw from need achievement and self-worth theories (McClelland, 1961; Covington, 2000) that offer perspectives on students' fear of failure (failure avoidance is also implicated in goal theory by way of performance avoidance goals; Elliot, 2005). Finally, uncertain control is informed by attribution theory (Weiner, 2010) which describes how the dimensions of stability, locus, and control influence students' motivation to learn.

The factors in the Wheel are assessed *via* an accompanying assessment tool, the Motivation and Engagement Scale (MES; Martin, 1999–2022). The MES has been extensively employed and tested in a variety of research studies (see Liem and Martin, 2012 for a review). The MES assesses not only the six positive and negative motivation factors described above, but also three positive engagement factors (planning and monitoring, task management, and persistence) and two negative engagement factors (self-handicapping and disengagement). With an expanded definition of engagement (by way of effort) that includes internal as well as external factors, the present study extends the operationalization of engagement in the MES to engagement factors outside it. To our knowledge, only one study has investigated the predictive links between the MES motivation and engagement factors, tentatively suggesting that motivation predicts engagement (Martin et al., 2017). The present study's focus on multidimensional effort (as an active, energetic form of positive engagement), and how the six motivation factors predict it (Figure 1), is an opportunity to incorporate a new measure of engagement into the evidence base.

Multidimensional effort: A means to better understand engagement and motivation

Researchers are increasingly focusing on students' engagement at school as a predictor of academic success (Lei et al., 2018). Fredricks et al. (2004) provided a seminal review of research and theorizing on engagement, describing it in terms of a (multidimensional) tripartite model, with behavioral, cognitive, and emotional engagement as constituent factors of an overarching engagement construct. Fredricks et al. (2004) described behavioral engagement in terms of student involvement and participation in school activities (in both academic and non-academic arenas). They described cognitive engagement in terms of a willingness and thoughtfulness to invest effort to comprehend academic concepts. Emotional engagement was described as encompassing (both positive and negative) reactions to teachers, peers, and the school environment (thus, also reflecting a social–emotional element), that in turn influences students' willingness to invest effort. Engagement is thus now generally acknowledged to be a

multidimensional construct, typically considered as tripartite with behavioral, cognitive, and affective (or emotional) components (e.g., Christenson et al., 2012; Lei et al., 2018).

Tripartite effort

Of particular relevance to the present investigation, the meta-analysis of engagement and achievement conducted by Lei et al. (2018), framed students' tripartite engagement in terms of being actively involved in learning tasks and learning processes. Active engagement implies the investment of energy and effort in learning tasks, as opposed to a more passive involvement in class (such as passively watching a video, or listening/paying attention in class but not making any effort to participate or play an active role in discussions). This emphasis on active (as opposed to passive) engagement implies effortful engagement in each of the constituent tripartite engagement dimensions. This being the case, we propose that academic effort sits under the umbrella construct of (positive) engagement and comprises similar components, namely: behavioral, cognitive, and affective/emotional dimensions—with a higher-order effort factor that represents the theoretical and empirical confluence of these first-order dimensions.

The few researchers who have sought to more explicitly account for both engagement and effort have emphasized the importance of distinguishing between them. For example, it is clear from Fredricks et al. (2004) that whereas school engagement encompasses positive and negative (e.g., disengagement) academic and non-academic dimensions, academic effort is a sub-component of school engagement that specifically relates to the academic arena and involves positive engagement (not disengagement) that is an active, volitional expenditure of energy in the domains of behavior, cognition, and social–emotional interactions. Fredricks et al. (2004) acknowledged that although engagement has received substantial empirical attention, it is theoretically messy and overlaps considerably with other constructs. According to them, the broad umbrella term of "engagement" is problematic as "it can result in a proliferation of constructs, definitions, and measures of constructs that differ slightly, thereby doing little to improve conceptual clarity" (p. 60). Of relevance to the present study, Fredricks et al. identified effort (a construct incorporated under engagement) as a particular example of this, and an avenue requiring further clarification and then investigation in this space. Indeed, Fredricks et al. (2004), Nagy (2016, 2017), and Carbonaro (2005) have all underscored the importance of effort and its multidimensional nature, comprising behavioral (or operative), cognitive, and social–emotional factors.

Following Fredricks et al. (2004), Nagy (2016, 2017), and Carbonaro (2005), the behavioral dimension of effort in the present study is focused on the notion of "doing" and "outcomes-completion"—referred to herein as *operative effort* and defined as active, purposeful, and energetic action-based application to learning. Operative effort is typified by the application of behavioral energy in the production and completion of schoolwork. *Cognitive effort* is defined as active, purposeful, and energetic mental/psychological application to learning. It is typified by concentration, attention, and focus directed toward understanding, comprehension, and mastery of schoolwork. *Social–emotional effort* is defined as active, purposeful, and energetic interpersonal/affective application to learning. It is typified by appropriate and respectful classroom social–emotional interactions that involve self-control and sensitivity to the social context of learning, conducive to completing schoolwork.

Measurement of tripartite effort

Building on this tripartite framing of effort in terms of its operative, cognitive, and social–emotional dimensions, a multidimensional effort scale (hereafter, the Effort Scale) was developed for implementation in the present study. This Effort Scale is designed to capture the three distinct aspects of effort, and also to represent a hypothesized overarching effort factor reflecting appropriate weighting (or loading) of each of the three constituent factors onto the whole—enabling both specificity (in the case of a first-order structure) and broader application (in the case of a higher-order structure) as appropriate to the research purpose. It is this tool that will represent an approach to multidimensional engagement (i.e., *via* effort) and be the basis of analyses with multidimensional motivation in the present study. It is described more fully in the section Materials and methods, below.

Context and background attributes relevant to motivation and engagement

In line with major motivation theories (e.g., Bandura, 2001; Ryan and Deci, 2017; Eccles and Wigfield, 2020), we also accounted for contextual and background attributes known to be implicated in motivation and engagement. We did so in two ways: by employing multilevel modelling to extend the typical student-level analyses of motivation and engagement to analyses at the classroom-level, and by including numerous pertinent student- and classroom-level background attributes as predictors of motivation and engagement (see Figure 1). The former enabled us to disentangle student- and classroom-level motivation and engagement. The latter enabled us to determine the unique association of motivation predicting effort, by controlling for variance attributable to pertinent student- and classroom-level background factors.

Aims of the present study

Historical conflation over the intertwined constructs of motivation and engagement has impeded advances in theory and practice relating to students' academic development. As the field

of engagement has progressed over the past decade, advances in its theoretical conceptualizing have led to new opportunities to better understand the interface between motivation and engagement. Questions can now be posed that further unpick the distinctiveness of these two intertwined constructs, such as how positive and negative motivation factors uniquely predict individual dimensions of engagement. This study seeks to bring clarity to this space through a purposeful investigation using the hitherto untapped and undefined construct of effort (representing a specific active form of multidimensional engagement) and to investigate the unique associations of its respective dimensions with multidimensional motivation. We aimed to closely consider effort from a conceptual perspective, hypothesizing a tripartite model of academic effort in terms of operative, cognitive, and social–emotional dimensions—and then developing a practical multidimensional effort measure—the Effort Scale, incorporating each of the three component factors.

We adopted a construct validation approach to explore motivation and this novel effort framework (e.g., Marsh, 1997, 2002; Martin and Marsh, 2008). Such an approach considers assessment of the validity of both within-network ("internal validity") and between-network ("external validity"). We pursued this construct validation by first testing the measurement properties of the Effort Scale at student- and classroom-levels (internal validity), then testing the association between motivation and effort *via* bivariate correlations at both levels (external validity), and then examining the role of motivation predicting effort at student- and classroom-level (external validity), appropriately controlling for pertinent student- and classroom-level background attributes (see Figure 1). For the purposes of this study, we are particularly interested in convergent (the extent to which motivation is associated with effort in theoretically plausible ways) and discriminant (the extent to which there remains sufficient unshared variance to indicate their distinctiveness) aspects of the constructs' external validity. We hypothesized that motivation and effort would be associated with each other (by way of correlations and predictive parameters) but left as an open empirical question the precise nature and strength of associations between their different dimensions.

Materials and methods

Participants and procedure

The sample for this study comprised 946 Australian high school students nested within 59 mathematics classrooms from five schools. The sample was chosen, within the given constraints and practicalities of data collection, to be as diverse as possible in terms of gender, academic ability, age, and school gender profile (*viz.* single-sex or coeducational) and therefore as representative as possible of potentially influential covariate attributes. All schools were non-academically selective in intake, in the independent school sector and located in and around a major capital city of New South Wales (NSW) on the east coast of Australia. Of the five schools, three were coeducational, one was a single-sex boys' school, and one was a single-sex girls' school. Just over half (53%) of students were boys. Students were in the first 4 years of high school in Australia and comprised: Year 7 (8%), Year 8 (41%), Year 9 (34%), and Year 10 (17%). The average age was 14.70 years ($SD = 0.98$ years). Non-English-speaking background (NESB) students accounted for 16% of the sample. Students typically came from higher socio-economic status (SES) postal districts ($M = 1{,}084$, range from 846 to 1,179, $SD = 64$) than the Australian average ($M = 1{,}000$, $SD = 100$) based on the Australian Bureau of Statistics (ABS) index of relative socio-economic advantage and disadvantage classification (SEIFA; Australian Bureau of Statistics, 2016). Of the 59 classrooms, class size varied from 7 to 29 ($M = 21$, $SD = 5$), with participation rates ranging from 31% to 100% ($M = 74\%$, $SD = 17\%$). Human ethics approval was received from the lead researcher's university, and school principals then provided approval for their school's participation in the study. Following this, parents/careers and students provided consent. An online survey was administered to students, in a regular mathematics lesson, in the final term of 2020.

Materials

The measures included in the survey comprised the substantive factors of motivation and effort. We also assessed student and classroom background attributes as covariates.

Motivation

Motivation was measured using six self-rated items from the brief form of the Motivation and Engagement Scale—High School [MES-HS-Short; Martin, 1999–2022]. The items captured three positive motivation constructs (self-efficacy, valuing, and mastery orientation) and three negative motivation constructs (anxiety, failure avoidance, and uncertain control). The items (e.g., for self-efficacy, "I believe I can do well in this subject") were rated using a seven-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). As each motivation factor was represented by a single-item, we could not estimate them as latent variables, and so we modelled each factor as error-adjusted mean scores so that our analyses could correct for unreliability (as latent modeling would do). The following equation was used to calculate the error-adjusted mean score: $\sigma^2 * (1-\omega)$, where σ^2 is the estimated variance of the substantive factor and ω is the reliability estimate of this factor (Hayduk, 1987; see also Cole and Preacher, 2014). The reliabilities (omega total; McNeish, 2018) and variances were taken from a prior research program using the full (multi-item) MES-HS in mathematics (Martin and Marsh, 2005; Marsh et al., 2008). Descriptive statistics for the present study are presented in Results.

Academic effort

Student-rated effort was measured using a three-factor, nine-item scale (the Effort Scale) emanating from work by Nagy (2016, 2017, 2022). Operative effort was measured *via* three items [e.g., "In mathematics, I try hard on schoolwork (e.g., in class or at home etc.) given to me"]; cognitive effort was measured *via* three items (e.g., "I am focused in mathematics class"), and social–emotional effort was measured *via* three items [e.g., "I show self-control in mathematics lessons (e.g., I wait my turn, do not interrupt, and do not talk over other students etc.)"]. As described in the Introduction, the hypothesized effort framework comprises three first-order factors and also an overarching higher-order effort factor. All effort items were rated using a seven-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*) and are detailed in Supplementary material (Supplementary Table S1). For completeness, also presented in Supplementary material is a brief form of the Effort Scale (the Effort Scale—Short [ES-S]; one item for each of the three dimensions, thus a three-item measure)—and its psychometric properties and correlations with motivation. Descriptive, reliability, and factor analytic findings for first- and higher-order Effort Scale factors are presented in the Results section below.

Student and classroom background attributes

Our hypothesized process model (Figure 1) was designed to assess the unique associations between motivation and effort beyond the roles of student and classroom background attributes. It was therefore important to account for notable student and classroom background attributes. Student background factors were: age (in years); gender (0 = female, 1 = male); socio-economic status (SES), home language background (NESB; 0 = English, 1 = non-English speaking background), and mathematics ability. The SES score was derived from self-rated postcode and/or suburb, using the Australian Bureau of Statistics Index of Relative Socio-Economic Advantage and Disadvantage classification (SEIFA; Australian Bureau of Statistics, 2016), with higher values representative of areas of greater socio-economic advantage.

Mathematics ability was assessed *via* a 10-item mathematics assessment, the High School Mathematics Competency scale (HSMC; Nagy, 2021; and evidence of validation demonstrated in Martin et al., 2020), developed to test the underlying mathematical competencies of students. Assessment items were graduated in difficulty but accessible to all students in years 7–10 without the need for stage-specific subject knowledge. Items were mapped against the New South Wales (NSW) and Australian national curriculums (Australian Curriculum Assessment and Reporting Authority, n.d.; NSW Education Standards Authority, 2019). Example items from this assessment that reflected the curriculum domains of Time, Patterns and Algebra, and Ratios and Rates, were respectively, [Time]: "What time will it be 75 min after 11:15 am? [(A) 11:30 am, (B) 12:30 am, (C) 11:30 pm, and (D) 12:30 pm]"; (Patterns and Algebra): "Find the next number in the pattern: 8, 11, 14, 17, [(A) 20, (B) 21, (C) 22, and (D) 23]"; (Ratio and Rates): "If the ratio of boys: girls in a class is 4:5, what fraction of the class is boys? [(A) 1/4, (B) 1/5, (C) 4/5, and (D) 4/9]." A mathematics ability score was calculated for each student (corresponding to the total number of correct responses out of 10) and then standardized by year group. Three classroom covariates were also included: class size, class-average age, and class-average ability (using the mean mathematics ability score for each classroom).

Data analyses

Data collected from school students that relates to their learning is typically part of a multilevel structure, with students clustered into classrooms. Within these classrooms, there is generally greater similarity among students than between students of different classrooms, due to factors such as how classroom groupings are chosen (e.g., streaming by ability-level) and unique classroom culture (e.g., due to the unique combination of teacher expectations and classroom climate). Typically, it is statistically invalid to analyze clustered data at a single-level, as it can violate statistical assumptions and give rise to Type 1 errors (Marsh et al., 2008). Furthermore, in measuring and analyzing constructs at either student-level or classroom-level, the interpretation of results may be different and yield different practical implications. It is now well established that accounting for these realities requires multilevel modelling that accommodates the clustering of students within classrooms and distinguishes between student-level effects and classroom-level effects. Indeed, differences in motivation and engagement (specifically, effort, in this study) may be influenced by both individual and classroom factors, and it is therefore appropriate to use a multilevel approach in bringing conceptual and empirical clarity to their association. The central analyses therefore consisted of multilevel confirmatory factor analysis (MCFA) and doubly-latent multilevel structural equation modelling (MSEM).

Analyses were carried out in M*plus* version 8 using maximum likelihood estimation with robust standard errors (MLR; M*plus* RRID:SCR_015578; Muthén and Muthén, 1998–2022), which accounts for non-normality of the sample. Missing data (4%) were handled using the M*plus* full information maximum likelihood (FIML) default. All multilevel modelling included Level 1 (L1; student-level) and Level 2 (L2; classroom-level) variables. To determine model fit, a Comparative Fit Index (CFI) greater than 0.90 and Root Mean Square Error of Approximation (RMSEA) less than 0.08 were used as thresholds for acceptable fit (Hu and Bentler, 1999), and a CFI greater than 0.95 and RMSEA less than 0.05 as thresholds for excellent fit. Prior to conducting multilevel analyses, measurement invariance tests as a function of key sub-groups (e.g., age and gender) were conducted for the effort factors and demonstrated relative invariance across all sub-groups tested. Full details of these tests can be found in Supplementary material in the section titled "Invariance Tests" and in Supplementary Tables S4–S6.

Multilevel descriptive analyses comprised student-level (L1) and classroom-level (L2) scale means, standard deviations, skewness,

kurtosis, reliability, and intra-class correlations (ICCs). To test factor structure, two MCFAs were first conducted using the Effort Scale (one involving only first-order effort factors, and the other including a higher-order effort factor). Then, these two MCFAs were re-estimated but with the motivation factors also included. These latter MCFAs enabled a test of fit for models where motivation and effort were represented as distinct factors and an assessment of correlations between motivation and effort. In MCFAs, L1 and L2 parallel latent factor loadings for effort (but not for motivation as these were single-item factors—see Materials) were constrained to be equal (i.e., isomorphism) and L2 residuals were constrained to be greater than zero to ensure a more parsimonious model with greater accuracy in parameter estimation at both levels (e.g., Morin et al., 2014). The hypothesized process model of motivation predicting effort was tested with two doubly-latent MSEMs (one for first-order effort and one for higher-order effort; Figure 1) that included controls for student- and classroom-level background attributes (as predictors of motivation and effort). In the MSEMs, all background covariates were correlated, motivation predictors were correlated, and effort outcomes were correlated.

Results

Preliminary descriptive statistics

Means and standard deviations (*SD*s) for effort factors at L1 (student-level) and L2 (classroom-level) are shown in Table 1A. Skewness and kurtosis values are also in Table 1A and are within indicative guidelines for approximately normal distributions (Kim, 2013). Descriptive statistics at L1 and L2 for motivation are displayed in Table 1B, with skewness and kurtosis values also reflecting approximately normal distributions.

Fit and dimensionality of motivation and effort

As described in the Introduction, it is vital to have sound measurement of engagement (by way of effort in this study) in order to effectively explore the distinctiveness of motivation and engagement. Therefore, we first conducted MCFAs to test the hypothesized effort dimensions, operationalized *via* the Effort Scale [see Supplementary material for a summary of single-level (student) CFAs of the Effort Scale]. The first-order effort structure yielded an excellent fit to the data [χ^2 (54) = 177.284, $p < 0.001$, RMSEA = 0.049, CFI = 0.966], as did the higher-order effort structure [χ^2 (56) = 176.868, $p < 0.001$, RMSEA = 0.048, CFI = 0.966]. As Table 1A demonstrates, mean MCFA loadings on the first-order effort factors ranged from 0.71 to 0.90 (L1) and 0.97 to 1.00 (L2), with a grand mean of 0.81 (L1) and 0.98 (L2). The mean MCFA loadings on the higher-order effort factor were 0.85 (L1) and 0.87 (L2). All factor loadings were therefore within an acceptable range (Byrne, 2012). Reliability estimates for first-order effort factors ranged from ω = 0.75 to 0.93 (L1) with a mean of 0.84, and ω = 0.98 to 1.00 (L2) with a mean of 0.99, indicating acceptable internal consistency. Reliability for the higher-order effort factor was ω = 0.89 (L1) and 0.91 (L2) and so also indicated acceptable internal consistency. Table 1A shows intra-class correlations (ICCs) which ranged from 0.09 to 0.15 for first-order effort factors and was 0.15 for the higher-order effort factor. The grand mean ICC (0.12) was above the 10% threshold recommended by Byrne (2012) and provided justification for our multilevel approach in this study.

Having established the dimensionality and measurement properties of effort, we then included motivation in the MCFAs to ascertain its dimensionality and distinctiveness relative to effort. Two models were run[1] that both yielded excellent fit to the data: one for first-order effort [χ^2 (126) = 296.852, $p < 0.001$, RMSEA = 0.038, CFI = 0.970] and one for higher-order effort [χ^2 (152) = 332.056, $p < 0.001$, RMSEA = 0.035, CFI = 0.969]. Thus, when modelled as separate factors, there is excellent fit, signaling distinct dimensionality between motivation and effort. Table 1B shows motivation factor loadings, determined from a fully-saturated MCFA that only included motivation items, which ranged from 0.76 to 0.89 (L1) with a mean of 0.82 and from 0.94 to 0.98 (L2) with a mean of 0.97. ICCs ranged from 0.07 to 0.18 with a mean of 0.13 indicating that the variance attributable to motivation at the classroom-level was above the recommended threshold (Byrne, 2012) justifying modelling motivation at L1 and L2.

Multilevel correlations between motivation and effort

The MCFAs involving both motivation and effort also generated latent correlations that were a further means of assessing their distinctiveness. All correlations are summarized in Table 2, with the correlations between the target substantive factors of motivation and effort displayed in bold font for clarity. At both L1 (student-level) and L2 (classroom-level), there were significant positive correlations between all three positive motivation and first- and higher-order effort factors; for operative effort (L1: $r = 0.50$ to 0.53, mean $r = 0.52$, $p < 0.001$; L2: $r = 0.81$ to 0.86, mean $r = 0.84$, $p < 0.001$), cognitive effort (L1: $r = 0.46$ to 0.50, mean $r = 0.49$, $p < 0.001$; L2: $r = 0.70$ to 0.74, mean $r = 0.72$, $p < 0.001$), social–emotional effort (L1: $r = 0.34$ to 0.43, mean $r = 0.39$, $p < 0.001$; L2: $r = 0.60$ to 0.66, mean $r = 0.64$, $p < 0.001$), and higher-order effort (L1: $r = 0.53$ to 0.56, mean $r = 0.55$, $p < 0.001$; L2: $r = 0.79$ to 0.84, mean $r = 0.82$, $p < 0.001$). There were also

1 For completeness we also tested a model where the six motivation factors and three first-order effort factors loaded onto a single higher-order factor (thus, a model where motivation and effort were not differentiated as separate constructs). This yielded a significantly poorer fit to the data relative to the excellent fit of the MCFAs separating motivation and effort as distinct constructs: (χ^2 [188] = 775.512, $p < 0.001$, RMSEA = 0.057, CFI = 0.897).

TABLE 1A Multilevel descriptive statistics and CFAs of first-order and higher-order effort.

Variable	Statistics						
	M	*SD*	Skew	Kurtosis	ω	CFA loadings (min., max., mean)	ICC
Level 1 (Student)							
First-order effort factors							
Operative effort	5.934	0.955	−1.362	2.755	0.853	0.687, 0.870, 0.808	-
Cognitive effort	5.779	1.051	−1.471	3.225	0.925	0.832, 0.933, 0.896	-
Social-emotional effort	6.243	0.713	−1.102	1.915	0.754	0.660, 0.742, 0.711	-
Second-order effort factor							
Higher-order effort	5.985	0.797	−1.093	1.733	0.888	0.698, 0.958, 0.847	-
Level 2 (Classroom)							
First-order effort factors							
Operative effort	5.893	0.405	−0.806	0.946	0.985	0.953, 1.000, 0.978	0.087
Cognitive effort	5.739	0.448	−0.637	-0.031	0.999	0.998, 1.000, 0.999	0.104
Social-emotional effort	6.227	0.306	−0.521	-0.281	0.977	0.904, 1.000, 0.966	0.147
Second-order effort factor							
Higher-order effort	5.953	0.350	−0.361	-0.445	0.912	0.657, 1.000, 0.870	0.149

ω = reliability (omega total; McNeish, 2018); ICC = Intra Class Correlation; CFA Loadings = Confirmatory factor analysis standardized factor loadings; *M*, *SD*, Skew and Kurtosis are calculated from unit-weighted scale scores of raw items.

TABLE 1B Multilevel descriptive statistics of motivation items.

Variable	Statistics						
	M	*SD*	Skew	Kurtosis	ω[a]	CFA loading	ICC
Level 1 (Student)							
Self-efficacy (positive motivation)	5.822	1.333	−1.683	2.950	0.771	0.852	-
Valuing (positive motivation)	5.542	1.384	−1.120	1.018	0.770	0.847	-
Mastery orientation (positive motivation)	5.590	1.283	−1.145	1.329	0.806	0.888	-
Anxiety (negative motivation)	5.251	1.754	−0.923	−0.129	0.771	0.759	-
Failure avoidance (negative motivation)	4.715	1.819	−0.474	−0.862	0.766	0.765	-
Uncertain control (negative motivation)	3.012	1.665	0.679	−0.439	0.788	0.821	-
Level 2 (Classroom)							
Self-efficacy (positive motivation)	5.738	0.635	−0.986	0.582	0.777	0.978	0.183
Valuing (positive motivation)	5.507	0.619	−0.578	0.871	0.789	0.971	0.165
Mastery orientation (positive motivation)	5.570	0.445	−0.709	0.595	0.840	0.969	0.106
Anxiety (negative motivation)	5.210	0.493	−0.260	−0.203	0.779	0.936	0.072
Failure avoidance (negative motivation)	4.746	0.605	−0.143	0.428	0.842	0.963	0.098
Uncertain control (negative motivation)	3.120	0.680	0.095	−0.201	0.876	0.980	0.141

ω = reliability (omega total; McNeish, 2018); ICC = Intra Class Correlation; CFA Loadings = Confirmatory factor analysis standardized factor loadings; *M*, *SD*, Skew and Kurtosis are calculated from raw items. [a] Motivation items are modelled as error-adjusted scores using established reliability and variance measures from a prior research program (ω and σ^2 values were derived from data used in: Martin and Marsh, 2005; Marsh et al., 2008).

significant negative correlations between the negative motivation factor of uncertain control and all effort factors: for operative effort (L1: $r = -0.30$, $p < 0.001$; L2: $r = -0.57$, $p < 0.001$), for cognitive effort (L1: $r = -0.28$, $p < 0.001$; L2: $r = -0.54$, $p < 0.001$), for social–emotional effort (L1: $r = -0.23$, $p < 0.001$; L2: $r = -0.35$, $p < 0.05$), and for higher-order effort (L1: $r = -0.32$, $p < 0.001$; L2: $r = -0.57$, $p < 0.001$). There were no significant correlations between the negative motivation factors of anxiety and failure avoidance and any of the effort factors at either level. Taken together, the bivariate associations between motivation and effort demonstrated significant alignments, but at the same time sufficiently sized unshared variance to support their distinctiveness.

Multilevel structural equation modelling of motivation predicting effort

The multilevel process model (Figure 1) of motivation predicting effort was then tested using doubly-latent MSEM. Two MSEMs were conducted, the first ($MSEM_1$) examined motivation

TABLE 2 Multilevel correlation matrix within and between motivation and effort factors.

Variables	Operative effort	Cognitive effort	Social–emotional effort	Self-efficacy	Valuing	Mastery orientation	Anxiety	Failure avoidance	Uncertain control
Level 1 (Student)									
Effort factors									
Cognitive effort	0.848***								
Social–emotional effort	0.611***	0.657***							
Motivation factors									
Self-efficacy (positive)	**0.533*** **	**0.503*** **	**0.344*** **						
Valuing (positive)	**0.533*** **	**0.501*** **	**0.407*** **	0.675***					
Mastery orientation (positive)	**0.501*** **	**0.461*** **	**0.428*** **	0.407***	0.532***				
Anxiety (negative)	**0.079**	**0.019**	**0.071**	−0.158**	−0.058	−0.002			
Failure avoidance (negative)	**−0.058**	**−0.055**	**−0.074**	−0.176***	−0.191***	−0.030	0.537***		
Uncertain control (negative)	**−0.301*** **	**−0.281*** **	**−0.228*** **	−0.497***	−0.329***	−0.181***	0.370***	0.387***	
Level 2 (Classroom)									
Effort factors									
Cognitive effort	0.942***								
Social–emotional effort	0.721***	0.782***							
Motivation factors									
Self-efficacy (positive)	**0.861*** **	**0.744*** **	**0.598*** **						
Valuing (positive)	**0.851*** **	**0.720*** **	**0.652*** **	0.770***					
Mastery orientation (positive)	**0.805*** **	**0.699*** **	**0.658*** **	0.631***	0.683***				
Anxiety (negative)	**0.149**	**0.085**	**0.217**	0.078	0.044	0.016			
Failure avoidance (negative)	**0.021**	**0.005**	**0.011**	−0.014	−0.043	0.180	0.332**		
Uncertain control (negative)	**−0.571*** **	**−0.544*** **	**−0.354***	−0.697***	−0.527***	−0.243	0.062	0.301*	
[a]Level 1 Higher order effort				**0.557*** **	**0.563*** **	**0.529*** **	**0.055**	**−0.065**	**−0.316*** **
[a]Level 2 Higher order effort				**0.836*** **	**0.826*** **	**0.792*** **	**0.144**	**0.014**	**−0.566*** **

Motivation items are modelled as error-adjusted scores; All correlations taken from the first-order CFA model with the exception of [a]higher-order effort correlations which are taken from the higher-order CFA model; values in bold highlight correlations between the substantive factors; *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

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predicting first-order effort factors, and the second ($MSEM_2$) investigated motivation predicting higher-order effort. To appropriately ascertain the unique associations between motivation and effort (beyond student and classroom background attributes), the MSEMs included controls for a range of student covariates (age, gender, SES, NESB, and mathematics ability) and classroom-level attributes (class-average ability, class size, and class-average age)—with these covariates predicting motivation and effort in the MSEMs. Both models yielded an excellent fit to the data [first-order effort model $MSEM_1$: χ^2 (174) = 365.398, $p < 0.001$, RMSEA = 0.034, CFI = 0.971; higher-order effort model $MSEM_2$: χ^2 (216) = 458.662, $p < 0.001$, RMSEA = 0.034, CFI = 0.964]. In the summary of substantive findings described here, only significant L1 and L2 standardized paths (β) between the substantive factors and notable results involving covariates are presented (and these are shown in Figures 2 and 3 for the first-order effort and higher-order effort models respectively). All significant and non-significant standardized substantive and covariate paths are reported in Table 3.[2]

At L1, student-level self-efficacy significantly positively predicted student-level operative effort (β = 0.27, $p < 0.001$), cognitive effort (β = 0.25, $p < 0.01$), and higher-order effort (β = 0.27, $p < 0.001$). Student-level valuing significantly positively predicted student-level operative effort (β = 0.18, $p < 0.05$), cognitive effort (β = 0.18, $p < 0.05$), social–emotional effort (β = 0.18, $p < 0.05$), and higher-order effort (β = 0.20, $p < 0.01$). Student-level mastery orientation significantly

2 Full results of the higher-order effort model ($MSEM_2$) can be seen in Supplementary Material Table S7.

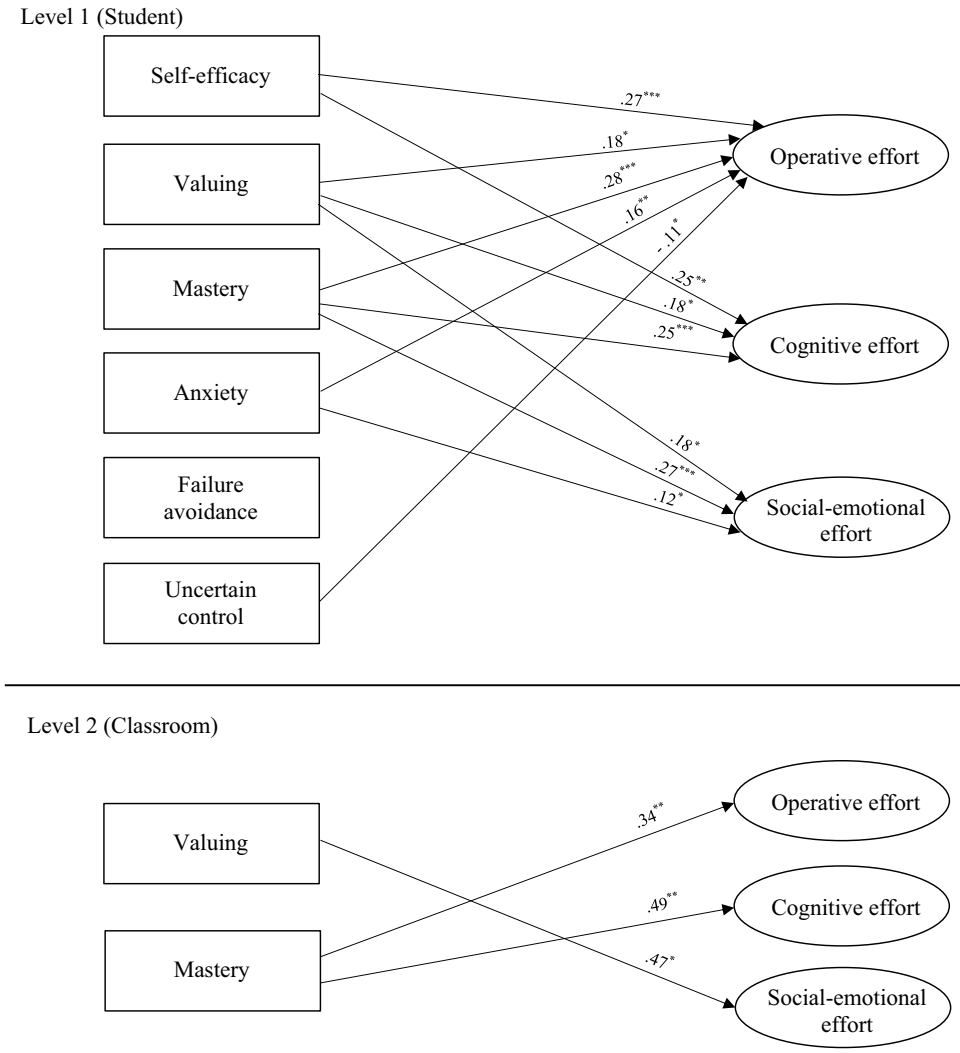

FIGURE 2
Significant substantive paths in central multilevel analysis—First order effort factors ($MSEM_1$). Only significant paths are shown and are labeled with standardized betas (β); *p<0.05. **p<0.01. ***p<0.001; All paths controlled for variance attributed to covariates (Level 1: age, gender, social-economic status, non-English speaking background, mathematics ability; Level 2: class-average ability, class size and class-average age). See Table 3 for all covariate associations and all non-significant paths.

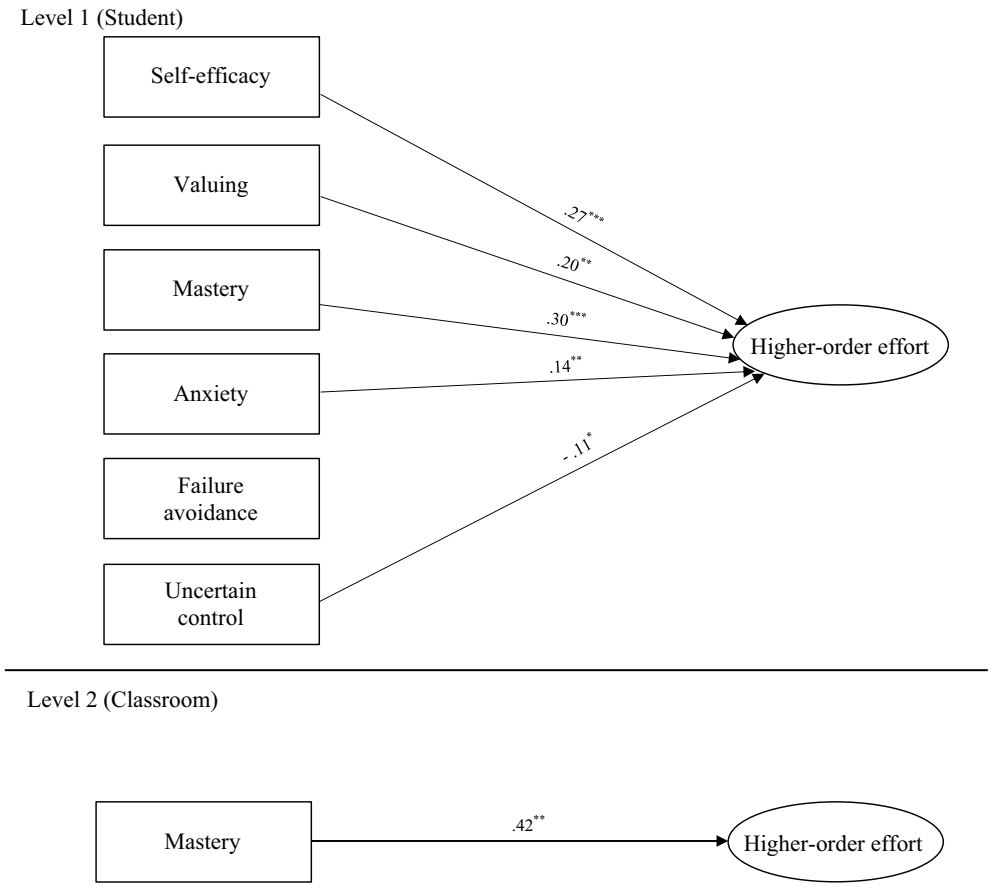

FIGURE 3
Significant substantive paths in central multilevel analysis—Higher Order Effort Factor ($MSEM_2$). Only significant paths are shown and are labeled with standardized betas (β); *p<0.05. **p<0.01. ***p<0.001; All paths controlled for variance attributed to covariates (Level 1: age, gender, social-economic status, non-English speaking background, and mathematics ability; Level 2: class-average ability, class size, and class-average age). See Table 3 for all covariate associations and all non-significant paths.

positively predicted student-level operative effort (β = 0.28, p < 0.001), cognitive effort (β = 0.25, p < 0.001), social–emotional effort (β = 0.27, p < 0.001), and higher-order effort (β = 0.30, p < 0.001). Examining the negative motivation factors at L1, student-level uncertain control significantly negatively predicted student-level operative effort (β = −0.11, p < 0.05) and higher-order effort (β = −0.11, p < 0.05). Interestingly, student-level anxiety significantly positively predicted student-level operative effort (β = 0.16, p < 0.01), social–emotional effort (β = 0.12, p < 0.05), and higher-order effort (β = 0.14, p < 0.01). At L2, the significant paths found between the classroom-level motivation and effort factors were in relation to valuing, which positively predicted social–emotional effort (β = 0.47, p < 0.05), and mastery orientation, which positively predicted operative effort (β = 0.34, p < 0.01), cognitive effort (β = 0.49, p < 0.01), and higher-order effort (β = 0.42, p < 0.01).

Although not the substantive focus of the study, for completeness we report here noteworthy patterns of covariate associations where a given L1 (student-level) or L2 (classroom-level) covariate significantly predicted both motivation and effort (see Table 3 for all covariate associations). At L1, gender significantly predicted student-level motivation and effort. Specifically, being male was positively associated with self-efficacy (β = 0.16, p < 0.001), and valuing (β = 0.10, p < 0.01), and negatively associated with anxiety (β = −0.16, p < 0.001), uncertain control (β = −0.09, p < 0.01), operative effort (β = −0.10, p < 0.05), social–emotional effort (β = −0.24, p < 0.001), and higher-order effort (β = −0.09, p < 0.05). Student-level mathematics ability significantly positively predicted self-efficacy (β = 0.21, p < 0.001), valuing (β = 0.16, p < 0.001), and higher-order effort (β = 0.06, p < 0.05), and negatively predicted failure avoidance (β = −0.12, p < 0.01), and uncertain control (β = −0.14, p < 0.01). At L2, class-average ability significantly positively predicted self-efficacy (β = 0.37, p < 0.01), valuing (β = 0.44, p < 0.01), and social–emotional effort (β = 0.35, p < 0.05), and negatively predicted failure avoidance (β = −0.55, p < 0.001), and uncertain control (β = −0.63, p < 0.001).

Discussion

The present study sought to bring new insights to the alignment and distinctiveness of motivation and engagement

TABLE 3 Multilevel structural equation process model: Standardized beta coefficients.

Variables	Outcomes ($MSEM_1$ using first-order effort factors)									$MSEM_2$
	Self-efficacy	Valuing	Mastery orientation	Anxiety	Failure avoidance	Uncertain control	Operative effort	Cognitive effort	Social–emotional effort	Higher-order effort
Level 1 (Student)										
L1 Covariates										
SES	0.056	0.035	0.007	0.063	0.012	0.012	0.023	−0.018	−0.083*	−0.010
Age	0.022	0.034	0.028	−0.032	−0.025	−0.014	−0.010	−0.018	−0.015	−0.016
Gender (male)	0.158***	0.101**	0.041	−0.162***	−0.034	−0.086**	−0.099*	−0.035	−0.236***	−0.087*
NESB	−0.045	0.052	−0.002	−0.025	0.061	0.070	−0.046	−0.022	−0.035	−0.036
Mathematics ability	0.213***	0.160***	0.044	−0.070	−0.123**	−0.142**	0.056	0.052	0.059	0.061*
L1 Motivation factors										
Self-efficacy (positive)							0.270***	0.252**	0.099	0.272***
Valuing (positive)							0.179*	0.177*	0.175*	0.198**
Mastery orientation (positive)							0.278***	0.248***	0.274***	0.295***
Anxiety (negative)							0.162**	0.087	0.121*	0.138**
Failure avoidance (negative)							−0.005	0.025	−0.037	0.005
Uncertain control (negative)							−0.114*	−0.089	−0.107	−0.113*
Level 2 (Classroom)										
L2 Covariates										
Class-average ability	0.368**	0.437**	−0.127	−0.097	−0.550***	−0.629***	0.132	0.337	0.351*	0.238
Class size	0.298*	−0.008	0.379*	0.292	0.407*	−0.142	−0.093	−0.259	−0.269	−0.171
Class-average age	−0.153	−0.361***	−0.287**	0.204	−0.036	−0.101	−0.178	−0.102	0.113	−0.135
L2 Motivation factors										
Self-efficacy (positive)							0.319	0.236	0.177	0.292
Valuing (positive)							0.193	0.000	0.465*	0.149
Mastery orientation (positive)							0.340**	0.490**	0.390	0.423**
Anxiety (negative)							0.101	0.082	0.015	0.101
Failure avoidance (negative)							0.014	0.061	0.006	0.027
Uncertain control (negative)							−0.158	−0.197	0.112	−0.148

Motivation items modelled as error-adjusted scores. SES, Social-economic status indicator (positive is higher SES); NESB, Non-English speaking background; *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

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(operationalized as effort). Beginning with a conceptual review to clarify definitional parameters of both motivation and engagement (with specific focus on the relatively neglected construct of effort), we tested a hypothesized multidimensional effort structure and then its empirical juxtaposition with a well-established motivation framework. Multilevel (student- and classroom-level) findings supported the reliability and validity of multidimensional effort (by way of the Effort Scale) and the distinctiveness of effort from motivation by way of multidimensional model fit and latent bivariate multilevel correlations. Then, MSEM explored the "classic" motivation → engagement (effort) process. This revealed significant associations between student- and classroom-level motivation and student- and classroom-level effort—as well as some noteworthy patterns of covariates predicting both motivation and effort at student- and classroom-levels. These findings and their implications for motivation and engagement theory, research, and practice are now discussed.

Findings of note

This study has not only reinforced well-established understanding of motivation and engagement as two inter-related constructs (Martin, 2009; Martin et al., 2017), it has also shed new light on some of the precise ways in which individual motivation factors interplay with specific multidimensional engagement factors. MCFA findings showed multidimensional motivation and multidimensional effort to have distinct factor structures, with significant and theoretically plausible bivariate correlations between first-order motivation and first- and higher-order effort factors. MSEM further supported this *via* unique predictive associations between first-order motivation, and first- and higher-order effort factors. In this study we were especially interested in the extent to which motivation is associated with effort in theoretically plausible ways (convergent validity) and also the extent to which there remained sufficient unshared variance to indicate their distinctiveness (discriminant validity). Our findings garner strong evidence for both convergent (significant associations) and discriminant validity (noteworthy unshared variance) between motivation and effort.

The MSEM provided a particularly nuanced insight into how multidimensional motivation and effort are aligned and distinct, bringing greater psychometric clarity to developments in theorizing, and affording a better understanding of the distinctiveness and interface of motivation and engagement (by way of our novel effort framework). Positive motivation factors were found to overwhelmingly predict effort at the student-level. Specifically (after controlling for student-level background attributes—discussed below), mastery orientation and valuing uniquely predicted all three effort factors (operative, cognitive, and social–emotional), and self-efficacy predicted both operative and cognitive effort. All three positive motivation factors predicted higher-order effort. In explaining the salient role of mastery orientation, it is worth noting central tenets of goal theory (Elliot, 2005) that posits effort as a means by which students' mastery orientation is operationalized. Indeed, classroom-level mastery orientation also predicted classroom-level effort, which is in line with the role of classroom motivational climates in classroom-level engagement under goal theory (Ames, 1992; Wentzel, 2012; Wentzel et al., 2017). There are thus strong theoretical roots underpinning the role of mastery orientation in predicting effort at both student- and classroom-levels.

Valuing was also predictive of all three effort dimensions at the student-level and of social–emotional effort at the classroom-level. Thus, when an individual student believes in the importance and relevance of their academic work to learning, they are more likely to try harder in their application to that learning. This finding aligns with major psycho-educational perspectives—particularly, expectancy-value theory—contending that "students' subjective task values predict both intentions and actual decisions to persist at different activities" (Wigfield and Cambria, 2010, p. 21). In addition, Wigfield and Cambria (2010) highlight that students' values are socio-culturally situated which may well explain why, at the classroom-level, valuing predicted social–emotional effort. Indeed, Eccles and Wigfield (2020) recently updated their conceptual framework to "situated expectancy-value theory" to reflect the situated nature of motivation and motivational processes. In the case of our study, classrooms comprising students who view academic tasks as more important (higher classroom-average valuing) seemed to be contexts conducive to greater class-average extension of interpersonal respect and self-control (higher classroom-average social–emotional effort). It is interesting that class-average valuing did not significantly predict either operative or cognitive effort at the classroom-level. The reason for this is not clear, but there may be something about classroom-level valuing that lends to classroom-level interpersonal prosocial behavior (in the form of social–emotional effort) but not classroom-level intrapersonal behavior (in the forms of operative and cognitive effort) that requires further investigation (see Warrington and Younger, 2011 for an example of related research identifying the role of peer group inclusion and exclusion in school).

It was also interesting to note that student-level self-efficacy, although predictive of students' operative and cognitive effort, did not significantly predict students' social–emotional effort. This suggests that the belief and confidence that students have about their own ability is reflected more towards the effort they invest in their own personal application and cognition rather than towards their inter-personal self-regulation and demonstration of respect for others. This confirms that self-efficacy as a motivational driver is associated more with what Bandura (2001) described as direct personal agency, than to other-oriented agency.

Another result warranting further consideration is that of student-level anxiety (a negative motivation factor) positively predicting operative, social–emotional, and higher-order effort. One could be forgiven for expecting that anxious students would be more avoidant or debilitated in their effort/engagement (Yang et al., 2021; Quintero et al., 2022). However, our results indicate that anxiety is a potentially arousing (rather than debilitating) factor—in line with

classic cognitive appraisal theories where task demands can be perceived as challenges more than threats (e.g., Lazarus and Folkman, 1984). Of course, another interpretation is that students responded to their anxiety with greater effort so they could avoid the poor performance they are anxious about (see Covington, 2000; Martin et al., 2003). However, failure avoidance did not predict effort at either student-or classroom-levels and so we believe we can discount this possibility.

Notwithstanding mastery orientation and valuing, our findings showed that the link between motivation and effort is predominantly manifested between students rather than between classrooms. This is consistent with findings of other studies demonstrating that the majority of variance in motivation and engagement occurs at the student-level (e.g., Martin and Marsh, 2005). At the same time, however, there was a more consistent pattern of classroom-level background attributes that predicted motivation and effort—and in fact, more so for motivation than for effort. Specifically, our findings indicated that: classroom-average ability was associated with higher positive motivation and lower negative motivation, in line with prior motivation research (see Elliot, 2005); classroom-average age was negatively associated with positive motivation factors, consistent with well-documented developmental declines in motivation (e.g., Jacobs et al., 2002; Gottfried et al., 2007); and, class size positively predicted positive motivation, but also positively predicted failure avoidance, potentially reflecting the somewhat equivocal results in class size research over the past five decades (e.g., see Glass and Smith, 1979; Blatchford, 2011).

Turning to the student-level background attributes, gender was the only factor predicting both motivation and effort. Interestingly, despite having higher positive motivation and lower negative motivation, boys were also significantly less likely than girls to invest this motivation in academic effort. Indeed, other research has also suggested that boys are higher than girls in some aspects of motivation (perceived competence) but lower in effort (Wilkie, 2019). Why this is the case requires further investigation, but we suspect answers may lie in gender-specific constructions of effort. For example, research has shown that being seen to put effort into academic work may not fit with culturally prescribed representations of masculinity (Connell and Messerschmidt, 2005) or what is considered "cool" for boys to do (Martino, 1999, 2000; Jackson and Dempster, 2009). Perhaps in some support of this, our results showed that it was the more visible and observable aspects of effort (operative and social–emotional) where boys scored lower, not the internal (cognitive) aspect of effort. Taken together, these findings have highlighted some of the student and context background attributes that are important to include in research seeking to better understand the salient alignments and distinctions between motivation and engagement.

Implications for theory and research

In line with the call for new expositions of engagement to advance the field (Reschly and Christenson 2012), we sought to bring greater lucidity to the motivation and engagement space through a purposeful focus on effort (a specific active form of engagement) and how it relates to multidimensional motivation. In this way, our findings build on recent developments in concepts and theory, helping to further understand the distinctiveness of motivation and engagement, the interface between them, and the interplay between their individual dimensions. For example, it supported theorized distinctions between internal and external aspects of motivation and engagement (Martin, 2012, 2022) in that there was clear measurement and correlational distinction between the study's motivation and effort factors. As noted above, findings also shed light on what aspects of major motivational theories [e.g., goal theory regarding mastery orientation, Elliot, 2005; (situated) expectancy-value theory regarding valuing, Eccles and Wigfield, 2020] are associated with distinct aspects of engagement. By introducing a novel engagement framework by way of multidimensional effort, our findings extend claims made by these theories with respect to motivation and its academic effects.

The study also offers measurement yields. To capture our hypothesized multidimensional effort framework, we developed and established evidence for the validity of a novel instrument—the Effort Scale—that assessed three distinct aspects of effort (operative, cognitive, and social–emotional) in line with its overarching umbrella construct, tripartite engagement (Fredricks et al., 2004). This study therefore offers future researchers a feasible new method of studying effort (as a pertinent example of active classroom engagement). In addition to the Effort Scale, in Supplementary material, we also established evidence for the validity of a parallel three-item version (the Effort Scale—Short) that may be useful in research where longer forms are not feasible (e.g., in real-time research, intensive longitudinal work, etc. see Gogol et al., 2014; Martin et al., 2020).

Implications for practice

The dominant pattern of findings suggests the importance of targeting self-efficacy, valuing, and mastery orientation—as these were the main predictors of effort. Martin (2007) gives some practical examples to develop each of these facets; for instance, the restructuring of learning to maximize opportunities for success may boost students' *self-efficacy*, as might enhancing students' beliefs about themselves and their academic capabilities, and developing their skills in effective goal-setting to boost competence. Providing students with relevance and meaning in their learning is one way of improving *valuing* (Martin, 2007), which is further enhanced by teachers modeling positive attitudes in valuing what they teach (Eccles and Wigfield, 2002). *Mastery orientation* can be enhanced by focusing students on the task at hand more than on the assessment grade associated with it (Martin, 2007), and also on students' own personal learning and progress more than how they compare and compete with other students (Martin and Elliot, 2016).

Alongside motivational intervention as a means of enhancing effort, it is also important to boost effort directly. This is where the multidimensional perspective on effort is especially useful, as it enables targeted and specific educational action. *Operative effort* may be supported by teachers encouraging students to complete schoolwork by the given deadline, emphasizing the importance of students' active investment of time and energy in the completion and quality of their academic work. Teachers who regularly check students' work are best placed to assess their operative effort, and in doing so, actively encourage such effort by commending students for trying hard where applicable. Teachers can also suitably acknowledge students' proactive academic output that is additional to the minimum specified task requirements, encouraging students to engage in supplementary practice, where appropriate, to cement understanding and techniques.

Cognitive effort may be targeted by encouraging students to develop 'active listening' and attentional skills (e.g., presenting positive indications of concentration and focus during instruction, such as eye-contact), commending students for their focus, and reflective thinking in their comments and academic work, where appropriate. Another strategy that can be adopted is for teachers to explicitly promote cerebral challenge (or "brain burn"; for specific examples appropriate to the mathematics classroom, such as the metaphoric "brain gym" see Nagy, 2013). Teachers can promote cognitive effort by allowing students sufficient processing time before eliciting responses to questions that arise in class discussions, affording students more opportunity to think about questions, and formulate proactive contributions to class discussions to clarify their developing schema. Students should be encouraged, where appropriate, to extend their learning by engaging in mentally challenging tasks, and to use cognitive strategies such as visualization and self-talk. A further strategy to improve cognitive effort is for students to increase the duration and frequency of their quiet task-focus time, in class and at home, including turning off mobile phones and social media notifications.

Teachers can enhance students' *social–emotional effort* by developing clear classroom expectations of mutual support and respect and being explicit about the behaviors they want sustained, such as interest in others' classroom contributions, support for others' participation, management of impulsivity, proactive self-regulation, and contribution to positive classroom culture. At the same time, teachers might seek to eliminate behaviors that are not acceptable, such as derision of others' contributions and achievements, shouting out, talking over others, not taking turns, and so on—so that they foster a social–emotional classroom that is a safe environment in which to explore and test ideas and critical thinking.

Not only does the study suggest direction on the motivation and effort factors to target, it also provides direction on the students and classrooms for whom boosting motivation and effort is particularly important. For example, the findings suggest the need to target boys' operative and social–emotional effort. It is also evident that girls may need help to reduce anxiety and uncertain control, alongside support to boost their self-efficacy and valuing. The study also suggests improving social–emotional effort among students in low ability classrooms and reducing failure avoidance in larger classes. When considering these students and classrooms for applied focus, it is worth remembering that the present study was conducted in the mathematics domain and it is known that this is an area where, for example, there are gender differences in motivation (Meece et al., 2006; Watt et al., 2012) and also motivation and engagement differences as a function of ability (Wang and Eccles, 2013). Indeed, as discussed in Limitations below, the extent to which this study's findings and practical advice apply to other subject domains remains to be investigated.

Limitations and future directions

There are some limitations to consider when interpreting our results and which provide potential direction for future research. First, the correlational approach in this study cannot be interpreted as supporting causal conclusions. Experimental and longitudinal designs are required to establish the causal ordering of motivation and engagement (effort) implied in our research. Second, as noted above, our study targeted motivation and engagement in mathematics. Further research is needed to verify the extent to which results are replicated in other subject areas. Third, data were collected *via* self-reports, reflecting students' perceptions of their motivation and effort. Recent research (e.g., Collie and Martin, 2017) has highlighted the importance of garnering perspectives from multiple informants (e.g., in this case, the students and their teachers) in order to obtain a more comprehensive understanding of a target construct like effort, that comprises both internal and external facets. Fourth, although we established illuminating associations between motivation and effort, an extension of the present study might investigate a fuller process, such as including achievement in our hypothesized process as a consequence of effort. Fifth, motivation was assessed using single-item indicators, modelled as error-adjusted scores using established reliability and variance measures from a prior research program. Further studies might consider using multiple-item latent motivation measures to ensure greater measurement accuracy. Sixth, our analyses were based on variable-centered techniques (MCFA, MSEM) which highlight associations between variables at a whole-sample level, but may mask important findings that are pertinent to subpopulations within the sample. Person-centered techniques such as latent profile analysis may identify effort profiles among particular subpopulations of students that are not evident in variable-centered approaches. Seventh, data collection took place at the end of 2020, in the first year of the COVID-19 pandemic. There was some minor disruption to learning earlier in the year, but Australian schools had returned to face-to-face learning for a period of 6 months prior to data collection, and as such we do not expect this to have significantly impacted results.

Finally, our sample comprised Year 7–10 Australian high-school students from independent schools. It is important to expand the age-range, national context, and type of school sampled in future studies to establish the generality of the present findings.

Conclusion

This study sought to shed further light on the unique and shared variance between motivation and engagement (by way of effort). The findings have provided several avenues of focus for subsequent motivation research and theorizing. They have also established evidence for the validity of a novel engagement framework (multidimensional effort) that may support future measurement and practice in academic engagement. In so doing, the research presented here offers greater clarity and coherence for educational researchers and practitioners in their approaches to optimizing students' academic development.

Data availability statement

The datasets presented in this article are not readily available because consent from participants to share the dataset is not available. Summative data are available and can be requested. Requests to access the datasets should be directed to AM; andrew.martin@unsw.edu.au.

Ethics statement

The studies involving human participants were reviewed and approved by UNSW Human Ethics Committee (Approval #HC200273). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

RN shared in the development of the research and materials design and led data analysis and report writing. AM and RC shared in the development of the research and materials design and assisted with data analysis and report writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

One of the measures (the MES) in the study was developed by the second author, AM, and is a published instrument attracting a small fee, of which a part is put towards its ongoing development and administration, and part of which is also donated to UNICEF. However, for this study, there was no fee involved for its use.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest

The handling editor FG declared a past co-authorship with the authors AM and RC.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1045717/full#supplementary-material

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Teachers' authentic strategies to support student motivation

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Introduction: Most theories of motivation have largely developed from the work of scholars rather than the perspectives of teachers. This means that although researchers have many recommendations to guide the way teachers motivate students, there is little understanding of what teachers naturally do to support student motivation. The purpose of this study was to prioritize teachers' perspectives by asking them, separate from theory, what they do to motivate students.

Methods: Forty-two practicing teachers completed an open-ended online survey in which they described their personal strategies for motivating students. We used thematic analysis to identify codes and themes from practicing teachers' responses in a qualitative descriptive design.

Results: We identified 36 discrete codes that gave rise to nine themes: relevance, interest, relationships, effort, safe environment, goals, student self-regulated learning, delivery, and rewards. Member checks were completed to provide evidence of confidence in the results.

Discussion: All of the strategies that teachers described align with recommendations motivation researchers would make with the exception of rewards, which, from a research perspective, are often discouraged. We discuss the results in light of motivation design principles and their relevance to partnering with teachers as a ubiquitous influence on student motivation.

KEYWORDS

teachers motivation strategies, student motivation, design principles, qualitative description, cross-theoretical

1. Introduction

Although curriculum, pedagogy, and assessment are the core canon of the teaching profession, teachers also report that supporting student motivation is one of their main responsibilities (Lauermann and Karabenick, 2013). To meet their professional obligations, including that of motivating students, teachers combine their personal histories and beliefs (Pajares, 1992) with professional learning in areas such as content expertise, pedagogical decisions, assessment practices, and classroom management strategies. If teachers choose to access edited volumes, books, dissertations, and journal articles on motivation (e.g., Graham and Weiner, 2012; Corno and Anderman, 2015; Wentzel and Miele, 2016; Elliot et al., 2017), they largely encounter constructs, theories, and applications to practice rooted in research and quite separate from classrooms and teachers. This lack of application to the classroom has been a longstanding concern in the field of motivation (Pintrich, 2003), however, more recently concerns have also be leveraged about the origin of motivation theories as largely "products of White researchers, mostly male, living and working in the United States during the mid-20th century" (Nolen, 2020, p. 2). This origin stands in contrast to the typical demographics of the teaching profession and the classroom full of students

they motivate (Matthews and López, 2020). Out of both professional responsibility and daily necessity, teachers use strategies to exert an influence on student motivation. It is unknown the extent to which these strategies resemble scholarly perspectives. Knowing the extent to which teachers' natural motivation practices converge with scholarly perspectives, can help researchers balance external intervention with strategies to augment teachers' natural practices. The aim of the current research was to prioritize currently practicing teachers' perspectives on student motivation over the top–down perspectives of discrete motivation theories. Toward this end, we used an exploratory qualitative design to answer the following research question: How does a sample of practicing teachers describe motivating their students?

1.1. Teachers and researchers

There are two potential differences between researchers and teachers that could influence the way they view student motivation. First, researchers and teachers experience student motivation under fundamentally different conditions. In pursuing motivation as a scholarly construct, researchers focus on drafting theories, operationalizing constructs, designing surveys, and accumulating evidence (Punch and Oancea, 2014). In other words, motivation researchers are at times very far from the complexity of classrooms (Pintrich, 2003). In contrast, teachers live student motivation in the classroom everyday. Thus, whatever teachers do to motivate students to engage, exert effort, study, and meet outcomes is the embodied reality of motivating students regardless of its evidence. Second, researchers and teachers have different accountability structures. The work of researchers is protected by the principles of academic freedom (Horn, 1999) which allow and even expect researchers to continuously seek new information and insights in their area of expertise. Teachers do not have academic freedom. Rather they are largely governed by accountability structures (Linn, 2006) that ensure they teach a prescribe curriculum so that students meet certain standards. These two differences may introduce constraints on the motivation strategies teachers use, leaving motivation theories potentially far removed from the natural practices of teachers.

These concerns are not new. In 2003, Pintrich insisted that because motivational science was "focused on student motivation in academic settings, the need for use-inspired basic research or work in Pasteur's quadrant is paramount. We [researchers] should be striving for both goals of contributing to basic scientific understanding of motivation as well as developing useful ideas and design principles to improve motivation in educational and other teaching and learning settings" (p. 669). This admonition would never apply to teachers who cannot ignore the daily utility of their actions and may focus on that over evidence. Daniels et al. (2020) demonstrated this differential focus showing that elementary school teachers were more likely to endorse a hypothetical motivation intervention on the basis of qualitative than experimental evidence. In a similar vein, Reeve and Cheon (2016) showed that teachers' belief that motivation interventions are easy to implement even with the classroom complexity and demands was a "functional necessity" (p. 185) for successful implementation.

1.2. Achievement motivation theories

When encountering the literature on motivation, teachers are likely to encounter a field that seems more complicated than simple in its potential to support them in motivating students. In part this is because there are simply so many theories of motivation including but not limited to achievement goal theory (Elliot, 1999), interest theory (Renninger et al., 1992), self-efficacy (Bandura, 1999), expectancy-value theory (Eccles and Wigfield, 1995), self-determination theory (Ryan and Deci, 2000), mindset theory (Dweck, 2008), and attribution theory (Weiner, 1986). The ongoing relevance of these theories to the field of motivation can be highlighted through their inclusion in special issues over the span of two decades (Alexander, 2000; Wigfield and Koenka, 2020).

Although an in-depth review of each of these theories is well beyond the scope of this paper, it is important to recognize that each theory regards motivation as not only quantifiable (i.e., how much motivation) but also as having a quality (i.e., what kind of motivation). By extension, each theory delineates certain qualities of motivation that tend to be associated with beneficial outcomes for students and other qualities that tend to be less adaptive (Elliot et al., 2017). These associations are now largely supported by results of meta-analytic studies that allow researchers to "provide information on average effects with far more statistical power than that of individual studies" (Patall, 2021, p. 142). Mastery-approach goals have been shown to have comparable associations with achievement as performance-approach goals (Mean Pearson rs = 0.10 and 0.13 respectively; Huang, 2012). However, mastery-approach goals have stronger positive associations with pleasant emotions (Mean Pearson $r = 0.42$; Huang, 2011), self-efficacy beliefs (Mean Pearson $r = 0.45$; Huang, 2016), and mastery goal structures (Mean $r = 0.49$; Bardach et al., 2020) than other types of goals. This tends to lead researchers to recommend mastery-approach goals relative to other types. In Self-determination Theory, more internally regulated forms of motivation tend to have stronger associations with adaptive outcomes than externally regulated forms. For example, Howard et al. (2021) used bivariate correlations adjusted for scale reliability in her meta-analysis showing that intrinsic motivation has stronger associations with self-reported and objective grades (ρs = 0.32 and 0.13 respectively), effort ($\rho = 0.54$), positive affect ($\rho = 0.52$), negative affect ($\rho = -0.29$), and enjoyment ($\rho = 0.69$) than other forms. Interventions derived from Attribution Theory and Mindset Theory are designed to shift perceived causes from uncontrollable to controllable (Haynes et al., 2009) and mindsets from fixed to growth (Yeager et al., 2019) because of the associated benefits with these cognitions relative to the others. As such, motivation researchers recommend strategies associated with certain qualities of motivation (e.g., intrinsic, effortful, growth-focused, mastery, etc.) and discourage other ones such as rewards and incentives even though there are occasions when such practices can be effective motivators (e.g., Hulleman et al., 2010).

1.3. The evolution of motivation design principles

More than ever before, motivation researchers are acknowledging that the field is "plagued by the diversity of constructs and theoretical approaches" (Pekrun and Marsh, 2022, p. 3) and that the advantages of identifying similarities is important. Leading this call nearly 20 years ago, Pintrich (2003) offered the first set of what he called motivational "generalizations" – or principles that are "supported by good empirical evidence in line with theoretical and conceptual reasoning about the

nature of motivation" (p. 668) and have relevance to designing classrooms. Pintrich highlighted five principles based on adaptive self-efficacy and competence beliefs (Bandura, 1999), attributions and control beliefs (Weiner, 1986; Skinner, 1996), interest and intrinsic motivation (Renninger et al., 1992; Ryan and Deci, 2000), value (Eccles and Wigfield, 1995), and goals (Dweck and Leggett, 1988; Elliot, 1999). For each principle Pintrich offered instructional design recommendations to enact the principle in a way that supports adaptive student motivation and outcomes relative to less adaptive forms. For example, he recommended that teachers "design tasks that offer opportunities to be successful but also challenge students" (p. 672) as a way to build self-efficacy and competence. To enhance interest and intrinsic motivation he suggested "provid[ing] content material and tasks that are personally meaningful and relevant to students" (p. 672). No research, however, presented these design principles to teachers or sought teachers' perspectives on enacting them to support student motivation.

Building on Pintrich's ideas, Urdan and Turner (2005) used achievement goal theory (Elliot, 1999), interest and intrinsic motivation (Renninger et al., 1992), self-efficacy (Bandura, 1999), expectancy-value theory (Eccles and Wigfield, 1995), self-determination theory (Ryan and Deci, 2000), and attribution theory (Weiner, 1986) to develop a list of eight classroom practices theorized to enhance students' adaptive forms of motivation. Their eight recommendations were:

1. Develop and assign academic tasks and activities that are personally meaningful and relevant for students.
2. Develop and assign moderately or appropriately challenging tasks and materials.
3. Promote perceptions of control and autonomy by allowing students to make choices about classroom experience and the work in which they engage. Also, encourage students to view intelligence, learning, and performance as personally controllable by attributing performance to controllable factors such as effort and strategy use. Avoid controlling or coercive language and instructional practices.
4. Encourage students to focus on mastery, skill development, and the process of learning rather than just focusing on outcomes such as test scores or relative performance.
5. Help students develop and pursue proximal, challenging, achievable goals.
6. Infuse the curriculum with fantasy, novelty, variety, and humor.
7. Provide accurate, informational feedback focused on strategy use and competence development rather than social-comparative or simply evaluative feedback.
8. Assess students' confidence, attributional tendencies, and skill levels to help meet their preferences for challenge and to help students approach tasks with realistic expectations and cope with difficulties adaptively (p. 306–307).

For each recommendation, Urdan and Turner identified sources of empirical evidence demonstrating how the principle enhances student motivation and related cognitive, affective, and performance outcomes. They also identified the two most common shortcomings in the research as a reliance on correlational evidence and limited involvement of actual classrooms or observations of teachers' actual practices. Indeed, Urdan and Turner highlighted that teachers had little involvement in this work and stated this as an obstacle that must be overcome for research to make authentic progress.

Most recently, Linnenbrink-Garcia et al. (2016) added the control-value theory of emotions (Pekrun, 2006) to the set of social-cognitive theories important to consider when making generalized recommendations about supporting student motivation. They state that their five design principles are based on "themes [that] run across the discrete theoretical perspectives and research traditions" (p. 232). Linnenbrink-Garcia et al. (2016) focused on reviewing experimental data from intervention studies (Elliot et al., 2017) to support the positive causal effects of design principles on student motivation and outcomes. The five principles are as follows:

1. Support competence through well-designed instruction, challenging work, and informational and encouraging feedback
2. Support students' autonomy through opportunities for student decision making and direction
3. Select personally relevant, interesting activities that provide opportunities for identification and active involvement
4. Emphasize learning and understanding and de-emphasize performance, competition, and social comparison
5. Support feelings of relatedness and belonging among students and with teachers.

The evolution of design principles highlights both the stability of constructs like competence, control, and value as well as a wax and wane of constructs like goal setting and fantasy for emotions and relatedness. Linnenbrink-Garcia et al. (2016) proposed design principles are based on data that shows positive associations amongst students' perceptions of classrooms that are caring, autonomy supportive, enthusiastic, mastery-focused, and relevant and adaptive outcomes such as intrinsic motivation, pleasant emotions, persistence, creativity, and achievement (see Elliot et al., 2017). Despite accumulating evidence, Urdan and Turner (2005) explained that "if principles of motivation research are to be applied in the classroom, teachers will have to endorse them" (p. 312). Although we do not disagree with this statement, an alternative approach to consider how teachers' natural motivation strategies align with existing theories. In other words, motivation researchers could prioritize teachers' perspectives by starting with their strategies rather than the theories. In doing so, both parties could better understand how wide or narrow the disparity is between teachers' natural practices and those based on empirical data.

1.4. Teachers' perspectives on motivational practices

Although motivation researchers offer these recommendations to support students' motivation, a fairly small portion of the studies on student motivation have examined teachers' authentic motivational practices in the classroom and most of them adhered to a single motivation theory. For example, Patrick et al. (2001) used a combination of self-report and observations to identify how teachers implicitly and explicitly communicated mastery or performance goals to students. Students completed self-reports on the perceived mastery and performance structure of their classroom and these reports allowed Patrick and colleagues to identify four classrooms that differed in combinations of mastery and performance goals (i.e., high/low on each domain). Next, Patrick and colleagues applied an observation protocol to determine what types of instructional practices occurred in the

different types of classrooms. Their results demonstrated that teachers in high mastery classrooms focused on learning as active by requiring participation and effort from students and scaffolding those expectations with high levels of social–emotional support for students' wellbeing and progress. Using a similar procedure Anderman et al. (2011) showed that students perceive a classroom as motivational when teachers provided constant support for their understanding, applied skilled classroom management practices, and built strong rapport.

Using discourse analysis Turner et al. (2003) found that when a teacher communicated "constant and explicit support for autonomy and intrinsic motivation, positive affect, and collaboration" (p. 357) students appeared more motivated and showed less negative affect and self-handicapping. A similar series of practices were associated with greater mastery approaches to instruction and fewer performance approaches to instruction in an observational study conducted during the first days of school (Patrick et al., 2003). In addition, Reeve and Cheon (2014) identified a total of 14 specific instructional practices that are used differently by autonomy-supportive teachers compared to controlling teachers to support student autonomy following a self-determination theory framework (e.g., controlling language, choice, etc.).

As an exception to the single-theory approach, Hardré and Sullivan (2008) used a mixed methods design to examine how rural public high school teachers' individual differences and perceptions influenced the motivation strategies that they use in their classrooms. In the quantitative portion of their study, they included a wide range of measures including interpersonal style, mastery and performance goals, teacher and peer factors, as well as a range of motivational strategies. For the qualitative portion, Hardré and Sullivan used written narratives and interviews to shed additional light on the quantitative results. From these sources, Hardré and Sullivan identified the four most common motivation strategies used by teachers as (a) building relationships, (b) providing encouragement, (c) promoting relevance, and (d) giving verbal praise. They also found that the majority of teachers interviewed admitted that they did not know how to motivate their students, they tended to use more intuitive strategies.

1.5. The current study

Motivating students is a daily part of teachers' work. However, little is understood about the strategies teachers choose to meet this task because the discrete theories of achievement motivation were developed by researchers who likely have different priorities than teachers based on their context and accountability. Thus, the purpose of this research was to prioritize teachers' perspectives by exploring the practices they authentically use to motivate their students. One major advantage of this atheoretical approach at the level of data collection is that teachers' lived expertise and skills are not curtailed or constricted to a limited set of motivation constructs.

2. Method

We used a qualitative descriptive design to answer the following research question: How do practicing teachers describe motivating their students? Qualitative descriptive designs are appropriate when the objective is to produce "straightforward descriptions of experiences and perceptions [and] do not require a deeply theoretical context" (Doyle et al., 2020, p. 444). The design allowed us to increase researchers' understanding of what teachers report doing to support student motivation without imposing *a priori* any specific motivation theory on their practices. The procedure was approved by the University's Human Ethics Research Board and had a cooperative activities approval from the school board.

2.1. Participants, procedure, and materials

Teachers were recruited through a snowball sampling procedure that involved circulating the survey link through a variety of social media and email platforms and requesting recipients complete an online questionnaire and forward the link to other eligible participants. Eligibility was stated as being a currently practicing teacher of compulsory level schooling. Daycare providers and post-secondary instructors were not eligible. Forty-two teachers responded consisting of 71.8% women teachers and 28.2% men teachers, with a mean age of 33 years. No ethnicity data was collected at the stipulation of the school board. Teachers had an average of 7.5 years of teaching experience and taught English ($n = 24$), Math ($n = 21$), Science ($n = 19$) or multiple subjects ($n = 27$). Sixty-four percent of participants taught elementary school and considered themselves generalists. Participants wrote responses to one open-ended question *What do you do to motivate your students?*

2.2. Research team positionality

The research team represents one mid-career motivation research and two graduate student authors as well as members of a larger motivation research laboratory who provided informal support and perspectives on the project and analyses. Prior to undertaking any analyses, the three authors sought to identify and make explicit our beliefs and biases (Pietkiewicz and Smith, 2014). First, we believe that teachers are at least partially responsible for student motivation and use a wide range of practices to support motivation. Second, we recognize that teachers may use motivational strategies that we as researchers would not consider beneficial for student motivation. However, no members of the research team are schoolteachers, and therefore we do not assume to know the realities of classrooms in compulsory levels of schooling in terms of motivational demands and sought to openly accept all approaches to student motivation. Third, we have considerable expertise in discrete motivation theories (e.g., Weiner, 1985; Elliot, 1999; Deci and Ryan, 2000; Pekrun, 2006) as well as the associated instructional design recommendations (e.g., Linnenbrink-Garcia et al., 2016). We balanced this expertise with an open mind such that we analyzed teachers' responses without seeking to confirm any specific theoretical orientation.

2.3. Rationale for analysis

As is common in qualitative descriptive designs, we analyzed participants' responses according to a general inductive thematic method (Doyle et al., 2020) following five steps (Thomas, 2006). The first author led the analyses. She began by open coded the written responses and attaching specific codes to each segment. Each code was entered into a codebook (DeCuir-Gunby et al., 2011) that consisted of four columns: codes, definition (i.e., what the code means), anti-definition (i.e., what the code is not), and examples of verbatim quotes that represent the code (see

Supplementary materials). The codebook was shared with the second and third authors and that conversation facilitated the combining of individual codes into themes. Themes were entered into the codebook which was presented to all members of the research laboratory for critique and comment to increase confidence in the process and the results. After the qualitative data was analyzed, interviews were conducted with four practicing teachers as member-checks to establish confidence in the thematic categories. Recruitment for the member-checks similarly used a social media post with interested teachers contacting the first author. The individual interviews were semi-structured, lasted approximately 1 h, and were audio-recorded. Participants received an information letter and signed a consent form. The interview began with each teacher describing her own motivation practices. Next, each participant reviewed the list of themes and provided their thoughts on its accuracy.

3. Results

The inductive thematic analysis resulted in 36 discrete codes that gave rise to the following nine thematic categories: relevance, interest, relationships, effort, safe environment, goals, student self-regulated learning, delivery, and rewards (Table 1). Each thematic category is described in detail next.

TABLE 1 Results of qualitative data analysis: themes, definitions, and codes.

Theme	Definition	Codes
Relevance	Making learning meaningful and relevant to students	Choice
		Make outcomes salient
		Make real world connections
		Point out relevance
Interest	Modeling enthusiasm and sustaining students' interest on activities and tasks	Engage
		Fun
		Good attitude
		Model enthusiasm
		Technology
Relationships	Trying to establish and maintain relationships across domains of their students' lives	Accept emotions
		Validate
		Show interest in personal life
		Develop personal rapport
		Peer support
		Home-school partnerships
Effort	Acknowledging student work without placing value on that same work	Acknowledge accomplishments
		Acknowledge improvements
		Encourage effort
Safe environment	Focusing on making students feel comfortable in the classroom and willing to take risks	Encourage questions
		Safe place to make mistakes
		Decrease stress
Goals	Focusing on setting goals with students	Attainable goals
		Create goals
Student self-regulated learning	Practices used that are focused on students developing self-regulated learning	Self-reflection
		Support students
		Encourage higher order thinking
Delivery	Delivering content in a way that allows students to best engage	Differentiate
		Interactive activities
		Provide additional material
		Variety in teaching
		Use as an example
Rewards	Using accolades, both tangible and intangible, to motivate students	Behavior Plan
		Competition
		Use of tokens
		Praise
		Reward with recognition

3.1. Description of thematic categories

3.1.1. Relevance

Teachers described practices that focused on the meaning and relevance of learning as ways to motivate their students. Relevance was used both in the short term such as letting "them know the importance of the information and how it relates to their every-day [life]" as well as in the long term by focusing on a "sense of accomplishment or post-secondary opportunities." Teachers also used "current and relevant examples" to help students see how topics relate to the real world.

3.1.2. Interest

Teachers used a variety of practices, including their own enthusiasm, as a way to model and sustain students' interest in activities and tasks. For example, teachers described supporting student motivation through their own "general good attitude toward students" and by modeling enthusiasm for subjects or tasks. Statements such as building students' motivation by "teach[ing] with energy and enthusiasm and try[ing] to convey passion about subject matter" were common. Teachers also discussed facilitating student interest in activities by "[attempting] to create engaging activities which spark student interest." They also emphasized the importance of knowing "what [students] like and [trying] to incorporate it into my [classroom]."

3.1.3. Relationships

Teachers used relationships with students and their families as a motivational strategy. Teachers described the importance of validating students and making them feel that their thoughts and feelings are important. One teacher noted that they "[assure students] that their inquiry is always valid" and another encouraged students to "talk openly about the fact that it's totally natural. … to feel frustrated and uncomfortable during learning." Many teachers indicated that they try to develop personal relationships with students and their parents in genuine and caring ways. For example, a teacher focused on "[making] personal connections with students" and also "[developing] a communication path between teacher-student-parents." Teachers also focused on relationships within the classroom, particularly between peers: "I give students opportunities to share their learning with one another."

3.1.4. Effort

Teachers viewed focusing on effort as a way to motivate their students. For some teachers the focus on effort was explicit with statements such as "encourage [students'] efforts" by reassuring them as they attempt work that can be difficult and focusing on effort separate from outcomes. For other teachers the focus on effort was less direct and they wrote about motivating students by recognizing their progress separate from grades or formal standards: "encouragement and acknowledging [students'] progress and accomplishments" and "point[ing] out improvement."

3.1.5. Safe environment

Teachers described how a safe environment was necessary for student motivation. For example, teachers wrote directly that they motivate by ensuring "students feel safe to ask questions" or by "creating a safe and empathetic environment with students where they know it is ok to make mistakes and take risks." In creating this environment, teachers also described decreasing stress in their classrooms, or working to actively lower the level of distress in their classroom.

3.1.6. Goals

Teachers used different types of goal setting to motivate students. First, teachers wrote about creating and setting goals with their students individually and as a whole class. For example, a teacher wrote about motivating students by "making and tracking goals, both individual and as a class." Moreover, teachers wrote about the quality of goals that motivate students, highlighting that goals need to be meaningful and achievable: "[setting] challenging, yet attainable learning goals."

3.1.7. Student self-regulated learning

Teachers described how helping students develop self-regulated learning can be used as a motivational strategy. For example, teachers focused on equipping students with specific skills such as "self-assessing current behaviors, work, and results" that they viewed would in turn help motivate the student. Teachers also described how "encouraging students to look critically [at] what they are participating in" can be used as a motivational strategy. Finally, teachers described these aims as eventually contributing to students' capacity to take on these tasks themselves by supporting students to "build their confidence in their own abilities."

3.1.8. Delivery

Teachers listed a variety of ways they shaped the delivery of their content to motivate their students. These strategies included "[implementing] differentiated tasks," "construct[ing] interactive activities," and "try[ing] to offer as many [hands]-on activities as I can." Teachers also reported specific strategies to sustain the motivation that students bring to class themselves. For example, one teacher wrote "If a student makes a point about something, I'll try to match it with research or an article that furthers their understanding about that point." Teachers also noted using a variety of media and teaching techniques in their practice to help motivate students including "technology, small-group learning, learning centers, and in-class discussions," or "DVDs, corny YouTube videos, and music."

3.1.9. Rewards

Teachers listed a variety of accolades, both tangible and intangible, as part of their motivational strategies. Numerous teachers described using point systems to motivate students. For some teachers, points were used to create "a competition with others in the class" whereas for others the points served more an individual function – for example "[it] is obvious that it is an internal reward for them because they often call out proudly how many points they have." Teachers rewarded students with things other than points. For example, teachers noted "reward[ing] success with recognition and calls home," and "[taking] time to point out instances of good" student outcomes that they wanted other students to model.

3.2. Confidence in thematic categories

Four women practicing Canadian teachers consented to be part of the member checking process, which involved an individual interview. Each participant reviewed the list of themes and provided her thoughts on its accuracy. Participants all indicated a high level of agreement with the thematic categories and described practices that they use in their classrooms that supported each thematic category. Participants noted that they felt that the categories were exhaustive. For example, one teacher said "You hit on all of it" referring to the things she does to motivate her students. Moreover, they did not suggest additional categories or practices to add to the findings when provided with the opportunity to do so: "It's covered a broad level of the main practices that we [teachers] use and that are used in the classroom. I cannot really think of anything that I would add." We take these participants' high level of agreement with the thematic categories, their acknowledgement that the categories felt like an exhaustive categorization of their practices, and their disinclination to add additional practices to the findings as evidence of confidence in the results.

4. Discussion

Our results showed that teachers described nine broad strategies to motivate students. The nine themes we selected represent our interpretation of teachers' descriptions while intentionally putting aside *a priori* theoretical frameworks. The main advantage to this approach is that it allowed us to recognize the important work teachers do everyday to motivate students and the substantial breadth of strategies they bring to bear on that task without constraining or curtailing their responses. We recognize, however, that these are not the only possible combinations of results. In particular, if we had used any number of discrete motivation theories to inductively analyze the data the results could have easily been brought to conform to the theory. For example, it will be obvious to SDT researchers that autonomy, competence, and relatedness are strongly present in teachers' descriptions. Applying SDT exclusively, however, would have ignored that teachers themselves did not provide descriptions alluded to motivation theory or fit under a single theoretical perspective. This underscores the importance of researchers considering a wide range of theories and constructs when partnering with teachers because their practices may not fit neatly into theoretical boundaries.

To facilitate the discussion of deductively produced themes and anchor the ideas generated by teachers to research, we use Linnenbrink-Garcia et al. (2016) design principles as a scaffold. We chose the notion of design principles as a middle ground to make comparisons between teachers' natural strategies and common motivation principles. To help visualize the convergence between our results and these recommendations, we undertook a mapping exercise in which we linked our nine thematic categories to the six design principles (Figure 1). All but one of the

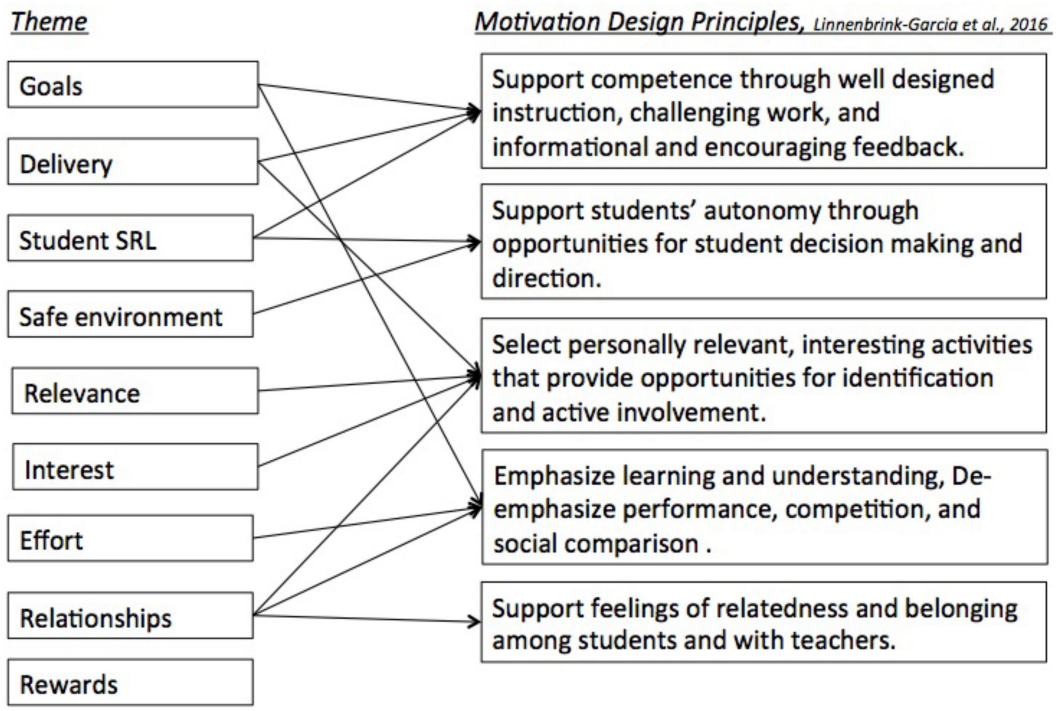

FIGURE 1
Mapping of teachers' authentic motivation practices with motivation design.

thematic categories of motivation strategies could be mapped onto the design principles and some strategies supported more than one principle. Based on our results, we also suggest that although motivation theories have largely scholarly origins, they seem to reflect the practices offered authentically by this sample of practicing teachers.

4.1. Convergence between authentic reports and design principles

The first design principle suggests that teachers can support student motivation by focusing on competence, well-designed instruction, challenging work, and information and encouraging feedback (Linnenbrink-Garcia et al., 2016). This principle reflects elements of three themes identified in teachers' authentic descriptions of how they motivate students. In particular, teachers' descriptions related to Goals, their Delivery, and developing Students' Self-Regulated Learning are consistent with this design principle. However, there were no teacher statements about using feedback to motivate students. This was surprising because formative and self-referent feedback have become common in teacher education and professional development and have been shown to not only improve student performance but also the quality of motivation (e.g., Butler, 1988; Koenka et al., 2019). Some research suggests that indeed teachers' general approaches to assessment can be described from an Achievement Goal Theory perspective and tend to parallel their preferences for mastery and performance approaches to instruction (Daniels and Poth, 2017). Future research into the tension between motivation and all types of assessment will be important to better understand how teachers consider their assessment practices specifically in light of student motivation (see Daniels et al., 2021 for a discussion).

The second design principle suggests that high quality student motivation is sustained when teachers support students' autonomy through opportunities for student decision making and direction (Linnenbrink-Garcia et al., 2016). Researchers (e.g., Reeve et al., 2008) have linked autonomy supportive teaching with many positive educational outcomes including both academic performance and more intrinsic motivation. These principles were most clearly captured by the ways in which teachers wrote about developing Students' Self-Regulated Learning. This connection can be seen in the broader literature where some researchers have argued that autonomous motivation is a specific form of self-regulation. Specifically, Reeve, Ryan, Deci, and Jang explain that "[t]he regulation of behavior when people's interests and self-endorsed values are the reason for acting is said to be *autonomous*" (2008, p. 224). Thus, linking teachers' authentic description of supporting students' autonomy through the development of self-regulated learning seems well justified.

The third design principle suggests teachers can support students' motivation by selecting personally relevant, interesting activities that provide opportunities for identification and involvement (Linnenbrink-Garcia et al., 2016). Teachers wrote not only about using Interest and Relevance directly to motivate students, but also the many ways that they use their Delivery to build interest. They also articulated how having Relationships with students in the sense of knowing what is important to them is necessary in order to maximize interest and involvement. In other words, four themes from teachers' described practices converge with this design principle. Teachers' practices here are consistent with Hidi and Renninger's (2006) four phase model of interest development, namely that they acknowledge there are different ways and strategies that they use to catch and then hold students' interest based on what they know about students. At times, teachers may opt to use strategies that spark student interest in new material, while at other

times, they may use the knowledge they have about students' personal lives to connect learning to their lives or to provide opportunities for additional knowledge development in these areas. Catching and holding student interest is an important concept for motivation as it is associated with the development of mastery goals and, over time, continued exploration of the same material (Harackiewicz et al., 2008).

The fourth design principle has two somewhat contrasting parts: (1) emphasize learning and (2) de-emphasize performance, competition, and social comparison (Linnenbrink-Garcia et al., 2016). In terms of emphasizing learning, this principle mapped onto teachers' statements regarding Goals and Effort. Teachers emphasized intra-individual competence as opposed to inter-individual competence and in doing so, focused on increasing student understanding and mastery of topics. These notions are core to a mastery approach to instruction (Maehr and Zusho, 2009), which encourages students to pursue mastery goals. Mastery goals, in turn, are associated with better understanding of material and desire for more challenging material (Meece et al., 2006; Senko et al., 2012; Paulick et al., 2013) as they encourage students to continue to set goals and focus on progress in learning. Teachers did not write explicitly about de-emphasizing performance, competition, and social comparison in their authentic strategies and thus there was no match in their statements for this portion of the design principle. One reason for this is that participants were explicitly asked to provide examples of what they *do* to support student motivation and any actions they avoid or minimize may not have been captured by these instructions. The extent to which emphasizing learning is naturally paired with de-emphasizing performance and competition is an open area for future research.

Finally, the last design principle focuses on supporting students' feelings of relatedness and belonging among students and with teachers (Linnenbrink-Garcia et al., 2016). Teachers expanded on this principle in their written comments by not only describing relationships with their students, but also relationships among peers and with students' families. Current literature seems to be focusing on the importance of meaningful and caring relationships between teachers and students. For example, Butler (2012), noting that "teaching is an interpersonal endeavor" (p. 727), and has added relational goals to her Goal Orientations for Teaching measure (Butler, 2007). She demonstrated that teachers' goals to create personal and caring relationships with students in their class are distinct from performance and mastery goals. Moreover, teachers who were more relational were more socially supportive of students and likely to acknowledge effort more than teachers who tended toward performance or mastery goals. When thinking of teachers' engagement, Klassen et al. (2013) argued that teaching has a unique demand in terms of requiring social engagement, both with students and with colleagues. In other qualitative research discussing teachers' feelings of responsibility for motivation, Daniels et al. (2018) revealed that teachers perceive relationships as almost foundational to student motivation.

4.2. Divergence between authentic reports and design principles

Teachers described using Rewards in their classrooms to motivate students. As mentioned, the use of Rewards runs contrary to nearly all social-cognitive theories of motivation and is often thought to undermine existing internal forms of motivation (e.g., Deci and Ryan, 1994; Ryan and Deci, 2000). Teachers listed several types of rewards as part of their authentic motivation strategies including teacher and peer recognition, points and tokens, and competition. There is recent empirical research from the perspective of neuroscience that may help negotiate the tension between researchers who suggest avoiding rewards and teachers who seem to continue to rely on them (Hidi and Renninger, 2019). Hidi and Renninger would argue that rewards are a natural part of how humans' brains are wired and that neglecting them ignores a major way that students are neurologically motivated in their environments. The fact that teachers organically discuss Rewards reinforces their relevance in the educational domain and is an important consideration for researchers to reconcile this practical reality with evidence to the contrary.

4.3. Implications

This research makes important contributions to both theory and practice. First, our results reinforce the importance for researchers to recognize that teachers' approaches to motivation may not align precisely with one theory of achievement motivation but are largely what would be conisdered "adaptive" practices. Although motivation researchers have extensive expertise in constructs and theories, teachers' expertise is accumulated in front of students. As such, when researchers ask teachers to complete surveys or conduct observations according to a single theory, they may inadvertently force teachers' responses or practices to conform to the parameters of the theory. Motivation researchers who want to work with teachers need to acknowledge the advantages and limitations of a singularly theory-driven approach.

Second, in terms of practice, teachers appear to use a wide range of strategies to support student motivation, the vast majority of which align with motivation design principles. Perhaps it would be beneficial to encourage teachers in their current practices rather than suggesting a new approach is required thereby balancing practices and classroom realities. In particular, this would be helpful in showing teachers that enhancing student motivation may not be hard or a major change to their typical practice (Reeve and Cheon, 2016). The one exception to this is in regards to the use of Rewards. Although researchers may acknowledge a role for Rewards as a motivating strategy, it is important for teachers to understand the nuances of this particular approach. Targeting the use of Rewards precisely might be an option for professional development. Alternatively, researchers may need to partner closely with teachers to understand Rewards as a motivational strategy in the complex classroom.

4.4. Limitations and directions for future research

It is important to note three main limitations of this research. First, teachers described their motivation practices *via* written responses to an open-ended questionnaire. This is relatively superficial way to collect qualitative accounts related to motivational practices because although some participants wrote a descriptive and detailed account of their practices, others provided point-form comments. To overcome this weakness, we conducted four in-person interviews as a form of member checking. Although those interviews provided depth of conversation and confirmed the themes we identified, we did not use any specific convergence process to gain a strong measure of the level of agreement. Similarly, we recognize that the nine themes we selected are not the only possible combinations of codes. In a field where the theoretical constructs are so well established, the temptation to superimpose theoretical structure to naturally occurring practices is strong. We encourage researchers to continue to weigh the balance of theory and authenticity in future research and partnerships with teachers and schools.

Second, while the thematic results conservatively describe *what* teachers do to motivate their students, they do not link to *when* or *how* teachers use these practices. The contextual aspect of the application of these practices is missing and would again have benefited from in-depth interviews or focus groups. Although it is outside the parameters of the current research to examine these additional questions, they provide interesting avenues for future research of a similar nature or using other methodologies. For example, teachers might use different practices depending on what they are attempting to motivate their students to do. Nolen and Nicholls (1994) asked teachers about increasing or sustaining their students' motivation and found that teachers responded in different ways to the same items, depending on the prompt. More specifically, teachers reported using three strategies when they wanted to increase student motivation and two different strategies when their goal was to sustain existing motivation. These findings suggest that teachers may use different practices depending on the context and underscore the importance of expanding our understanding not only of which motivation practices teachers use, but when and how they employ them.

Finally, the researchers asked teachers to describe what they do to motivate students thereby assuming that the participants viewed student motivation as their responsibility. Indeed, there may be a selection bias with participants who chose to participate being teachers who prioritize student motivation. This assumption needs to be considered because teachers' responsibility for student motivation consistently scores as the lowest of four domains of personal responsibility (Lauermann and Karabenick, 2013; Eren, 2015; Daniels et al., 2016, 2017). One reason for the low score in the area of motivation may be because of its complexity. Both quantitative and qualitative researchers may need to give more attention to the dynamic and complex nature of the classroom in order to understand teachers' role in student motivation – and arguably students' role in teachers' motivation (Frenzel et al., 2021). If researchers acknowledge that teachers and students co-create the motivational climate within classrooms then they should adjust their research methods and questions accordingly (Kaplan and Patrick, 2016). Employing methodologies that allow for naturalistic observation or *in situ* research could provide an important additional illustration of these relationships. These are important areas for future research to bring further precision to understanding teachers' motivational practices.

5. Conclusion

Teachers' perspectives were given priority in this research by allowing them to openly describe the practices that they apply in their classrooms to motivate students. They described a variety of practices, which provided a balanced view of classroom practices that includes both practices that converge with and diverge from motivation theory and current design principles (Linnenbrink-Garcia et al., 2016). However, they are not consistent with any one discrete theory; instead, it appears that a cross-theoretical perspective, focused on broad design principles, is most helpful in understanding the motivational practices that teachers apply in their classrooms and that this perspective should be recognized in research with teachers.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by University of Alberta Research Ethics Board 2. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2023.1040996/full#supplementary-material

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Examining culturally diverse learners' motivation and engagement processes as situated in the context of a complex task

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Student learning processes, including motivation and engagement, have been identified as malleable and situated in context. We have limited understanding about how to enhance motivation and engagement processes for culturally diverse learners in today's multicultural classrooms. To support thinking about that challenge, this work built on research on both culturally responsive teaching (CRT) and self-regulated learning (SRL), each of which identifies pedagogical practices that enhance student engagement and motivation. This study examined how students at a culturally diverse independent elementary school in the West Coast of Canada participated in classroom context that integrated CRT and SRL-promoting practices. Specifically, this study examined culturally diverse learners' engagement and motivation during a complex learning task. Data collected included classroom observations, practice records and documents, students' work samples, and student interviews and student surveys. The results demonstrated: (1) above medium levels of engagement and motivation, among participants, that varied across specific contexts; and (2) associations between culturally diverse learners' engagement and motivation; and complex learning context such as CRT and SRL-promoting practices. Implications for future research on culturally diverse students' engagement as well as designing a complex task that integrated a culturally responsive teaching and self-regulated learning pedagogical practices to support engagement and motivation are discussed.

KEYWORDS

engagement, culturally responsive teaching, self-regulated learning, complex task, motivation

Introduction

Today's classrooms, especially in the western societies, are populated by students from diverse linguistic and cultural backgrounds. These students bring into the classroom their individual differences (e.g., interests), expectations (e.g., aspirations), social and cultural heritages (e.g., ways of knowing and being), and lived experiences (e.g., of learning in other contexts in their cultural backgrounds). Research has identified how a dynamic interaction between what individual student bring and the learning contexts shapes their achievement, learning experiences including motivational and engagement processes (Okoye and Anyichie, 2008; Järvenoja et al., 2015; Graham, 2018; Gray et al., 2020). In culturally diverse classrooms, students from historically unrepresented groups experience a higher lack of engagement and motivation in classroom activities that are disconnected from their cultural backgrounds, interests, prior knowledge and experiences. Giving the increase in classroom student diversities and their learning needs, many educators who are not trained on how to design a learning context that support motivation for students of colour struggle with creating an empowering context to support culturally diverse students' motivation (Gay, 2018).

Based on these challenges, we need research that will advance our understanding of how educators can support culturally diverse learners' learning processes such as motivation and

engagement by designing activities that are relevant to *all* learners' cultural background and empower learning and foster agency (Anyichie, 2018). Culturally informed pedagogies such as culturally responsive teaching, culturally relevant pedagogy and culturally sustaining pedagogy is beneficial due to its emphasis on how culture influences and shapes students learning (e.g., Ladson-Billings, 1995, 2001; Villegas and Lucas, 2002; Gay, 2018), and the need to sustain students' linguistic and cultural backgrounds in schools (Paris, 2021). For instance, culturally responsive teaching (CRT) demonstrates how students are motivated to participate in classroom contexts that are relevant and personally meaningful to their cultural backgrounds and lived experiences (Gay, 2018). Nevertheless, most research in this area tend to focus on teacher instructional activities with less investigation into the impact on students' experience of motivation and engagement.

On the other hand, self-regulated learning (SRL) research has directly documented the relationship between practices that foster SRL and diverse learners' motivation and engagement. SRL describes students' exercise of control over their thoughts, emotions and behaviours in order to achieve a goal (Zimmerman, 2015). Self-regulating learners are active and successful learners who deploy diverse cognitive strategies to sustain their motivation and engagement during learning. SRL research has examined how educators can empower students' motivation by weaving practices that promote SRL into regular class activities (Butler et al., 2017; Dignath and Veenman, 2021). SRL-promoting practices (SRLPPs) such as choice provision and formative assessment practices (e.g., teacher and peer feedback, self-assessment) have the potential to foster student motivation and engagement (Perry, 2013), if deliberately designed to support students' understanding of the relevance of their learning activities. Lately, research in this area is beginning to pay a closer attention to sociocultural influences on learners' experiences (Hadwin and Oshige, 2011; Järvenoja et al., 2015; Anyichie, et al., 2016; Perry et al., 2017; Anyichie, 2018; Mclnerney and King, 2018). However, we need more research to understand how educators can embed SRL-promoting practices to design a culturally inclusive classroom contexts to support culturally diverse students' motivation and engagement.

Based on the complementarity between self-regulated learning (SRL) and culturally responsive teaching (CRT), it may be beneficial to integrate their practices to support culturally diverse students (Anyichie and Butler, 2017; Anyichie, 2018). Integrating these pedagogical practices can support culturally diverse students' motivation and learning engagement when deliberately woven into activity design to connect with students' backgrounds, interests and lived experiences; and empower learners' active participation (Gay, 2013; Anyichie, 2018; Anyichie and Butler, 2018, 2019; Kumar et al., 2018; Gray et al., 2020; Anyichie et al., 2023). Therefore, this research focused on examining the motivation and learning engagement of *all* students from diverse linguistic and cultural backgrounds in a classroom context (e.g., complex task) that embedded self-regulated learning and culturally responsive teaching practices.

Designing classroom contexts for culturally diverse students' motivation and engagement: CRT and SRL pedagogical practices

Like research on SRL, literature on CRT also identifies qualities of classroom contexts including pedagogical practices that relate to students' motivation and engagement. Although culturally informed frameworks such as culturally responsive teaching (e.g., Villegas and Lucas, 2002; Gay, 2010); culturally relevant pedagogy (e.g., Ladson-Billings, 1995); and culturally sustaining pedagogy (e.g., Paris, 2012) emerged from diverse perspectives, they all highlight the role of sociocultural contexts in the individual learning processes. Based on the knowledge that learners are motivated to participate in classroom contexts they perceive to be personally meaningful to their social and cultural backgrounds, interests, values and lived experiences, these frameworks suggest some instructional practices. Specifically, this study was stirred by culturally responsive teaching (CRT) due to how it emphasises the need to create classroom teaching practices to support the learning of minority and racialized students of colour (Gay, 2018). Examples of culturally responsive pedagogical practices (CRPPs) include adjusting curriculum content to connect with students' cultural backgrounds and lived experiences such as introducing multicultural textbooks; designing opportunities for diverse students' interactions about personal or cultural issues to establish cross-cultural communications; developing teachers and students' cultural competence through support for their knowledge of their cultural heritages and that of other students; and utilising students' socio-cultural backgrounds, prior knowledge and lived experiences as resources for instruction in order to establish cultural congruity (Gay, 2013, 2018; Ladson-Billings, 2021). Research suggests connection between these pedagogical practices and student motivation (e.g., Ginsberg and Wlodkowski, 2015), and learning engagement (e.g., Villegas and Lucas, 2002; Aceves and Orosco, 2014; Howard and Rodriguez-Minkoff, 2017; Gay, 2018; Ladson-Billings, 2021).

SRL literature complements CRT research by showing pedagogical practices that also foster student motivation and engagement and context. Self-regulating learners are successful in regulating their participation in learning processes including motivation and engagement (Zimmerman, 2002; Perry, 2013). SRL-Promoting Practices (SRLPPs) include offering students opportunities to make choices and decisions about their learning, engage in self and peer assessment, evaluate their work and engage in cycles of strategic action. SRLPPs are linked to student motivation and quality of engagement (McCann and Turner, 2004; Anyichie and Onyedike, 2012; Perry, 2013; Anyichie and Butler, 2015, 2019; Schmidt et al., 2018; Anyichie et al., 2023).

In line with culturally inspired frameworks, SRL models (e.g., Winne and Hadwin, 1998; Pintrich, 2000; Zimmerman, 2000; Efklides, 2011) also emphasise individual and social processes of learning. For example, Butler and Cartier's situated model of SRL (Cartier and Butler, 2016; Butler and Cartier, 2017) highlights the role of dynamic interactions between individuals and contexts in shaping their motivation and learning engagement. This situated model provided a practical guide for the development of the integrated framework drawn on in this study. For example, a deliberate integration of culturally responsive and relevant pedagogy and SRL-Promoting practices has the potential to boast culturally diverse students' motivation and engagement especially when explicitly designed to support both sociocultural and individual processes of learning (Anyichie et al., 2016, 2018, 2023; Anyichie, 2018; Anyichie and Butler, 2019). Learning contexts that foster SRL, such as building meaningful complex tasks that involve students in choice making, collaboration, self-evaluation, monitoring, and strategic action (e.g., task interpretation, planning, monitoring) increase students' engagement (Wigfield et al., 2008; Perry, 2013). Such contexts have the potential to foster culturally diverse learners' regulation of their motivation and learning engagement especially if they are deliberately designed to attend to both individual and

sociocultural processes of learners (Anyichie et al., 2016, 2018, 2023; Anyichie and Butler, 2017).

An integrated pedagogy: A CR-SRL framework

We have briefly described above how CRT and SRL principles can be applied in creating classroom learning contexts including pedagogical practices that are associated with student motivation and the quality of their engagement including their SRL. In this section, we introduce an integrated framework that draws SRL and CRT practices together (see Figure 1; for more specific information about this framework and its development, see Anyichie and Butler, 2017; Anyichie, 2018). The integrated pedagogies in this framework are consistently related to increase in students' motivation, engagement, SRL and achievement (Brayboy and Castagno, 2009; Elaine and Randall, 2010; Wolters and Taylor, 2012; Aceves and Orosco, 2014; Anyichie, 2018; Anyichie and Butler, 2018; Kumar et al., 2018; Perry et al., 2020; Anyichie et al., 2023). This framework was developed as a guide for educators in designing an inclusive classroom context that are connected to students' cultural background, interests, lived experiences in order to motivate them to engage in new knowledge construction (e.g., learning a new topic). This framework includes three interdependent and continuous dimensions including: (1) classroom foundational practices; (2) designed instructional practices; and (3) dynamic supportive practices (see Figure 1). Each of these dimensions demonstrates how CRPPs and SRLPPs could be combined to design culturally empowering learning environments.

Classroom foundational practices describe teacher's proactive preparatory activities in setting up a classroom context that is ripe for implementation of effective teaching and learning practices (e.g., creating a culturally responsive/relevant, safe, empowering and supportive learning environment). Both CRT and SRL literatures identify foundational practices such as supporting knowledge of learners and designing culturally inclusive and supportive contexts. For example, as a strategy, "knowledge of learners" refers to those instructional practices teachers can use to gain a better understanding of their students' background, histories and support metacognitive knowledge of themselves (e.g., ice breakers, a know yourself game, background surveys, etc.). In addition, educators can foster their own cultural competence, activate their prior knowledge by questioning their cultural bias and facilitating conversations about issues of racism, cultural diversity, and inequity (Ginsberg and Wlodkowski, 2015; Gay, 2018; Ladson-Billings, 2021). The knowledge base from these instructional practices will help educators in creating culturally relevant classrooms (e.g., by connecting class learning activities to students' cultural backgrounds and lived experiences, *CRPP*), activating students' prior knowledge and empowering their interests to participate in new learning, *SRLPP* that sustains their ways of being. These kinds of classrooms increases students cultural competence, sense of belonging, engagement and motivation (Ginsberg and Wlodkowski, 2015; Gay, 2018).

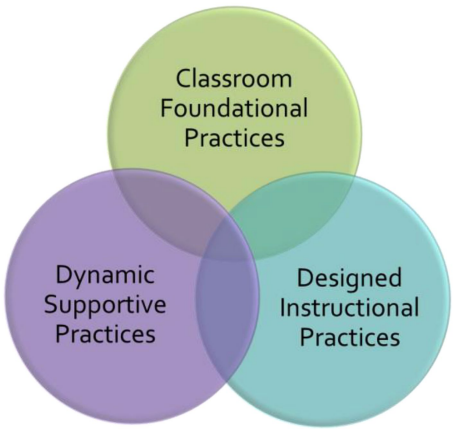

FIGURE 1
A culturally responsive self-regulated learning framework. Source: Adapted from Anyichie (2018).

Designed Instructional practices form the epicentre of this framework. These instructional practices describe a blend or a combined CRPPS and SRLPPs within a learning context. For example, SRLPPs such as choice provision and prior knowledge activation could be embedded into a task to promote the relevance and meaningfulness of that task to learners' lived experiences and cultural background (CRPPs). Research shows how students' motivation and engagement increases in context they feel sense of autonomy over their learning experiences (Jang et al., 2016; Butler et al., 2017). Learning tasks that are "complex" in design create opportunities to weave in CRPPs and SRLPPs. A "complex" task defines the learning activity that encompasses many features such as integrating different subject areas, addressing many instructional goals, focusing on different chunks of learning content, involving students in making meaningful decisions, and with opportunities to demonstrate their learning in multiple ways (Perry, 2013). For example, a complex task (e.g., a science project) can be designed to connect with students' cultural background and lived experiences (CRPPs); and empower their agency towards cultural competence (SRLPP, CRPP) by providing opportunities for decision and choice making, exercising control over the level of learning challenge, self-evaluation, and strategic action (SRLPPs). The integration of CRPPs and SRLPPs creates opportunities for educators to design empowering culturally relevant classroom context. For instance, fusing culturally relevant choices into a complex task (i.e., CRPP & SRLPP in tandem, such as asking students to choose a topic for their science project with cultural relevance and that will address a need of their community), as well as weaving a sequence of CRPPs and SRLPPs within the sample task has benefits in supporting student motivation and engagement in culturally diverse classrooms (Anyichie, 2018).

Dynamic supportive practices refer to all the supports that are offered to students as their learning unfolds. These instructional practices can embed SRLPPs and CRPPs together in a learning context. Dynamic supportive practices include multidimensional feedback from peers, teachers and parents (e.g., highlighting examples of what could be done to improve an on-going project); formative assessments e.g., completing self and peer assessment forms based on rubrics; (Nicol and Macfarlane-Dick, 2006) that are relevant to student cultural backgrounds and lived experiences (Montenegro and Jankowski, 2017; Egbo, 2019; Ladson-Billings, 2021).

Research-based pedagogical practices integrated in this framework have been associated with student SRL, engagement, motivation and success (Anyichie, 2018; Anyichie and Butler, 2018; Kumar et al., 2018; Anyichie et al., 2023). Researchers have identified the significance of situating SRL and motivation research within learners' social and cultural contexts (e.g., McInerney, 2011; Zusho and Clayton, 2011; Järvenoja et al., 2015; King and McInerney, 2016; Perry et al., 2017).

Building on this opportunity, the current study examined students' experiences of a complex task an elementary school teacher designed based on CRT and SRL principles and instructional practices to support motivation and engagement for *all* learners in his multicultural classroom.

Defining engagement and motivation

In this study, we investigated engagement as a multidimensional construct in a more integrative way. Still, to ground our research and inform our development of our measures, it was important to delineate the dimensions of engagement that are intertwined in the context of any given learning activity. Engagement describes the quality of a student's active participation in a learning activity (Christenson et al., 2012). Student engagement including behavioural, emotional, cognitive and agentic dimensions involves a range of actions taken up to advance learning and make academic progress (Fredricks et al., 2004; Reeve and Tseng, 2011; Reeve, 2013). *Behavioural engagement* describes students' overt behaviour and involvement in learning activities (e.g., asking and answering questions, concentration, help seeking and participation). *Emotional engagement* refers to students' feelings, attitude, and reactions about classroom tasks (e.g., expressions of anxiety, frustration). *Cognitive engagement* defines students' deliberate investment of needed effort in their learning activities, e.g., use of cognitive strategies, self-regulation, engagement in cycles of strategic action, persistence in challenging tasks (Fredricks et al., 2004; Cleary and Zimmerman, 2012; Pekrun and Linnenbrink-Garcia, 2012; Schunk et al., 2013; Sinatra et al., 2015). Recently, Reeve and Tseng (2011) introduced *agentic engagement* that is defined as a "student-initiated pathway to a more motivationally supportive learning environment" such as active contribution to the flow of a learning activity including making suggestions and offering input (Reeve, 2013, p: 581). Although, there are research on these dimensions of engagement based on self-report approach (e.g., Jang et al., 2016), it can be challenging to distinctively capture them in context because of their interconnections and overlap within a given learning activity (Bingham and Okagaki, 2012). For instance, student behavioural engagement is linked to emotional engagement such as enjoyment (Pietarinen et al., 2014); and there is a relationship between behavioural and cognitive engagement (Wang et al., 2011; Martin, 2012). Thus, the current study looks at all these dimensions together without trying to tease them apart. Research findings have associated engagement with positive learning outcomes including student motivation, achievement and success (Fredricks et al., 2004; Appleton et al., 2008; Reeve and Tseng, 2011; Reschly and Christenson, 2012; Kahu, 2013). Similarly, scholars tend to agree that there is a relationship between engagement and motivation while at the same time identifying them as distinct constructs (Martin, 2012; Reeve, 2012).

Motivation defines the rationale and driving force for a learning behaviour. Student motivational processes (e.g., perception of learning context as valuable, interesting, relevant, enjoyable, important) predicts their engagement (e.g., concentration; Anyichie, 2018; Jones et al., 2021; Anyichie et al., 2023). For instance, students have increased motivation to engage in learning activity they feel the sense of autonomy (Evans and Boucher, 2015; Jang et al., 2016), and perceive as relevant and useful in attaining their goals (Wigfield and Eccles, 2000).The different dimensions of engagement are also connected with motivational and/or self-regulation constructs (Sinatra et al., 2015). On the one hand, researchers in the field of engagement include self-regulatory behaviours as part of engagement (e.g., cognitive, and agentic engagement). On the other hand, researchers in the field of SRL have identified a reciprocal relationship between SRL and cognitive engagement (Cleary and Zimmerman, 2012; Wolters and Taylor, 2012). However, less research has considered student engagement in self-regulation of learning.

Engagement in self-regulation of learning

Engaging in self-regulation of learning entails exercising control over one's involvement and participation in a learning activity. Models of self-regulation advance our understanding about how students' engagement in learning activities involves cognition and metacognition, motivation and emotion, and strategic action (Butler et al., 2017). Therefore, SRL cuts across all the dimensions of engagement. For instance, agentic engagement implies proactive exercise of control and ownership of learning (i.e., SRL). All the other identified dimensions of engagement are within the terrain of self-regulatory processes during learning engagement. That is, self-regulated students proactively participate in learning activities, and manifest the type of overt behaviours and emotions that are connected with engagement in effective forms of learning (Wolters and Taylor, 2012). Based on the interconnectivity among the different dimensions of engagement, and overlap between SRL and engagement, this study focused also specifically on engagement in SRL.

Association between classroom contexts and students' engagement and motivation

Research demonstrates how teachers can create classroom contexts including tasks and instructional practices that foster students' development and engagement in SRL (Perry and Vande Kamp, 2000; Butler et al., 2013). Tasks that allow opportunities for students to make choices, exercise control over the level of their learning challenges, evaluate their learning progress, and participate in cycles of strategic action (e.g., planning, enacting and adjusting strategies, and monitoring) have been associated with motivation and engagement in SRL (Perry, 2013; Butler et al., 2017). Further, meaningful tasks that are "complex" in design allow opportunities to weave in SRL-promoting practices.

Research in the fields of CRT and SRL has independently examined student motivation and engagement. For instance, SRL research shows how embedding SRLPPs such as offering students choices support their motivation and engagement due to how it empowers student autonomy in their learning process (Jarvela et al., 2012; Jang et al., 2016; Patall et al., 2016; Montenegro, 2017; Perry et al., 2020). Also, literature is suggesting that culturally diverse students could be motivated to actively engage in classroom activities that are relevant to their cultural backgrounds, lived experiences and prior knowledge (i.e., CRPPs; Kumar et al., 2018; Gray et al., 2020). Nevertheless, there is a dearth of research about how the integration of SRLPPs and CRPPs can support motivation and engagement for students in culturally diverse classroom.

Student learning processes including motivation and engagement in SRL are dependent on the contextual features of a learning environment (Järvenoja et al., 2015; Nolen et al., 2015). For instance, the interaction between students and their classroom context impacts the quality of their engagement and motivational processes including enjoyment, importance and interest (Järvenoja et al., 2015; Nolen et al., 2015; Shernoff et al., 2016; Butler and Cartier, 2017; Anyichie, 2018; Anyichie et al., 2023). Furthermore, utility-value intervention research (e.g., Yeager et al., 2014; Harackiewicz and Priniski, 2018; Hecht et al., 2021) that built on expectancy-value-theory (Wigfield and Eccles, 2000) document how students' motivation (i.e., perceived usefulness or value

of a learning tasks) shape their engagement (i.e., effort, concentration, self-regulation, and persistence). Therefore, the current student focused on examining culturally diverse students' engagement and motivation in the context of a complex task that integrated both CRPPs and SRLPPs in tandem.

Study context

This study investigated the use of a CR-SRL framework in fostering student engagement and motivation in a culturally diverse classroom. The full study was conducted with two volunteer teachers and students in their upper elementary school classes (grades 4 and 5, respectively) in schools located at a multicultural urban centre in a western province in Canada. For the purposes of this report, we focus on just an in-depth case study of one of those teacher's classrooms (Joseph who volunteered and consented to participate). The choice of upper elementary classes was to include students with the maturity to articulate their cultural backgrounds and learning experiences. Prior to this study, the lead author was already collaborating with Joseph in supporting culturally diverse learners in his classrooms. He had separate conversations with Joseph about his goals and research interests for his students. While serving as a collaborator, the lead author facilitated independent meetings with Joseph about the content and implementation of the CR-SRL framework to support engagement and motivation for students from diverse cultural backgrounds. Their meetings were guided by the collaborative inquiry framework that focuses on identification of goal, planning and implementing instructional practices, reflection on learning progress and refining strategies (Butler et al., 2013; Timperley et al., 2014).

Further, the lead author collaborated with Joseph and discussed possible ways of design learning activities that combined across CRPPs and SRLPPs. The lead author, a researcher of an African descent had experiences of studying and working in culturally diverse contexts. His experience in these contexts were influential on how he was assisting Joseph's implementation of the framework. Nevertheless, Joseph made the decisions about how to integrate the SRLPPs and CRPPs within his chosen learning activity as he considered appropriate for his students.

As well, before the data collection in Fall 2017, the lead author explained all the data collection measures and processes to Joseph and formally invited him to participate. He provided Joseph with consent/assent forms for himself, his students' parents/guardians, and the students. He explained to the students that the study was to investigate with their teachers on how best to support their learning. Joseph as well as the students that submitted signed parental/assent forms to participate were invited to be part of the studies. Ultimately, all the appropriate ethics approvals were received for this study. The researcher then worked with the Joseph across the year to plan and enact CRPPs and SRLPPs in the context of a complex task.

Purpose and research questions

This study examined culturally diverse learners' engagement in a complex task that integrated SRLPPs and CRPPs within one elementary classroom; and how their motivation-related perception of the contextual features shaped their learning engagement. It asked the question: (1) How did student engage in the complex task? and (2) How were contextual features related to students' motivation and engagement in the complex task?

Materials and methods

Design

We conducted an in-depth, case study of a complex learning task that involved grade 4 and 5 classrooms. Case study designs are effective in examining a complex, dynamic and multidimensional phenomenon as it manifests *in situ* (Merriam, 2009; Butler, 2011; Yin, 2014; Butler and Cartier, 2017). Such designs provide a framework for understanding students' learning processes and the connections between pedagogical practices (e.g., CRPPs and SRLPPs) and associated outcomes (e.g., SRL, engagement, and motivation). Also, a case study design is helpful in gathering multiple sources of data to investigate student learning processes as they unfold in context.

Participants

Joseph's classroom

This paper focuses on Joseph and his Grade 4 classroom that is situated in St. Mary's Elementary School (i.e., an independent school) identified as having multicultural and multilingual student populations in British Columbia, Canada. Joseph, a 5th generation male Canadian with Western European background, had bachelor's in Education (BEd). He had 25 years of teaching experience and had taught grades 4–12. He has been teaching in his current school (St. Mary's elementary) for 19 years and grade 4 for 9 years. Although Joseph had knowledge of designing complex tasks in his class, he had no knowledge of SRLPPs and CRPPs.

Table 1 shows that Joseph's 31 grade 4 classroom students were between the ages of 8 and 9 and came from linguistically and culturally diverse backgrounds. In this classroom, while 8% of the students had English as their first language, 16% had first languages other than English; and 29% had a home language other than English. Fifty-four percent (54%) of the class had both parents as born in Canada and 45% had at least one parent who was not born in Canada. Table 2 shows the diversity of student identified first and home languages, countries and ethnicities, and that of their parents.

Student participants in Joseph's classroom

All students in Joseph's classroom ($n = 31$) were invited to participate in this study. Joseph distributed parent consent and student assent forms to the students approximately 2 weeks prior to data collection. Ultimately 18 students participated in the study. Tables 1, 2 show that these participants reflected the linguistic and cultural diversity in the whole class.

Selected students in Joseph's classroom

To gain an in-depth understanding of the students' learning processes and experiences in the context of a complex task, we also selected 12 students for deeper study, from among the 18 participants, through purposeful sampling. Purposeful sampling involves the deliberate selection of participants from whom one can learn the most (Creswell and Plano Clark, 2010; Palinkas et al., 2015). This subset of students was identified through their teacher's professional judgement as experiencing different levels of engagement (i.e., low, medium and high-level). The teacher's judgement might be limited by bias and lack of full knowledge of students' levels of engagement at the beginning of the academic year. The selection of students at different levels of

TABLE 1 Student demographics.

Grade 4 students	Total # of students	M	F	Ages Years (Months)	First language as English # (%)	First language other than English # (%)	Home language other than English # (%)	Both parents are born in Canada # (%)	Either or both parents are not born in Canada # (%)	Special needs designation # (%)
Whole class	31	18	13	8 (9) – 9 (8)	26 (83.9%)	5 (16.1%)	9 (29%)	17 (54.8%)	14 (45.2%)	3 (9.7%)
Participants	18	11	7	8 (10) – 9 (8)	15 (83.3%)	3 (16.7%)	5 (27.8%)	10 (55.6%)	8 (44.4%)	1 (5.6%)
Selected	12	8	4	8 (10) – 9 (7)	10 (83.3%)	2 (16.7%)	4 (33.3%)	6 (50%)	6 (50%)	1 (7.7%)

TABLE 2 Students' linguistic and cultural diversity.

Grade 4 students	First language other than English	Home language other than English	Countries of parent(s) born outside of Canada	Ethnicity/or countries of origin
Whole class	Spanish, Croatian, Portuguese, and Greek.	Italian, Portuguese, Croatian, Greek, and Spanish.	Philippines, Croatian, Italy, Yugoslavia, Greece, Germany, Portuguese, El Salvador, Mexico, Guatemala, and Columbia.	Caucasian, African, Latino, Italian, Southeast Asian, Australian, Scottish, and Trinidad.
Participants	Portuguese, Greek, and Spanish.	Italian, Portuguese, Greek, and Columbian.	Philippines, Italy, Greece, Germany, Portugal, and El Salvador.	Caucasian/ Canadian, southeast Asian, Italian, African, Latino, and Trinidad.
Selected	Portuguese and Greek.	Italian, Portuguese, and Greek.	Philippines, Italy, Greece, Germany, and Portugal.	Caucasian, African, Italian, and Southeast Asian.

engagement gave a rough sense of how the teacher perceived students to be engaged and motivated in the class prior to the start of the complex task. Again, Tables 1, 2 show that these selected students reflected the linguistic and cultural diversity of the class as a whole and the full set of participants.

Procedure

Co-designed complex task

As part of this study, the lead researcher co-designed a complex task with Joseph based on "A Culturally Responsive Self-Regulated Learning Framework" (Anyichie and Butler, 2017; Anyichie, 2018), as described earlier. Joseph made a choice of the focus and structure of the learning task as it allowed him opportunities for the integration of CRPPs and SRLPPs. The complex task "*Understanding Animal and Human Adaptations to the Land*" co-designed for students in Joseph's class was divided into three major interconnected sections: (1) animal adaptations; (2) First Nations' adaptations to the land; and (3) my adaptation to school. The first section asked the students to research the senses and adaptation of any insect of their choice from the "Bug Wars Playlist" posted on the class website designed by the teacher for this complex task. Instructions for this section included: (i) make a best copy of a scientific drawing after viewing "Austin's Butterfly"[1]; (ii) create a multimedia book using the "Book Creator" app; and (iii) share and present your project online. Building on what the students were learning on the first section, the second section focused on human adaptation with attention on the First Nations peoples. Section two required the students to each research one of the Aboriginal peoples in Canada (e.g., Inuit, Metes and First Nations). This section also asked the students to compare their findings with their own daily lives by responding to questions, including: "What is the biggest difference? What is most surprising when I think of my life? If I was a First Nation person my age, what would I enjoy the most?" and in groups to record their thoughts and impressions of a field trip to Museum of Anthropology in a podcast. The third section asked the students to build on what they were learning about animal adaptations, First Nations' challenges and adaptation, and research on their personal challenges in school and generate possible strategies for their own adaptations. As part of the third section, the complex task ended by asking the students to gather in their small groups, discuss their common challenges and adaption strategies, and present their ideas through a role play.

Data collection

To gather evidence in relation to the research questions, we used mixed methods embedded into a case study design (Yin, 2014). A case study design allowed us to study the SRL engagement of selected students in considerable depth by coordinating multiple sources of data including: (1) classroom observations and associated field notes; (2) documents (e.g., learning task instructions); (3) student work samples; (4) students' self-reports about their engagement and motivation using an Experience Sampling and Reflection Form (ESRF); and (5) interviews with the participating students.

Observations

Overall, the lead researcher conducted 9 days observations (515 min) with 12 learning episodes while the students were working on their complex task in Joseph's classroom. Observations focused on the instructional practices Joseph enacted to support culturally diverse

1 Austin Butterfly if a video of models, critique and constructive feedback. (https://www.youtube.com/watch?v=E_6PskE3zfQ).

students both in the task and as their participation in it unfolded; and how the students were participating in those practices. Each observation lasted between 40 and 70 min. Observing the same students across different sections of the complex task provided an opportunity to understand their engagement and motivation processes as related to the specific features of the context in which they were working.

During each classroom observation, the lead researcher created a running record of what he observed (see Anyichie, 2018), including teacher and student talk. In those records, he tried to capture all actions "verbatim" as much as he could during individual and small group activities. Some of the observations were video-taped when it was possible to capture only students who consented to participate. Those video-taped observations supported us in gathering contextual information, and better understanding and interpreting behaviour including non-verbal cues. Occasionally, the lead researcher debriefed with the students as he circulated during an observation; and, with the teachers after each observation to clarify how what was happening related to engagement and observed practices, respectively.

Teacher document review

The lead researcher accessed the complex task instructions and plans to help identify instructional practices Joseph embedded in the task to support his students. The review of those documents helped to focus attention during observations on how students were engaging in relation to their motivation-related perception of the specific contextual features (e.g., SRLPPs, such as opportunities for choice and self-evaluation; and CRPPs including opportunities for students to bring ideas from cultural backgrounds and lived experiences).

Student work samples

During the observations, as students worked on their complex task, the lead researcher photographed samples of their work. He, sometimes, took pictures of draft copies in students' work folders. These pictures aided us in seeing how students were engaging in the complex task in relation to their motivational processes based on their perception of the contextual features of each different section.

Experience sampling and reflection form (ESRF)

To gather students' self-reports of their motivational processes and engagement in the complex task, we used the ESRF (adapted from Larson and Csikszentmihalyi, 2014). This form asked questions about students': (1) *feelings* (i.e., how did you feel about working on this activity today?); (2) *concentration* (i.e., how well did you concentrate while working on this activity/project today?); (3) *perceptions of challenge* (i.e., was this activity challenging for you? If so, what made it challenging? What did you do about the challenge?); (4) *perceptions of importance* (i.e., how important is this activity?); (5) *perceptions of enjoyment* (i.e., did you enjoy what you worked on today?); and (6) *interest* (i.e., was this activity interesting?). Students rated their responses from: *not at all = 0, slightly = 1, somewhat = 2, much = 3; to very much = 4*; and explained the reason for their rating by responding to a follow-up "why"? Students were asked to fill in this form each time they worked on their complex task. Asking them to report their experiences immediately reduces retrospective bias. These repeated reports ($n = 77$) helped us to examine and understand students' real-time experiences of motivation and engagement over time.

Interviews

To gather information from the students, the lead researcher conducted individual in-depth semi-structured interviews at the end of the study. Participating students were asked about their perceptions of classroom activities (i.e., their motivational processes) and their engagement within them. For example, they were asked questions such as: Can you tell me how you felt about the project (i.e., complex task)? Was it interesting? What was helpful? Why was that helpful? What was challenging? Why was that challenging? What would you recommend if your teacher were to do that again?

Data analysis

Our interpretative strategies included a combination of qualitative (e.g., of classroom observations, documents, student interviews and student work samples) and, quantitative (e.g., of student self-reports on the ESRF) analyses.

Coding of teacher practices

We started by transcribing video-taped classroom observations, debriefings and semi-structured student interviews. We also reviewed the instructions for different sections of the complex task and student work samples. *A priori* categories derived from CR-SRL framework (see Anyichie and Butler, 2017; Anyichie, 2018 for detailed review) were used for coding while being open to new instructional practices. Two levels of coding were employed to enable capture a wide range of teacher pedagogical practices.

At the first level, we developed a sequential list of all the instructional practices enacted in each section of the complex task. Next, we started our coding by looking at each of the listed practices from an SRL point of view, identifying any practice consistent with SRLPPs. Next, we reviewed the full list of teaching practices from a CRT lens, flagging any practice clearly associated with CRT principles. The result was a sequential list of instructional practices identified as SRLPPs, CRPPs, neither or both. This coding approach empowered us to interpret whether and how SRLPPs and CRPPs were interwoven within each section of the task (Larson and Csikszentmihalyi, 2014).

At a second level, once all sections and activities were coded, we categorised the instructional practices in relation to the three main categories of instructional practices identified in the CR-SRL framework (i.e., foundational, designed instructional and supportive practices). This lens facilitated our interpretation of how the teaching practices Joseph enacted were either consistent or not with the major recognised instructional practices within the SRL and CRT literatures. Lastly, we mined fieldnotes and teacher documents for confirming or disconfirming evidence.

Coding of SRL-promoting practices (SRLPPs)

Teacher instructional practices were coded as supportive of SRL if there were evidence of the teacher: (a) providing opportunities for choice and control over challenge (e.g., allowing students' choice and decision making, scaffolding students' meaningful choices, and supporting control over learning); (b) fostering self-assessment (e.g., by creating opportunities for students' self-reflection, self-monitoring, and adjusting of learning); (c) offering teacher support [e.g., by providing resources and instrumental supports, and co-regulatory opportunities between the teacher and student(s)]; (d) providing opportunities for peer support (e.g., offering opportunities for peer-to-peer support group activities, co-regulation of learning, and assessment); and/or (e) providing opportunities for students to engage in cycles of strategic action.

Coding of CRT pedagogical practices (CRPPs)

Teacher instructional practices were coded as CRT when there was evidence of the teacher: (a) establishing cross-cultural communication (e.g., creating opportunities for social interactions about personal or cultural issues); (b) designing cultural diversity in curriculum content (e.g., adjusting and situating curriculum content to connect with students' prior knowledge and lived experiences by using multicultural textbooks); and/or (c) establishing cultural congruity in classroom teaching and learning (e.g., matching class instruction with students' prior experiences and cultural background).

Note that each instructional practice was reviewed twice, once from an SRL lens and once from a CRT perspective. The result was that some practices were coded under both SRL and CRT (see findings).

Coding of students' engagement and motivation

We analysed and interpreted students' engagement based on three sources of data: (1) students' reflections through the complex task (using the ESRF), (2) students' work samples and (3) observations of students' engagement over time. We analysed the ESRF by creating a display of each student's ratings on concentration (as an indicator of engagement), perception of challenge, and the two motivationally-related self-reports (i.e., perceptions of importance, and interest)[2]. Then, we calculated descriptive statistics, and constructed displays to help us see how students' motivation (i.e., their perceptions about the contextual features of the complex task in terms of being important and interesting) shifted across days and were related to their engagement (i.e., self-reported concentration). Furthermore, to gain more understanding of the possible relationships between students' motivational perceptions of, and engagement in the complex task, we conducted correlational analyses. To support identifying patterns, we roughly interpreted quantitative data from the ESRF (<2.5) as below midpoint and (>2.5) as above midpoint.

To code observational data on students' engagement in the complex task, we reviewed all the field notes from observations and transcripts of debriefs to describe student activities and identify examples of their engagement in specific contexts of the task. Student activities were coded as engagement when there was evidence of students' participation and direct involvement in learning activities including asking and answering questions, listening, note taking, help-seeking, making suggestions, offering input in class, and reacting about the task. Behaviours that do not directly reflect engagement in a learning activity (e.g., arranging seats and gathering textbooks in preparation for lessons) were not coded as engagement in learning.

Whenever we identified an association between students' motivational processes (e.g., perception of Joseph's instructional practices in terms of being interesting, important) and student engagement in our displays, we then examined other forms of data (e.g., student work sample and complex task instruction) to look for patterns to examine and understand how specific instructional practices such as CRPPs and SRLPPs may have facilitated individual students' engagement in specific contexts.

Identifying associations between student engagement and motivation, and the contextual features of the complex task

To see patterns between enacted integrated instructional practices such as CRPPs and SRPPs, students' motivation-related perception and students' engagement in them, we created data displays cross-referencing teachers' instructional practices and students' interactions in specific contexts (Miles et al., 2013) using Nvivo 11 software. Students' profiles across different data sources were cross-analysed for recurring patterns. We also created displays that showed teachers' instructional practices in relation to selected students' self-reported engagement on different days, based on both observations and their narrative descriptions on the ESRF.

Results

Our major goal for this paper was to examine and understand how culturally diverse students' engagement and motivation were related to the contextual features of a complex task that integrated CRPPs and SRLPPs. In this section, we start by presenting the quantitative findings of student engagement and motivation as situated in the context of a complex task, and the link between their engagement and motivation, and teacher instructional practices in that context. Then, we present case study results with mixed evidence of both quantitative and qualitative findings of associations between students' engagement and teacher's integrated CRPPs and SRLPPs.

Students' motivation and engagement in the complex task

To gain understanding of students' motivation (i.e., their in-the-moment perceptions in the complex task), as it unfolded across days, we examined ESRF reports of both (1) students' self-reported concentration (as an indicator of engagement); and (2) whether they perceived the complex task on each day as challenging, interesting, important, and/or enjoyable (as an indicator of situated motivation). Table 3 shows that students who participated in the CR-SRL complex task across the 5 days experienced high-levels of engagement (concentration, $M = 3.20$, $SD = 0.74$). They also perceived the complex task to be highly important ($M = 3.53$, $SD = 0.87$), interesting ($M = 3.36$, $SD = 1.18$), and not very challenging ($M = 0.74$, $SD = 0.90$). Their perceptions of the task as highly important and interesting reflected high-levels of motivation ($M = 3.50$, $SD = 0.80$).

Selected students' motivation and engagement in the complex task

Similar to the ESRF results for all participants, Table 4 shows that selected students who participated in the complex task across the 5 days experienced high-levels of engagement. Across days, like all the participants, the selected students perceived the complex task to be highly important, and interesting; and not very challenging.

2 Ratings of enjoyment were not available. Joseph decided to redesign the ESRF to make it more appealing to his students and mistakenly excluded the question on enjoyment. By the time the lead author realised it, it was too late to include it in their reflection form.

TABLE 3 ESRF: Mean values and standard deviation for students' experiences of engagement, perceptions of challenge, and motivation during the complex task across days.

				Engagement	Perceptions of challenge	Motivation		
	Day*	# of participants	# of ESRF	Concentration *M* (SD)	*M* (*SD*)	Important *M* (*SD*)	Interesting *M* (*SD*)	Overall Motivation *M* (*SD*)
	5	18	16	3.19 (0.63)	0.94 (0.75)	3.77 (0.42)	3.83 (0.55)	3.81 (0.31)
	8	18	15	2.87 (0.96)	0.87 (1.09)	3.33 (0.94)	3.00 (1.57)	3.10 (1.07)
	9	18	17	3.44 (0.60)	0.50 (0.76)	3.63 (0.70)	3.88 (0.48)	3.81 (0.34)
	10	18	16	3.19 (0.73)	0.88 (0.93)	3.19 (1.24)	2.40 (1.25)	2.84 (1.03)
	11	18	13	3.33 (0.62)	0.58 (0.86)	3.83 (0.37)	4.00 (0.00)	3.92 (0.19)
Total	5	18	77	3.20 (0.74)	0.74 (0.90)	3.53 (0.87)	3.36 (1.18)	3.50 (0.80)

* = Day with self-report on ESRF. The rating and coding schemes are based on data from the ESRF: Scale: 0 = Not at all, 1 = slightly, 2 = somewhat, 3 = much, 4 = Very Much. There are 5 days of data instead of 6 because many students did not complete the ESRF on one of the days. ESRF of that day is excluded.

TABLE 4 ESRF: Selected students' engagement, perceptions of challenge, and motivation during the complex task across days.

				Engagement	Perception of challenge	Motivation		
	Day	# of selected	# of ESM	Concentration *M* (SD)	*M* (*SD*)	Important *M* (*SD*)	Interesting *M* (*SD*)	Overall *M* (*SD*)
	5	12	12	3.19 (0.63)	0.94 (0.75)	3.77(0.42)	3.83 (0.55)	3.81 (0.31)
	8	12	12	2.87 (0.96)	0.87 (1.09)	3.33 (0.94)	3.00 (1.57)	3.10 (1.07)
	9	12	12	3.44 (0.60)	0.50 (0.76)	3.63 (0.70)	3.88 (0.48)	3.81 (0.34)
	10	12	12	3.19 (0.73)	0.88 (0.93)	3.19 (1.24)	2.40 (1.25)	2.84 (1.03)
	11	12	6	3.33 (0.62)	0.58 (0.86)	3.83 (0.37)	4.00 (0.00)	3.92 (0.19)
Total	5	12	54	3.24 (0.79)	0.81 (0.84)	3.67 (0.83)	3.37 (1.22)	3.53 (0.88)

TABLE 5 Bi-variate and partial correlations among concentration, interest, and importance.

Control	Variables	Concentration	Interest	Importance	M	SD	N+
none	Concentration	1			3.18	0.78	62
	Interest	0.491*	1		3.34	1.2	62
	Importance	0.321*	0.399*	1	3.56	0.86	62
Importance	Concentration		0.418*				
Interest	Concentration			0.157			

+Total valid number (listwise) of responses from the participants. *Correlation is significant at the 0.05 level (2-tailed).

Links between student motivation, engagement and teacher instructional practices

To trace the links between students' motivation and engagement, and teacher instructional practices in the complex task, this section presents: (1) the association between student motivation (i.e., students' self-reported perceived interest and importance) and engagement (i.e., self-reported concentration); (2) Joseph's perception of students' typical level of engagement as related to engagement in the complex task; and (3) a case study analysis of overall engagement as linked to contextual features (e.g., the integrated CRPPs and SRLPPs) of activities on specific days.

Associations between student motivation and engagement in the complex task

To better understand how students' motivational perceptions (i.e., interest and importance) in the context of the complex task could be associated with their engagement (i.e., concentration), we conducted a correlational analysis among the three variables of concentration, interest, and importance (see Table 5). Results indicated that all three variables were positively inter-correlated, suggesting a positive relationship between students' engagement and their motivational perceptions of the context.

Entering engagement as related to engagement in complex task

When choosing participants to focus on more closely (i.e., the selected students), Joseph identified students he perceived to be engaging at different levels across different kinds of classroom activities [i.e., high (HE), medium (ME), and low (LE) levels of engagement]. To examine how students with different entering levels of engagement perceived and participated in the complex task each day, ratings for selected students are presented in Table 6.

TABLE 6 Selected students' engagement, perceived challenge, and motivation profiles on ESRF during the complex task across days.

		Engagement Concentration					Perception of Challenge					Motivation									
												Importance					Interest				
Engagement levels	Students/ Days	5	8	9	10	11	5	8	9	10	11	5	8	9	10	11	5	8	9	10	11
HE	S1	4	3	4	4	3	1	1	1	1	1	4	4	4	4	4	4	2	4	0	X
	S2	3	3	4	4	3	1	1	0	0	X	4	4	4	4	X	4	4	4	4	X
	S3	3	3	3	3	X	2	2	1	2	X	4	4	4	4	X	4	4	4	4	X
ME	S1	3	3	3	4	4	1	1	1	1	0	4	3	3	4	X	2	1	4	3	4
	S2	2	1	4	3	X	0	0	0	2	X	4	4	4	4	X	4	0	4	2	X
	S3	4	3	4	4	4	2	0	1	0	1	4	4	4	4	3	4	4	4	4	4
LE	S1	4	1	3	3	X	1	0	0	0	X	X	1	4	0	X	X	0	4	2	X
	S2	2	2	3	3	3	1	3	0	0	3	4	3	4	4	4	4	4	4	3	X
	S3	3	3	3	2	2	0	0	0	0	2	3	4	3	1	3	4	4	4	1	X
	S4	3	4	4	4	X	2	2	1	2	X	4	4	X	4	X	4	4	X	4	X
	S5	4	3	4	4	4	2	0	1	0	1	4	4	4	4	4	4	4	4	4	4
	S6	4	4	4	2	X	1	0	0	0	X	4	4	4	3	X	4	4	4	1	X

HE = High-Engaged; ME = Medium-Engaged; LE = Low-Engaged. The shaded columns are the days on which the students reported concentration, interest, or importance at least three. X = Days particular student did not submit ESRF. The shaded columns are the days on which the students reported concentration, interest, or importance at least (3).

Overall, findings suggest that, while there were variations in self-reported concentration for all but one student across days, all of the pre-selected students, whatever their "entering" engagement, reported relatively high-level engagement in the complex task, at least on some days. For example, the shaded columns in Table 6 show that all students rated their concentration at 3 or above on at least 2, and most typically 3–4 out of 5 days.

Table 6 shows that, consistent with teacher's reports prior to the study, HE students ($N = 3$) all reported high-levels of concentration during the complex task each day. Two of the three students who the teacher had judged at the start to be somewhat engaged (ME students; $N = 3$) also reported high-levels of concentration across all days. The exception was S2, whose concentration varied from low (1 or 2 on Days 5 and 8) to high (3 or 4 on Days 9 and 10). Interestingly, contrary to teacher's prior experiences with the LE students ($N = 6$), these students were very often engaged during the complex task. All LE students were highly engaged on at least 3 of the 4 or 5 days on which they reported their concentration. While four of the LE's engagement varied across days, two LE students (S4 and S5) reported high levels of engagement throughout the complex task.

To better understand why these students' engagement might have varied across days, we looked at the context in which they were participating. As with the larger group, it did seem there were connections between students' perceptions of the context, especially in terms of whether it is interesting and important, and their engagement (see highlighted cells in Table 6). First, parallel to their relatively high-levels of engagement, most students reported high interest, importance, and concentration across days, including HE, ME, and LE students. Second, the days with the least concentration did seem to be somewhat (if not perfectly) associated with lower ratings of interest or importance (e.g., see LE S3 on Day 10 and ME S2 on Day 8). Still there were exceptions. For example, one of the ME students (S2) perceived the complex task to be highly interesting and important on Day 5 but reported relatively low concentration.

It is worth noting that all the pre-selected students perceived the complex task to be highly important and interesting on Day 9, suggesting that there were contextual qualities that all students perceived similarly on that day. Further, all students perceived the complex task to be interesting and important overall, at least at some point, whatever their "entry" engagement, suggesting some common benefits across students in task. But then some students' perceptions on some days (e.g., 8) were low, suggesting that not all students responded to the context in the same way. This finding suggests that it might be students' perceptions of the context that are key in predicting engagement, and also that individual students may experience the same contexts differently (individual and context interactions).

Associations between students' engagements and teacher instructional practices in the complex task: A case study of days 8 and 9

To gain more insight into the links between students' engagement during the complex task that integrated CRPPs and SRLPPs, as it unfolded across days, we looked at reflective written justifications for students' ratings on the ESRF and linked self-reported and observed engagement to observed teacher instructional practices including CRPPs and SRLPPs in specific contexts (i.e., days and sections of the complex task). In addition, we cross-checked these findings against other data, such as complex task instructions and student work samples. In this section, we chose Days 8 (i.e., when some students were less engaged) and 9 (i.e., when all the students were highly engaged) for an in-depth case study of those connections.

Case study of day 8

Selected students' self-reported engagement and motivational perceptions varied most on Day 8 (see Table 6). Prior to Day 8, Joseph had asked the students to conduct independent research on the First Nations' ways of life and share their findings in small groups. On Day 8,

TABLE 7 Classroom learning contexts (Days 8 and 9), teacher instructional practices (code), and samples of students' comments.

Days	Learning context	Teacher instructional practices (Code)	Sample of students' comments (ESRF)
8	Lesson Activity One: Teacher and students were brainstorming and sharing students' research findings about Aboriginal groups	scaffolded student thinking through brainstorming and questioning (SRLPP); – offered support on making connections between class activities and personal lives (SRLPP & CRPP); and, instructional support (SRLPP).	HE S1: "I felt bored because we did not use the ipads"; HE S3: "I like the First Nations people"; ME S1: "because we compare our differences, I get to learn about First Nations"; ME S2: "I'm not a fan of First Nations"; ME S3: "It was fun writing about First Nations Life"; LE S1: "I did not feel like working"; LE S2: "Some human beings [peers] are a little mean"; LE S3: "I like knowing about First Nations"; LE S6: "You get to learn about people that came before us."
	Lesson Activity Two: Students were independently and in groups comparing independent research findings about aboriginal groups and their own personal lives	scaffolded how to compare the First Nations' life with the students' lives through metacognitive questions (SRLPP & CRPP), – provided opportunity for choice making (SRLPP); and offered emotional support.	
9	Lesson Activity One: Students were completing their independent reflection worksheets on their visit to UBC Museum of Anthropology. Lesson Activity Two: Students were in small groups prepping and recording podcasts	Provided: – conducive working environment, – scaffolds and modelling (SRLPP) – resources for self-evaluation and reflection (SRLPP & CRPP) – participation structure (SRLPP), – opportunity for social interaction (CRPP & SRLPP), and choice making (SRLPP). Offered: - instructional support and feedback (SRLPP), – support on making connections between class activities and personal lives (SRLPP & CRPP), – emotional support, and – facilitate student learning activities	HE S3: "I've never been to the museum; There is old stuff in the museum"; ME S3: "The First Nation people made all that clothing and all the things; It is about the First Nation people"; ME S1: "We went on a field trip and learned more about first nation people"; ME S2: "The art was outstanding"; LE S1: "We saw beautiful carvings"; LE S2: "Because we learn about the First Nations."

On each of Day 8 and Day 9, the students reported their experiences of both lesson activities in one ESRF.

they focused on comparing their research findings about the First Nations' life and their individual lives. Joseph had two connected activities in his lesson: brainstorming and completing a worksheet (see Table 7).

Teacher instructional practices on day 8

During the complex task on Day 8, building on the CR-SRL framework, Joseph enacted both SRLPPs and CRPPs (see Table 7, Row 2, Column 3). For example, he spent the first 10 min of this lesson facilitating a brainstorming activity about how the First Nations lived and adapted to their land, and how that might be similar or different from today's way of life (CRPP). He supported students' thinking about the First Nations' ways of life through guided questions (CRPP, SRLPP), and retention of generated ideas by writing all their responses on the white board.

The second activity asked the students to compare their own life experiences with that of the First Nations by generating at least 3 similarities and differences (CRPP). Joseph supported students' completion of this activity through a structured worksheet.

Also, while scaffolding students' strategic thinking about this activity, he instructed them to: "…think about the most dramatic differences you come up with, most important to the least important" [Running Record]. He, further gave them choices about how and where to work saying: "It's lot more of individual work, but, you can work with your partner to get at least 3 similarities and differences," and at any corner of the class or at the Resource room (a room adjacent to their class) [Running Record] (SRLPP).

As the students completed their worksheets, Joseph circulated from group to group and answered questions. Occasionally, he scanned through their worksheets and offered emotional support by saying "good, good." At one point, after visiting a group, he shared an idea from S5: "he says that the First Nations people hunted for food; but we hunt for sport. Yet, we get food from it, but have it for sport." In this way, he offered instructional support by sharing an idea from a student and by facilitating conversations around it (SRLPP).

Linking student engagement to teacher instructional practices on day 8

Overall, the reported findings show that student engagement was related to the CRPPs and SRLPPs Joseph enacted. For example, we observed that most of the students were actively engaged during the lesson activities. For example, at the beginning of the lesson, the students asked and answered questions, and updated their notes. This finding could be linked to the open-ended questions Joseph posed to them during the brainstorming exercise, as well as recording their responses on the board. During the group activity, students in one group were observed taking turns in comparing their lives with that of the First Nations, as well as negotiating ideas that will be written in their main worksheet. We observed this kind of negotiation among other groups as well. This involvement in co-construction of ideas could be associated with the opportunity Joseph created for collaborating in an activity; and completing a structured worksheet he designed for the activity.

Although the students were engaged during this lesson, examination of their reflections on ESRF showed mixed and contradictory perceptions about their interest in the learning context (see Table 7, Row 2, Column 4). Their comments, that can be associated with the wide variations in their engagement, could be attributed to individual differences and preferences in relation to the activities assigned (e.g., not liking the content or lack of access to technology, feeling disengaged).

Case study of day 9

Whatever their "prior" history of engagement according to their teacher (HE, ME, or LE), all the selected students reported high levels of motivation and engagement on Day 9. Prior to Day 9, the students had attended a field trip to the University of British Columbia Museum of Anthropology. This Museum, among other things, contains many artefacts of the Aboriginal groups especially First Nations' peoples, and other cultural communities in BC, Canada.

Teacher instructional practices on day 9

Joseph started the lesson by reminding the students about their deadline to finish the podcast[3] of their learning experiences about the museum. Then, the students participated in two interdependent activities: (1) independent completion of a booklet; and (2) group prepping and recording of a podcast (see Table 7).

Joseph instructed the students to use the first 10 min to individually complete the "Museum Booklet" he had designed as a resource for this activity (SRLPP). This 6-paged booklet had 3 sections (i.e., Totem Poles in the Great Hall, First Nation Fact Finding, and Museum Podcast Planning). He provided opportunities for the students to make connections between what they were learning in the class (e.g., research about the First Nations) with life experiences including the field trip to the Museum (CRPP) through the guiding open-ended questions in each section of the booklet. For example, in the section on "Museum Podcast Planning" he asked students to reflect and record: (1) "Something that surprized you"; (2) Something that makes you respect the First Nations people"; and (3) How is my life changed after I have seen these exhibits." Through the CRPPs and SRLPPs woven into this booklet, Joseph offered instrumental support for his students' learning.

Second, after the independent activity, Joseph communicated the learning expectations of the group activities: to share ideas, group thoughts and record their impressions about the Museum of Anthropology. Next, he announced the members and leaders of the small groups he created for this activity (i.e., 5 groups of 6 students). Before the students assembled in their groups, he asked them to highlight their top two main ideas on the section "Museum Podcast Planning" (SRLPP). In addition, he offered emotional support by appreciating the students' efforts and knowledge about recording a formal podcast. Then, he invited and encouraged his students to demonstrate their learning through a podcast. Again, he scaffolded their participation in developing an informal and conversational podcast by asking the students to generate transitional phrases: "What I like about the First Nations was…" and, to acknowledge the previous speaker's ideas before adding new idea. For example: "I thought that was a good idea S1"; "Waooh, that was interesting S3." Finally, Joseph and his students generated some transitional phrases that he recorded on the board.

During the group activities, Joseph circulated among the groups, answered questions, offered feedback, checked on them, and maintained a good working environment (e.g., through classroom management; SRLPP). For example, during the prepping stage, he provided feedback to a group about using transitional phrases: "…it has to sound supper natural. I want that done smoothly and very informal." Similarly, during the recording practice, he offered both group and individual feedback. For example, the lead author observed him in the recording room telling a group to keep the conversation going when they make mistakes in live recording instead of stopping. He informed S5 that: "you have a little bit of soft voice… if you do not say it loud enough it [ipad record volume is] sets at automatic. Ok, this is a good experience. You gonna try it once again." Through these means, especially the feedback, Joseph offered dynamic supportive practices.

In sum, evidence showed how Joseph created opportunities for choice, self-reflection, teacher and peer support, and cultural congruity. Taken together, these findings show that Joseph embedded CRPPs and SRLPPs to facilitate students' learning on the Day 9.

Linking students' engagement in SRL to teacher instructional practices on day 9

On Day 9, when everyone reported high levels of engagement, which we also observed, we focused instead, more specifically, on a more detailed analysis of how students were self-regulating their learning. Analysis of the observational data, student work samples, and responses on the ESRF showed that the students were engaged in behaviours associated with SRL, such as choice making, self-evaluation, offering and receiving peer support, and cycles of strategic action. As described in the upcoming sections, students' active engagement in regulatory processes could be linked to supportive instructional practices Joseph embedded into the activities of Day 9.

Choice making

Examination of work samples showed that students made decisions across the different sections of the "Museum Booklet" about what they were learning and sharing about the First Nations as well as themselves. For instance, in the section "Totem Poles in the Great Hall," they made choices of the Totem Poles they were interested in knowing more about: "Dlidlam Interior House Post" (LE S3); "Memorial Pole of Skim" (LE S4).

In addition, while prepping and recording their Podcasts, the students in their small groups made decisions about the structure of their recording, such as how to introduce and end their conversation; soundtracks to add; and how many rounds they would do of practice recording. For example, the transcribed recording of one of the groups showed that they decided on who and how they introduced their podcast recording: "S6. This is grade four worldwide radio. Did you miss us? Well, if you did well, we have another podcast today. Its about our [all the members shouted excitedly] 'Museum of Anthropologyyyyyy'." They also made culturally relevant choices in the section "Museum Podcast Planning," while comparing their lives and the First Nations.

Students' choice making could be related to opportunities Joseph offered them in the different sections of the booklet and during the group activities to exercise control over what they were learning. To illustrate, the section "Totem Poles in the Great Hall" asked the students to "Look carefully at the poles in the Great Hall and choose three. Read the plaques below them and record the name of the First Nations community it came from…" [Instructions] (SRLPP). Through this instruction, Joseph offered both opportunities for, and support in, their choice making. Taking up this opportunity, the students exercised control and ownership over their learning through their choices.

Self-evaluation

Examination of student work samples showed evidence of students' engagement in self-reflection and assessment. In the section "Museum Podcast Planning" they reported what they were learning about the First Nations, and how those impacted their lives. For example, HE S3 noted that what makes him respect the First Nations people is that "they had to make all of their tools, boats and weapons by hand." Also, LE S3

3 This class records podcasts that are aired to the school almost every week. They have a small room "Grade 4 Worldwide Radio" in their class that function as their studio. So, most of the students have taken turn in recording a podcast before this complex task.

reported: "my life has changed by seeing a lot of Totem Poles, maybe I should start carving wood when I'm older."

Further, the students were assessing and reflecting on their participation (e.g., concentration, interest) on this and other days when they completed the ESRF (see Table 7, column 4). Though used as a tool for data collection, the ESRF was also an activity integrated into the complex task by their teacher in order to support students' reflection on their learning (see Table 7). A review of the ESRF data showed how Joseph engaged students in evaluating their learning progress and relating class activities to their own lives through self-reflection and self-assessment. Students' engagement in reflective processes could be associated with opportunities Joseph created for student thinking about their participation in the class activities (SRLPP) and connecting what they were learning with their personal lives (CRPP). Through guiding questions, together with those in the ESRF, Joseph provided scaffolds for his students' self-evaluation of their learning progress and engagement.

Peer support

The students supported their peers in group activities through task interpretation and understanding (e.g., explaining what happened and what was needed to students that did not attend the field trip); accommodating individual differences (e.g., allowing time for peers that were struggling with reading to practice their podcast session); and making sure that each person's reflection was recorded very well. Further, the students generated group feedback on how to improve their group work. For example, at the beginning of the podcast planning, the lead author observed a student (i.e., S1) offering feedback to his group members:

> S1. [says to the group members] read your Podcast planning [i.e., what they have under the "Museum Podcast Planning" section]. SS. [take turns reading]. S6. (Group Leader) We have to say our names first.

S1. says, we are [mentions their names] grade 4 students of St Mary's School.

SS. yes, and S1. says to S6 "do yours first." S6 [reads Museum podcast planning].

> S1. no, you have to start from [points to the "something that surprised you" in S6 booklet].
>
> S6. says something that surprised me was the totem pole because their totem pole was extremely hard to draw then…; S1. fantastic thought S6, something that surprised me was that they put special dead people in boxes, funeral boxes… S3. Something that surprised me was that the first nations was… [noise in the class].
>
> S1. [talks to S3] you have to say something like *fantastic thought S2* and then start talking, then we do that and start all over again [running record of observation].

The above running record shows that, although S1 was not the group leader, he supported his group members. He facilitated their participation, structuring the flow of their discussion for a successful podcast recording (i.e., co-regulation and socially shared regulation).

The support students offered to each other could be related to the opportunities Joseph provided for group activity, collaboration, and social interaction (SRLPP). For example, he created mixed groups of boys and girls with diverse abilities, achievement, and engagement levels [Debriefing], and communicated participation structures and expectations by appointing group leaders with the instructions that: "… You all are all leaders and responsible for one another, but the leader will come to me to collect your Ipad, direct the conversation etc." [Running Record] (SRLPP). Joseph's instruction may have inspired S1 (Group One) to exercise his agency by co-regulating his group members' participation.

Strategic action

Evidence combined to show how students were engaged in cycles of strategic action including planning, enacting strategies, monitoring, and adjusting their plans. For example, the students planned and enacted strategies for their podcast by generating ideas, highlighting their two most important things to report, and adding transitional phrases. In this context, the lead author observed a group that strategically engaged in three rounds of practice. First, they sequentially read their main ideas for the podcast. Second, they did a double round of acknowledging each others' ideas using transitional phrases, such as "Fantastic thoughts S6…" (S1); "Good ideas S1…" (S2); "Great thought S2…" (S3); "Waoh [high pitch] S3, Waoh S3 [low pitch] …" (S4); "Amazing idea… S4" (S5); "I did not think about that S5…" (S6). Third, they negotiated ideas about how to introduce and end their recording. During these rounds, the students generated feedback for each other, monitored their progress, and adjusted their plans about the sequence of their conversations. Similarly, during their voice recording, another group did multiple recordings. Occasionally, they stopped after each round, generated feedback and adjusted their presentation (see excerpts under peer support above).

These findings from observations and work samples show that the students were actively engaged in cycles of strategic action. Their involvement in strategic action could be related to the support Joseph built into the activities. For instance, he supported student planning with the guided questions in the section "Museum Podcast Planning." During the prepping and recording, he facilitated their self-monitoring by offering feedback on the use of transitional phrases and being audible. Also, he allowed time for the students to enact their strategies, monitor and adjust their learning engagement before the final version of their recordings. Through guided questions, feedback and instruction (SRLPP), Joseph supported his students' engagement in cycles of strategic action.

Discussion

The present investigation examined culturally diverse learners' motivation and engagement within the context of a complex task. Overall, findings from Joseph's class show that the students were generally very engaged in the CR-SRL complex task (see Table 4). This finding was true even for students the teacher had identified at different levels of engagement prior to the start of the study (see Table 6). Nevertheless, there were variations in students' engagement and motivation, related likely to a combination of activities (e.g., Day 9 activities were very engaging for all learners), and personal perceptions of the context and preferences (e.g., see variations on Day 8). The findings show that students' motivation (i.e., perceptions of interest and importance) were associated with their engagement (i.e., self-reported levels of concentration; see correlational data and see Table 6). Finally, student engagement levels on Day 8 and engagement in SRL on Day 9 could be linked to the kinds of CRPPs and SRLPPs Joseph built into his classroom.

These findings were consistent with prior research that student motivation and engagement processes are malleable and situated in context, and cannot be understood outside the context in which they occur (Fredricks and Mccolskey, 2012; Nolen et al., 2015; Salmela-Aro et al., 2016; Butler and Cartier, 2017; Anyichie and Butler, 2018, 2019; Anyichie et al., 2018, 2023). For example, culturally diverse students were highly engaged in the contexts (e.g., Day 9) with a rich integration of CRPPs and SRLPPs. Overall, we found that students' high level of engagement was associated with the combined CRPPs and SRLPPs practices Joseph integrated in the complex task. Multiple sources of evidence including observational data, documents (e.g., worksheets, work samples), and ESRF reports combined to show that students' learning engagement, motivation and SRL during the complex task could be linked to the way in which Joseph enacted SRLPPs and CRPPs in the task.

Also, our findings suggested a dynamic interaction between the learner and context (e.g., features of the complex task, peers' behaviour) that shaped their learning engagement. For example, findings showed that the pre-selected students in Joseph's classroom, regardless of their entry levels of engagement (i.e., HE, ME, LE), more consistently perceived the CR-SRL complex task to be motivating and were actively engaged in it. Furthermore, student reflective explanations of their experiences revealed wide variations within class engagement levels. These variations could be associated with individual differences and preferences in relation to the activities assigned (e.g., not liking the content, writing, or lack of access to technology, and feeling disengaged). Moreover, findings from the ESRF data and correlational analyses revealed tight connections between pre-selected students' motivational perceptions of, and their engagements in, the CR-SRL complex task in Joseph's classroom. Again, this finding suggest that learners' perceptions of contexts are influential in shaping their learning processes.

Taken together, these findings extend previous research showing how student motivational perceptions of their learning contexts such as task features and teacher dynamic support shape their learning engagement (Jang et al., 2016; Kelly and Zhang, 2016; Butler and Cartier, 2017; Parsons et al., 2018; Jones et al., 2021). For example, Jarvela et al. (2012) in their study found that elementary school students' situational motivation in a real science classroom context was associated with self-regulation of their cognitive engagement. Furthermore, this current research corroborates findings that students are highly engaged in learning tasks perceived to be interesting, important and enjoyable (Ainley, 2012; Patall et al., 2016; Harackiewicz and Priniski, 2018; Jones et al., 2021). It adds by showing how students' perceptions of CRPPs and SRLPPs shaped their increased level of motivation and engagement.

Finally, the findings of this study demonstrate how student engagement and motivation is shaped by a dynamic interaction between the learner and context (Yang et al., 2017; Anyichie and Butler, 2018; Anyichie et al., 2023) and draw attention to the importance of designing learning contexts (e.g., complex task) that integrated CRPPS and SRLPPs based on CR-SRL framework to support culturally diverse learners motivation and engagement.

Limitations and implications for future research

This study is limited in several ways. First, this study provided an in-depth study of a limited number of participants (i.e., one teacher and 18 students). Future studies can extend what we have done by involving more teachers and students to better investigate and understand how culturally diverse learners' engagement and motivational processes is situated in an integrated CR-SRL practices during a complex task. Second, the Grade 4 participants in this study may not have full cognizant of their cultural norms and values in ways that would have facilitated their effective connection of classroom activities to their cultural backgrounds and lived experiences. Involving middle school students (e.g., grades 6–9) or even high school students might be of help to examine more fully how student cultural backgrounds might be influencing their learning processes. Third, the selection of students with different levels of engagement prior to the studies was based on Joseph's professional judgement. The use of established criteria that are clear to both the teacher and students could enable a better comparison of pre, during, and post-levels of engagement in relation to pedagogical practices.

Contributions and conclusion

Our study adds to the body of research investigating students' motivation and engagement *in situ*. Specifically, it adds to the methodological approach in investigating and understanding culturally diverse learners' motivation, engagement and SRL processes as situated in the context of a complex task. Our use of a case study design was beneficial in examining and understanding how students' interaction with contextual features (e.g., CRPPs and SRLPPs) could be related with their SRL engagement processes (Butler, 2011; Butler and Cartier, 2017). A case study design allowed us to collect multiple sources of evidence (see data collection above). Also, this study contributes to teaching by showing how a complex learning context is a site for combination of CRPPs and SRLPPs. In conclusion, the findings of this study show that culturally diverse students were motivated to engage in the CR-SRL complex task when they perceived it to be personally relevant and interesting. There were variations in students' experiences based on contextual features with high level of engagement in contexts with rich combinations of CRPPs and SRLPPs. This study shows how teachers could support culturally diverse learners' engagement and motivational processes by designing CR-SRL complex tasks. We encourage researchers and educators to investigate more deeply how culturally diverse learners' engagement and motivation process is situated in a complex task that deliberately integrated CRPPs and SRLPPs.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Behavioural Research Ethics Board (BREB) of the University of British Columbia, Vancouver with the certificate number H16-03235. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

This study is an original intellectual work of AA and part of his dissertation. AA developed the research proposal including the culturally responsive self-regulated learning framework employed in this study, research design, recruitment of participants, data collection methods and analyses plan. He was responsible for the data collection, analyses and writing of this paper in collaboration with DB. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Developmental trajectories of conditional parental regard and long-term association with students' academic functioning

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To feel unconditional love and acceptance from parents is a need which fundamental character is widely recognized. This article presents the results of a longitudinal study which first objective is to identify trajectories of change in perceived parental support conditional on academic success over a 5-year period. The second objective examines whether students' gender, mental ability, and parental education predict membership in the trajectories and the third examines whether students' academic functioning differs according to their membership to different trajectories 1 year later, when they were in Secondary 5. A sample of 776 students (371 males) reported their perception of conditional parental support yearly from grade 6 to Secondary 4. In Secondary 5, they answered a questionnaire on their academic motivation, self-regulation, test anxiety and intention to drop out. Teachers also reported their perceptions of the participating students' academic motivation and self-regulation and rated their academic performance. Results of latent class growth analysis (LCGA) shows that the most optimal model identified three patterns of change in students' perceptions of their parents' conditional support. Students' gender, mental ability, and parental education do not predict membership in trajectories. Results of the BCH procedure indicate that whether self-reported or teacher-reported, the academic functioning of students in the low perceived conditional support trajectory was superior to that in the other two trajectories. These results add evidence that parents can have a long-term impact on children's academic functioning and underscore the need to educate parents about the importance of avoiding associating their support and regard with their child's academic performance.

KEYWORDS

conditional support, academic functioning, developmental trajectories, adolescence, person-centered approach

Introduction

To feel loved and accepted by others is a need whose fundamental character is widely recognized. This is even truer when it comes to parents: the quality of parent–child relations is a significant factor in the children's harmonious development and adaptive school functioning (Grant et al., 2000; Cauce et al., 2003; Woolley and Bowen, 2007; Assor and Tal, 2012; Makri-Botsari, 2015). Children's perception of being loved unconditionally by their parents in any situation is an important characteristic of a good parent–child relationship. However, some

children feel loved and supported only if they respect the rules set by their parents, behave according to their desires and reach the standards of performance they expect of them. These children receive what is called "conditional parental regard." Conditional parental regard is usually seen as domain-specific. In this study, we focus on the academic domain.

To date, numerous studies have documented a variety of deleterious outcomes associated with using conditional parental regard the academic domain, but most of them are issued from cross-sectional correlational data. The concept of conditional parenting refers to the perception of children, not to what parents really do. Developmental psychology has well documented the fact that with age and cognitive development, the person's conceptualization of the same phenomenon change (Bouffard et al., 1998). For example, a compliment from a parent seen as positive feedback by a young child may be seen years later as an attempt to control them. From this perspective, one might think that a young person's perception of conditional parental regard may change over time. This may be particularly the case in adolescence, a developmental period where youths assert their growing need for autonomy, which requires renegotiating their relationships with their parents (Laursen and Collins, 2004). According to Grolnick (2012), not all parents manage to respond adequately to the new needs of their child. Some parents react by using more power-assertive and controlling practices that allow for less autonomy granting and do not satisfy a particular need in adolescent but relate to compliance and parents' control. Adolescents can discriminate between legitimate and illegitimate authority and control (Gingo et al., 2017).

Due to the general non developmental nature of prior studies on the perception of conditional parental regard, important questions have not yet been explored. Does the perception of parental conditional regard change during adolescence? Are these changes the same for everyone or are there different trajectories? Are different trajectories linked to different outcomes? This article presents the results of a six-year longitudinal study that used latent class growth analysis to track changes in children's perception of conditional parental regard throughout five consecutive years from grade 6 to grade 11. It also examines whether belonging to different trajectories is related to their school functioning 1 year later at grade 12.

Conditional parental regard

The distinction between conditional and unconditional love is not new. As early as 1959, Rogers suggested that some people feel accepted and loved for who they are as a person and not for what they do, while others feel loved and accepted for their success in meeting the expectations that others have of them. Harter (1999, 2012) has taken up the concept of conditionality proposed by Rogers and defines it in turn as children's perception of being loved and supported only when they behave according to their parents' generally high and sometimes unrealistic expectations. These children do not feel that their parents' love and support is free but believe that they must earn it by meeting their expectations and demands. When they succeed in doing so, they feel that their parents show them more warmth and affection; when they fail, they feel they show them less.

Conditional parental regard operates as a psychological control on children: their feelings of guilt and the withdrawal of affection from their parents when they fail to act as desired make them feel manipulated (Grolnick, 2003; Grolnick and Pomerantz, 2009). Parents' psychological control practices undermine children's intrinsic motivation and their need for autonomy, hinder the development of their perceived academic competence and behavioral self-regulation, instigate the fear of failure, deteriorate their school grade and performance and make them feel disrespected by their parents (Deci and Ryan, 1985, 2002; Barber, 1996; Soucy and Larose, 2000; Bean et al., 2003; Elliot and Thrash, 2004; Barber et al., 2012; Maltais et al., 2021). According to Assor (2018), conditional parental regard reflects a form of psychological control, but it differs from the latter by the presence of intrusiveness and blame from which children cannot escape. It would lead to an introjected regulation of behavior; to gain parental affection or avoid losing it, children feel pressured to act as expected (Brambilla et al., 2015; Israeli-Halevi et al., 2015). They come to disavow or deny those parts of themselves that are different from those valued by their parents, manipulate their public image, and engage in false-self or inauthentic behaviors (Harter et al., 1996; Harter, 2012). Parental expectations are thus transformed into compelling self-evaluation standards: children judge that their personal value is equal to their ability to meet these standards (Assor et al., 2004, 2009; Harter, 2012). In this way, conditional regard would conduct to the development of self-esteem that is contingent on meeting the standards set by others (Assor et al., 2004; Kollat, 2007; Curran et al., 2017; Øverup et al., 2017; Curran, 2018; Otterpohl et al., 2021) which is, according to various authors, weak and unstable (Leary and Baumeister, 2000; Crocker and Wolfe, 2001). Finally, because children may interpret parents' pressure to behave in a specific way as their lack of confidence in their child' ability to behave correctly on their own, this can arouse negative emotions toward the parents.

Conditional parental regard can manifest itself in a variety of areas of child functioning, including the school domain. There is a consensus on the value placed on education as a sure path to success and social status. Thus, it is one of the most important areas for parents likely to generate conflicts and discord with their children (Smetana et al., 2016), leading the latter to believe that parental love depends on their success in school (Harter, 2012). This belief leads children to feel pressure to behave and perform as well as their parents want them to, accompanied by an ongoing sense of threat to alienate their support if they fail to do so.

Conditional parental regard and academic outcomes

Children who benefit from an attitude of acceptance, warmth, and respect in all circumstances from their parents, who evolve in an environment free from all external judgment, can live and reflect on their emotional experience in a safe space that allows them to use their resources and realize their full potential (Rogers, 1968; Harter, 2012; Assor, 2018; Proctor et al., 2021). Difficulties and errors are inherent in school learning situations, making it a context that requires unconditional regard to enable children to use their abilities and meet challenges. Conditional parental regard linked to academic success would lead children to become involved in their learning activities without real interest or personal importance, but because they feel compelled to do so (Roth et al., 2009; Assor, 2018). Furthermore, some of the children's mental resources are diverted to the fear of failure and

thus losing their parents' love. This can make them less cognitively available to mobilize their cognitive and metacognitive resources and thus self-regulate their learning (Bartels and Magun-Jackson, 2009).

Various studies suggest that conditional parental regard on academic achievement relates to student academic outcomes, including motivation, self-regulation, test anxiety, and attitudes toward dropping out (Bartels and Magun-Jackson, 2009; Roth et al., 2009; Assor et al., 2014; Bouffard et al., 2015). Perceived parental regard conditional on academic success and emotional control was related to resentment toward parents, which was associated with poorer control of negative emotions and disengagement from school among high school students (Roth et al., 2009). Others have shown, also among high school students, that conditional parental regard was linked to excessive feelings of pride following academic success and guilt and shame about failure, which in turn were associated with a tendency to over-invest in school (Assor and Tal, 2012). High school students' perceptions of parental and teacher regard conditional on academic achievement were negatively associated with their academic motivation (Makri-Botsari, 2015), which is considered by several authors to be necessary for the exercise of active self-regulation (Schunk and Usher, 2012; Schunk et al., 2014). Côté et al. (2014) showed that conditional regard, both student-perceived and parent-reported, negatively related to students' self-regulation as assessed by their teachers. Other researchers also linked the development of children's self-regulation and emotionally positive parent–child relationships (Brody and Ge, 2001).

Because of the perception that parents' love depends on their ability to do as well as they want, it is likely that this conditional regard promotes the presence of student test anxiety due to fear of failure (Bouffard et al., 2015; Otterpohl et al., 2019). Test anxiety arises when failure is perceived to have adverse consequences and students perceive that the outcomes of actions they think they can take to avoid it are uncertain. Some students become so anxious and uncomfortable at school that they develop a sense of academic alienation and a positive attitude toward dropping out of school (Assor, 2012). Actual dropping out is generally not the result of an impulse or thoughtless action (Christenson and Thurlow, 2004; Rumberger, 2011). This is preceded by a period of disengagement of varying lengths in which the student experiences negative emotions and dispositions toward school, has little interest in what is happening there, has a low sense of belonging to the school, and feels out of place (Alexander et al., 1997; Sameroff and Fiese, 2000; Rowe et al., 2007; South et al., 2007). Contemplating the idea of dropping out of school as a lifeline, a way out of discomfort and anxiety is likely to increase the likelihood of actually doing so (Janosz et al., 2013). Few studies have examined the relationship between conditional parental regard and positive attitudes toward dropping out. Itzhaki et al. (2018) showed that boys aged between 14 and 21 who had dropped out of school early reported higher perceptions of conditional parental regard than those with a mentor or receiving help because they risk dropping out of school and those enrolled in a program for dropout students. Less directly, Côté and Bouffard (2011) showed that conditional parental regard was associated with a negative self-evaluation bias of academic competence and lower achievement, both of which are risk factors for dropping out of school (Janosz et al., 1997; Mahoney and Cairns, 1997; Vallerand et al., 1997; Archambault et al., 2009a,b).

In sum, different studies showed that conditional parental regard for academic achievement is associated with poorer academic outcomes and premature dropout. However, these studies simultaneously measured perceived conditional parental regard and indicators of academic functioning, with the student also typically being the sole informant. This raises the problem of shared common variance, which makes it difficult to assess the validity of observed relationships that may be artifactual due to the contemporary nature of the measurement of the phenomena.

Longitudinal studies of conditional parental regard

According to our review of the literature, few longitudinal studies have been conducted on changes in perception of conditional parental regard whatever its domain of reference. In the Hascoët (2016) study, which lasted only 2 years during the primary-secondary transition, the perception of conditional parental regard based on academic success was low and stable over the entire period. In the cross-sectional study of Seidah (2004) among students in Secondary 1, 3, and 5, those in Secondary 1 perceived lower conditional parental regard than their peers in Secondary 3 and 5, who did not differ. As mentioned earlier, adolescence is a developmental period when children's quest for more autonomy can lead them to wrongly interpret parental behaviors or expectations as attempts to control them. Thereby, the increased importance that some parents place on academic performance when their child enters secondary school may lead some young people to perceive higher conditional regard from their parents (Midgley et al., 1995; Anderman and Midgley, 1997; Bouffard et al., 2001). We found no longitudinal study that investigated whether children's perception of conditional parental regard evolves with time and whether different profiles of evolution are linked to different outcomes. Thus, it is unclear whether the perception of conditional parental regard is momentary or stable, how it may change over time, and whether different developmental trajectories are associated with different aspects of a student's academic functioning. The longitudinal approach used in this study makes it possible to answer these questions and to examine the long-term sequelae of various profiles of conditional parental regard as proposed by others (Haines and Schutte, 2022; Steffgen et al., 2022).

The present study

The study covers a six-year period that began when participants were in grade 6 (the last year of elementary school in the Quebec educational system) and ended when they were in grade 11. The objectives are twofold. The first objective is to examine the patterns of change in students' perceptions of conditional parental regard assessed once a year at spring time during five consecutive years from grade 6 to grade 10. Given the lack of prior longitudinal studies, it is difficult to postulate the precise form of potential trajectories. Thus, this study is largely exploratory. However, based on Hascoët (2016) study, we expect to observe a trajectory of relatively low and stable perception of conditional parental regard. As research showed that a majority of young people perceived weak parental psychological control throughout adolescence (Roth et al., 2009; Assor and Tal, 2012; Rogers et al., 2020; Steffgen et al., 2022), this trajectory should include most of the students. Also, following the results of Seidah (2004), and

because some parents place growing importance on academic performance when their child enters secondary school, we expect a trajectory in which the perception of conditional parental regard should increase throughout the study.

Results from some studies have shown that boys perceive higher parental conditional regard than girls do (Côté and Bouffard, 2011; Bornstein, 2013; Côté et al., 2014), but others have found no difference between boys and girls (Israeli-Halevi et al., 2015). Students with weaker intellectual abilities tend to be less successful at school; their parents may be inclined to use more psychological control as conditional regard to promote their success (Gottfredson, 2002; Deary et al., 2007; Laidra et al., 2007). Some authors report that socio-economic status, particularly parents' education, is linked to more controlling parenting style (Coleman and Karraker, 2000; Benner et al., 2016) and students' academic functioning (Stull, 2013; Choi et al., 2015; Wiederkehr et al., 2015). Overall, these studies suggest that having lower academic ability and less educated parents may contribute to boys' greater perception of conditional support from their parents. However, they do not provide information on how these factors may play a role in shaping this perception, and the lack of previous studies does not allow for any specific predictions on this issue. Thus, just as it was unwarranted to hypothesize with certainty the number and shape of expected trajectories, so was it unwarranted to predict how covariates could affect the likelihood of belonging to these trajectories. Thus, students' gender, academic ability, and parents' education were used as covariates to explore whether and to what extent they predict membership in the trajectories.

The second objective examines if students' academic functioning when in grade 11 differs according to their belonging to the trajectories. Based on cross-sectional studies on academic correlates of students' perception of their parents' conditional regard (Bartels and Magun-Jackson, 2009; Roth et al., 2009; Assor and Tal, 2012; Assor et al., 2014; Bouffard et al., 2015), we predict that students in the low and stable trajectory of conditional parental regard will have better academic functioning than those in the other trajectories. In this study, the academic outcomes to assess academic functioning are students' reported motivation, self-regulation, test anxiety, and positive attitudes toward dropping out, and teachers' reports of students' motivation, self-regulation, and academic achievement. In the Quebec educational system, in secondary school, there is a designated teacher responsible for a group of students. This teacher usually delivers teaching in one of the core subjects and spends more time in contact with students than teachers of specialized disciplines. Thus, those teachers provided the rating for students assigned to their group.

Materials and methods

Sample and procedure

This study is part of a large-scale longitudinal project on the school functioning of students conducted between 2005 and 2012. At the beginning of the project, students ($N = 801$) were in grade 4 or 5 and attended nine public schools in the Greater Montreal area (Quebec, Canada). All teachers, parents, and students completed a consent form approved by the University du Québec à Montréal's ethics committee. The acceptance rate of parents was just over 95%. According to the indices of disadvantage calculated each year by the Ministry of Education and Higher Education (MEES) of Quebec, two of those schools served families from low socio-economic backgrounds, five from average socioeconomic backgrounds and two from high socioeconomic backgrounds. Once in secondary school, students attended 25 different schools: 18 were public schools (including a vocational training center and a school for students with learning difficulties) and seven were private schools. Thus, the sample of this study is normative and not representative of disabled, neuroatypical nor students of different ethnic groups.

After removing the students who did not filled out the scales of conditional parental regard at any of the five measurement times, the sample included in the analyses comprises 776 students (371 males). The data are aligned so that all students are in grade 6 at T1 of this study (mean age = 12.4 years old, SD = 0.52). Socio-demographic data are available for 640 families, and they concern the nationality and the age of the responding parent (the mother in 87.8% of cases), the level of education of each parent, the number of children in the family and the annual family income. The vast majority of parents reported being Caucasian (90.7%), 1.3% reported being Haitian or Asian and 8% refused to answer. The age of the responding parent ranged from 28 to 55 years and averaged 38.9 years (SD = 4.69). Among the parents, 24.3% of fathers and 22.5% of mothers had a university degree, and 24.6% of fathers and 36% of mothers had a college diploma. 30.1% of fathers and 23.6% of mothers had a secondary school diploma, and 18% of fathers and 15.7% of mothers had a vocational diploma. Finally, 3% of father and 2.2% of mother had no qualifying diploma. 11.3% of families had one child, 52.4% had two, 27.4% had three, and 8.9% had four or more. The annual family income in Quebec in 2005 was 58,000$ (Institut of Statistic of Quebec, 2005). 12.6% of the parents refuse to report their annual family income. Of those who responded, 7.4% had an income of $30,000 or less, 7.6% had an income between $30,000 and $40,000, 11.6% between $40,000 and $50,000, 13.5% between $50,000 and $60,000, 12.5% between $60,000 and $70,000, and 47.4% had an income greater than $70,000.

Using the sample of 776 participants, we performed attrition analyses on the outcome measures. ANOVAs analyses comparing students who did not complete the last measure of conditional regard at T5 ($n = 214$) and those who did so ($n = 562$) revealed that they did not differ significantly on their self-reported motivation, self-regulation, school anxiety, and attitudes toward dropout ($p_s > 0.10$). Students who did not complete T5 had slightly lower scores on motivation as reported by the teacher ($p < 0.04$) than those who did. However, they did not differ significantly on self-regulation and academic achievement ($p_s > 0.10$) as reported by the teacher. A similar number of boys as girls did not complete the measure of conditional regard at T5. The percentage of missing data was 20.03% over the T1 to T5 measurement times of conditional regard and Little's Missing Completely at Random test indicated that the data were missing completely at random, $\chi^2(68, N = 776) = 74.76$, $p = 0.27$.

At each spring of the longitudinal project, the students filled in questionnaires in collective sessions in their respective classes during school hours. Trained research assistants and psychology university students tested the students. At the beginning of each administration, the experimenter reminded them of the confidentiality of their responses and their right to refuse to answer or to stop at any time, without consequences. To increase the aspect of confidentiality, once

their questionnaire was completed, the students put it in an envelope that they sealed before giving it to the experimenters.

The scales of interest for the present study were included as a part of the testing battery of the large-scale longitudinal project. One experimenter read each question aloud while a second experimenter walked around the classroom to answer any questions and to ensure that students were keeping up. From grade 9, the students filled out the questionnaire at their own pace. We randomly distributed the items relevant to the present study among those of the broader study. This prevents the students from trying to be consistent in referring to previous responses to items of the same variable and thus adds to the credibility of the internal consistency. The whole session lasted approximately 50 min. The responding teachers answered their questionnaire about each of the participating students assigned to their group and returned it to the laboratory by mail.

Measures

Students' gender and mother and father education

Gender (males = 1, females = 2) and mother and father education (no diploma = 1, vocational diploma = 2, secondary school diploma = 3, college diploma = 4, university diploma = 5) were recorded at Year1 of the larger longitudinal project.

Academic ability

At Year-1 of the broader longitudinal project, the French version (Sarrazin et al., 1983) of the standardized Otis-Lennon Ability Test was used to measure students' mental ability. This test is administered in groups and evaluates aspects of intelligence and draws on general knowledge, vocabulary, the ability to manipulate series and sets, and mathematics. The total number of correct answers is converted into a school ability index (SAI), according to the student's chronological age (mean score = 101.63, SD = 10.58). The longitudinal stability of the academic ability test has been established in previous studies, so it was deemed unnecessary to assess it every year (Bouffard et al., 2011).

Students' report

The answer format for each instrument was the same, namely a Likert-type scale ranging from 1 (not at all) to 4 (entirely), measuring the extent to which students deemed themselves to be similar to the fictitious student described in each item.

Conditional parental regard (T1-T5)

The conditional character of parental regard was measured yearly from grade 6 to grade 10 using seven items of the Parental Support Subscale of Harter and Robinson's Approval Support Scale for Children (Harter and Robinson, 1988) translated into French using the translation back-translation method. The instructions told students to indicate which parent was most involved in their school life and to answer the items according to this parent. 88% of students indicated their mother as the parent most involved in their school life. The average score for the items is calculated, and the higher the result, the more it indicates that students feel that their parents' regard depends on meeting their expectations. A sample item is: "This student believes that their parents will not love them as much if they make mistakes." The internal consistency was satisfactory across the five measurement times (α ranged between 0.78 and 0.86). Longitudinal invariance testing is presented in the Results section and Table 2.

School functioning at grade 11

Motivation

The general subscale of the Children Intrinsic Motivation Inventory of Gottfried (1985) served to assess students' academic motivation. Gottfried et al. (2001) verified and showed the validity of items for young people aged 9, 10, 13, 16, and 17. An example of the five items used follows: "This student keeps working on a problem until they understand it." The internal consistency is satisfactory (α = 0.77).

Self-regulation

Students' self-regulation was assessed using the Self-regulated Questionnaire (Bouffard et al., 1995). Among the 20 items, seven concern means students used to acquire knowledge and solve problems ("When encountering a difficulty or a problem, this student tries to find a solution"). The internal consistency is satisfactory (α = 0.79). Another group of eight items refers to study strategies students used when studying material, as in the following sample statement: "When studying, this student set specific objectives to reach." Internal consistency is satisfactory (α = 0.86). Finally, five other items concern students' organization of time to deal with learning activities like in the following example: "Most of the time, this student waits until the last minute to study for their exams and homework." Internal consistency is satisfactory (α = 0.79). As the relations between the three categories were high (r = 0.67), an average score of self-regulation was computed, and the internal consistency is satisfactory (α = 0.88). The higher this score, the higher the level of self-regulation.

Test anxiety

Students' test anxiety was measured using five items (α = 0.84) from Govaerts and Grégoire (2008) slightly reformulated to apply to academic evaluation. Here is a sample statement: "This student is worried when they know that a test is coming up." The average score for these items was then calculated, and the higher the result, the more it indicates that students experience test anxiety. Internal consistency is satisfactory (α = 0.83).

Attitudes toward dropout

Attitudes toward dropout refer to students' feelings that schooling has no value, that school learning is not meaningful to them, and that they are out of place at school. We used five items drawn from Galand and Philippot (2002) as the following: "This student thinks school is not made for them." The internal consistency for the present study is satisfactory (α = 0.79).

Teachers' report

Teachers' report of students' school functioning at grade 11 comprises three indicators: their perception of students' motivation, self-regulation and academic achievement. For both motivation and self-regulation, teachers rated on a three-point scale (0, never or rarely, 1, sometimes, and 2 almost always or always), how often the student shows each behavior described in the statements.

Motivation

We assessed teachers' perception of students' motivation with the same five items used to assess students' motivation. The internal consistency is satisfactory ($\alpha = 0.94$).

Self-regulation

Several cognitive and metacognitive self-regulation strategies used by students are internal processes that are not easily accessible to observation by others. Thus, for teachers to assess students' self-regulation, we selected from the Self-regulated Questionnaire (Bouffard et al., 1995) seven items that tap into the students' overt use of planning, effort to solve problems before help-seeking, perseverance in the face of difficulty, sustained attention, etc. An example follows: "This student organizes themselves in order to finish their work on time." The internal consistency is satisfactory ($\alpha = 0.95$).

Academic achievement

Given the varying evaluation practices used in different schools of the Quebec educational system, the quality of academic achievement was assessed by asking the teacher to answer the following question: "In your opinion, compared to his/her classmates, the academic results of this student are." Teachers indicated their response on a six-point Likert scale as follows: very poor (1) poor (2), average (3), good (4), very good (5), and excellent (6).

Data analysis strategy

First, the measurement model for perception of conditional parental regard was tested based on the items of measurement at grade 6–10. Then, we performed longitudinal measurement invariance across the five time points to ensure that students understood the conditional parental regard questions in a similar way over the years. To evaluate the adequacy of the theoretical model to the data, we used the following indicators of model fit: chi-square ($\chi 2$); comparative fit index (CFI) and Tucker-Lewis Index (TLI), with values >0.90 deemed adequate, and > 0.95 excellent; standardized root-mean-square residual (SRMR), with values <0.08 considered adequate; and root mean square error of approximation (RMSEA) less than <0.08 (or less than 0.05 for an excellent fit), with the lower-bound confidence interval closest to zero (0) and the higher-bound confidence interval less than 0.10 (Wang and Wang, 2019). Although we report χ^2, this fit index tends to favor small samples, therefore, is likely to always be significant with complex models and large samples (Wang and Wang, 2019). To compare the adequacy of a more restrictive model, we used delta values of change between a more restrictive and a less restrictive model, according to Chen (2007). A non-significant chi-square change ($\Delta\chi^2$) indicates that the more constrained model fits the data as well as a less constrained model (though $\Delta\chi^2$ is also sensitive to sample size, with the index likely to be significant with large samples). Chen (2007) also indicates that a change in CFI and TLI equal to or less than 0.010 complemented by a change of less than 0.015 in RMSEA and SRMR would indicate invariance within the adequate threshold. The parameters of the models were estimated using the Maximum Likelihood estimator. Missing data were accounted for using Full Information Maximum Likelihood using the Mplus software version 8.6 (Muthén and Muthén, 2017).

Then, the approach of latent curve trajectory models (Muthén, 2002; Jung and Wickrama, 2008) served to examine the objectives of the study. We used a semi-parametric group-based modeling strategy to verify the presence of latent longitudinal classes of students sharing a similar initial level of conditional regard and the same change pattern from grade 6 to grade 11. We estimated models in Mplus v.8.1 *via* latent class growth analysis (LCGA) in which individual variation across time is considered to be homogenous in each sub-group (Muthén and Muthén, 2000). We treated time as a fixed parameter in the models. The time points were fixed incrementally based on the equidistant spacing between each assessment session (e.g., spring of Grade 6 fixed at 0, spring of Grade 7 fixed at 1, etc). We carried out the LCGA models using the maximum likelihood with robust standard errors estimator (MLR), which is robust to non-normality in the data. As missing at random (MAR) was the likely missing data mechanism, full information maximum likelihood (FIML) was used to accommodate missing data. We compared models comprising two, three, four, and five classes. To determine the most optimal model, we used the Bayesian information criterion (BIC), the adjusted Bayesian information criterion (SSABIC), the Bayesian information criterion (AIC), the Lo–Mendell–Rubin Likelihood Ratio Test (LMR LRT), the Vuong-Lo–Mendell–Rubin likelihood ratio test (VLMR LRT), the bootstrapped likelihood ratio test (BLRT) ($p < 0.05$), entropy and the posterior probabilities of latent class membership. The smallest absolute values of BIC, SSABIC and AIC indicate the best model in the data. Non-significant LMR-LRT and BLRT suggest that adding one class to a given model does not provide a better fit. The entropy summarizes the classification precision and values close to 1 indicate higher classification precision with values higher than 0.8 indicating good classification. The posterior probability of latent class membership allows determining the models' classification precision and values lower than 0.8 suggest classification uncertainty. Then, we incorporated students' gender, SAI, and parents' education as covariates directly into the model to estimate their likelihood of affecting membership into the various trajectories using multinomial logistic regression. The regression coefficients represent the importance of the predictors on the log odds of the outcome (i.e., the probability of membership in one profile versus another in a pairwise comparison) that can be expected for a one-unit increase in the predictor.

Finally, to test the equality of means between profiles for each variable of school functioning reported by students and teachers, we applied the automatic BCH approach in Mplus 8. This method is recommended by Asparouhov and Muthén (2014) when latent profiles are used to predict continuous distal variables. In addition, unlike alternative methods, it avoids latent class changes at the last step of model estimation because it uses a weighted multi-group analysis, in which groups correspond to latent classes.

Results

Descriptive statistics

Table 1 displays the means and standard deviations of students' perception of conditional parental regard at five time points, potential covariates and academic variables, as well as Pearson correlation coefficients between all variables. Stability over time between the adjacent time-points of the conditional regard measures varied between $r = 0.24$ and $r = 0.62$. Results indicate that most of the relations between conditional regard and academic functioning variables are statistically significant, and these relations are in the expected

TABLE 1 Descriptive statistics and bivariate correlations between all variables.

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. CR T1	1.39	0.54	–														
2. CR T2	1.48	0.59	0.42**	–													
3. CR T3	1.51	0.64	0.31**	0.52**	–												
4. CR T4	1.58	0.64	0.24**	0.50**	0.57**	–											
5. CR T5	1.56	0.62	0.26**	0.48**	0.54**	0.62**	–										
6. Gender	0.52	0.50	−0.06	−0.01	−0.01	−0.07	−0.05	–									
7. SAI	102.6	10.7	−0.11**	−0.05	0.02	−0.03	0.02	0.03	–								
8. FEdu	2.40	1.22	−0.06	−0.03	−0.01	0.06	0.11*	−0.05	0.19**	–							
9. MEdu	2.57	1.16	0.01	0.01	−0.01	−0.03	−0.01	−0.03	0.20**	0.46**	–						
10. Mot	2.82	0.54	−0.05	−0.17**	−0.17**	−0.13**	−0.18**	0.13**	0.12**	0.10	0.09	–					
11. SReg	2.45	0.80	−0.13**	−0.15**	−0.16**	−0.17**	−0.17**	0.15**	0.03	0.12*	0.16**	0.63**	–				
12. Anx	2.07	0.67	0.13**	0.07	0.10*	0.08	0.14**	0.21**	−0.10*	0.04	0.04	−0.12**	−0.09*	–			
13. Adrop	1.81	0.63	0.15**	0.12*	0.11*	0.18**	0.20**	−0.20**	−0.13**	−0.14**	−0.14**	−0.58*	−0.50**	0.09	–		
14. TMot	1.38	0.55	−0.03	−0.06	−0.08	−0.11*	−0.16**	0.25**	0.15**	0.10*	0.10*	0.35**	0.35**	0.03	−0.29**	–	
15. TReg	1.39	0.59	−0.03	−0.06	−0.06	−0.11*	−0.14**	0.33**	0.21**	0.12**	0.12**	0.29**	0.29**	0.03	−0.35**	0.79**	
16. AAchie	3.40	0.81	0.08	0.07	0.04	0.06	0.07	0.16	0.21	0.07	0.06	0.23**	0.24**	−0.09	−0.19**	0.40**	0.45**

CR T1, conditional regard time 1; CR T2, conditional regard time 2; CR T3, conditional regard time 3; CR T4, conditional regard time 4; CR T51, conditional regard time 5; Gender, boy = 0, girl = 1; SAI, school ability index; FEdu, Father's education; MEdu, Mother's education; Mot, motivation; SReg, self-regulation; Anx, test anxiety; Adrop, attitudes toward dropout; TMot, motivation reported by teacher; TReg, self-regulation reported by teacher; academic achievement. $^{**}p < 0.01$; $^{*}p < 0.05$.

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TABLE 2 Results of the longitudinal measurement invariance analysis of the conditional regard questions measured at T1, T2, T3, T3, and T5.

Model	$\chi2$	CFI	TLI	RMSEA	SRMR	$\Delta\chi2$	ΔCFI	ΔTLI	ΔRMSEA	ΔSRMR
1a. Configural	417 (215)	0.966	0.952	0.035	0.035	–	–	–	–	–
1b. Metric	616 (235)	0.935	0.918	0.046	0.065	199	0.031	0.034	−0.011	−0.030
1c. Partial metric	490 (231)	0.956	0.943	0.038	0.047	73	−0.010	−0.009	0.003	0.012
1d. Scalar	700 (242)	0.922	0.903	0.050	0.052	210	−0.034	−0.040	0.012	0.005
1e. Partial scalar	554 (240)	0.947	0.933	0.041	0.044	64	−0.009	−0.010	0.003	−0.003

In Model 1c., four factor loadings (out of 25 loadings) were allowed to be freely estimated between time points. In model 1e, intercepts of two items at T-1 were allowed to be freely estimated (out of 25 intercepts). All the $\Delta\chi2$ are significant at $p < 0.001$.

direction. Table 1 also reveals that students' perception of conditional regard is generally unrelated to their gender and SAI, and to parents' education levels. However, students' gender, SAI, and both mothers' and fathers' education levels relate significantly to all variables of academic functioning although these relations are mainly weak.

The scale of conditional parental regard had an excellent model fit at each year of measurement: Grade 6: χ^2 ($df = 5$) = 12.11, $p = 0.04$; *CFI* = 0.988; *RMSEA* = 0.03; Grade 7; χ^2 ($df = 5$) = 4.39, $p = 0.49$; *CFI* = 1.00; *RMSEA* = 0.000; Grade 8: χ^2 ($df = 5$) = 11.85, $p = 0.03$; *CFI* = 0.99; *RMSEA* = 0.01; Grade 9: χ^2 ($df = 5$) = 11.11, $p = 0.03$; *CFI* = 0.988; *RMSEA* = 0.01; Grade 10: χ^2 ($df = 5$) = 8.31, $p = 0.09$; *CFI* = 1.00; *RMSEA* = 0.03. We tested the longitudinal measurement invariance hypothesis by examining the stability of the factor structure of the conditional regard scale over time (T1 through to T5). Model fit information and their delta difference tests are reported in Table 2. We applied increasing equality constraints to test the longitudinal invariance as reported above. In the first step (model 1a in Table 2), the five-item structure of the scale was applied to all the time points. Thresholds for model adequacy of the configural solution were met, with an excellent fit of the model to the data, $\chi^2_{215} = 417$, $p < 0.001$, CFI = 0.97, TLI = 0.95, RMSEA = 0.035 (95% C.I. 0.030–0.040), SRMR = 0.035. This means that the factorial structure remained equal over time. Test of metric invariance (Model 1b) revealed significant changes in CFI, TLI, RMSEA and SRMR when all factor loadings were constrained to equality. Therefore, full metric invariance was not supported. We performed partial metric invariance (Model 1c) by allowing the loadings of two items to be freely estimated (the first item at only one time point and the second item at three time points) which yielded an adequate solution. As can be seen in Model 1d (Table 2), scalar invariance stemming from constraining the item intercept to equality with the results of the partial metric model was not supported. Results of the partial scalar invariance testing (Model 1e) revealed that two item intercepts needed to be freed at T1 in order to achieve invariance. From these results, we can conclude that the conditional regard scale used in this study is partially time-invariant at the scalar level. These results support the use of the conditional regard scale in our latent trajectory classes.

Defining the latent trajectory classes

Analysis of the single-class trajectory of conditional regard indicated that a quadratic model fit the data, $\chi^2(6, N = 776) = 4.77$, $p = 0.57$, CFI = 1.00, TLI = 1.00, RMSEA = 0.01, SRMR = 0.02. Then, we determined the number of homogenous latent classes using model fit information. Table 3 displays fit information for the models with two, three, four, and five classes. The fit indices of the model with three growth trajectories were excellent: entropy was 0.89, the values of the LMR-LRT and the VLMR-LRT were both significant, and the posterior probability of belonging to a trajectory was greater or equal to 0.90. The model with four trajectories had a better AIC, BIC and SSABIC when compared to the three classes and the values of the LMR-LRT and the VLMR-LRT remained significant. However, the fourth class did contain only 2.4% ($n = 19$) of students. Therefore, taking into account the conceptual clarity of the models, as well as the number of participants included in each trajectory (< 5% of the sample; Nylund et al., 2007), we retained the unconditional quadratic LCGA with three latent classes.

Figure 1 depicts the developmental trajectories of conditional regard. As predicted, a "*Low stable*" trajectory represents 78.6% of students whose perception of conditional parental regard is low at baseline (Intercept: $M = 1.25$, $p < 0.001$), and remains relatively stable, although slightly more conditional over time (Linear slope: $M = 0.04$, $p < 0.04$; Quadratic slope: $M = -0.01$, $p = 0.47$). As also postulated, an "Increasing" trajectory comprises 12.4% of students who have a low level of conditional parental regard at baseline (Intercept: M = 1.39, p < 0.001) that significantly increases over time (Linear slope: $M = 0.85$, $p < 0.001$; Quadratic slope: $M = -0.142$, $p < 0.001$). Finally, a "*Declining*" trajectory includes 9% of students whose high level of perception of conditional parental regard at baseline (Intercept: $M = 2.68$, $p < 0.001$) significantly decreases to a moderate level over time (Linear slope: $M = -0.48$, $p < 0.001$; Quadratic slope: $M = 0.08$, $p < 0.01$).

Predictors of membership to trajectories

We conducted a multinomial logistic regression to estimate the trajectory membership probability considering students' gender, SAI, and father and mother education. The results show that there is no significant relationship between any of these variables and trajectory membership.

Students' academic functioning according to their trajectory membership

Table 4 presents the means and standard deviations of students and teachers' report of variables of students' school functioning. There are significant differences across the latent trajectory classes for

TABLE 3 Model fit indices for 1–5 class solutions of latent trajectories of perception of conditional parental regard.

C	AIC	BIC	SSABIC	Ent	LMR LTR	VLMR LRT	Post. prob.	Smallest group
1	4833.07	4898.23	4853.77					
2	4832.51	4888.36	4850.25	0.87	805.65***	2822.21***	0.97/0.92	16.1%
3	**4608.14**	**4682.61**	**4631.80**	**0.89**	**223.95***	**2404.25***	**0.90/0.90/0.97**	**9.02%**
4	4449.85	4542.93	4479.42	0.89	160.27*	2288.07*	0.88/0.95/0.96/ 0.89	2.50%
5	4335.28	4446.98	4370.77	0.86	123.46	2207.69	0.88/0.97/0.83/0.87/0.93	2.06%

Fit information for the retained model is presented in bold typeface. C, number of classes; AIC, Akaike information criterion; BIC, Bayesien information criterion; SSABIC, Sample-size adjusted BIC; Ent, entropy; LMR LRT, Lo-Mendel-Rubin likelihood ratio test; VLMR LRT, Vuong LMR LRT. *$p<0.05$; **$p<0.01$; ***$p<0.001$.

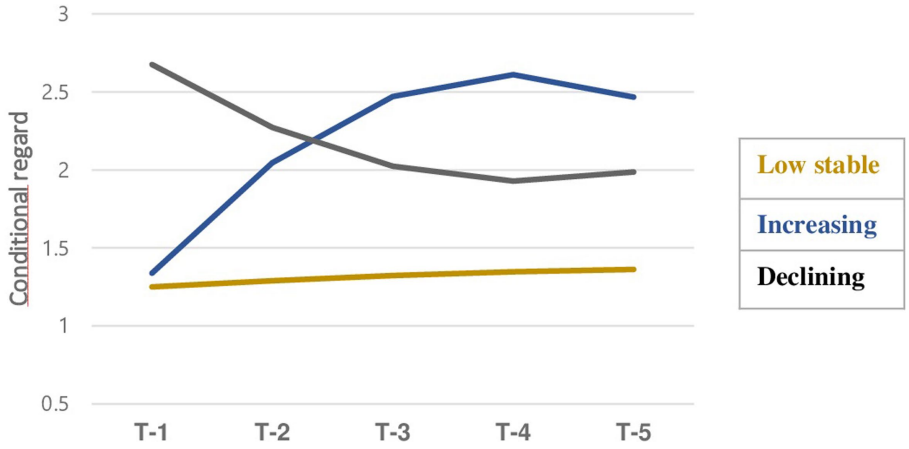

FIGURE 1
Latent growth trajectories of conditional support from T1 to T5. Low stable=78.6% of the sample; increasing=12.4% of the sample; declining=9% of the sample.

self-reported motivation, χ^2 (2, $N=776$) = 16.40, $p<0.001$, self-regulation, χ^2 (2, $N=776$) = 20.37, $p<0.001$, and positive attitudes toward dropout, χ^2 (2, $N=776$) = 16.83 $p<0.001$, but not school anxiety, χ^2 (2, $N=776$) = 3.15, $p=0.21$. There are also significant differences across the latent trajectory classes for teachers' reports of students' motivation, χ^2 (2, $N=776$) = 5.94, $p<0.05$, and self-regulation, χ^2 (2, $N=776$) = 4.97, $p<0.05$, but only marginally significant differences for academic achievement χ^2 (2, $N=776$) = 5.42, $p=0.06$.

As expected, results indicate that compared to students from the Low stable trajectory, those in the Increasing trajectory report lower motivation. Students in the Increasing and Declining trajectories report lower self-regulation and more positive attitudes toward dropout than those in the Low stable trajectory. Students from the Increasing and Declining trajectories have similar scores on all variables. The teachers rate the motivation and self-regulation of students in the Increasing trajectory lower than those in the Low stable trajectory. Finally, they evaluate that the academic achievement of students in the Low stable group is marginally superior (p = 0.06) to that of students in the other two groups.

Discussion

The objectives of this five-year longitudinal study were two-fold. The first was to identify heterogeneous developmental trajectories of students' perceptions of conditional parental regard based on academic success while testing whether students' gender, academic ability, and their parents' education are involved in the belonging to trajectories. The second objective compared, 1 year later, students' academic functioning according to their membership in the different developmental trajectories observed. The variables of school functioning were obtained from two sources: the students themselves and their teachers.

Patterns of change in perception of conditional parental regard

The interest of the longitudinal and person-centered approach used in this study is to show that while the perception of conditional parental regard is well correlated from one measurement time to the next, there are three subgroups of students who evolve in different ways based on yearly assessments from grade 6 to grade 11. A majority of students follow a low-stable trajectory where they rarely perceive that doing well in school is a necessary condition to merit their parents' regard. This finding is consistent with that of others who observed that the majority of young people perceived weak parental psychological control throughout adolescence (Roth et al., 2009; Assor and Tal, 2012; Rogers et al., 2020; Steffgen et al., 2022). By showing that low perception of conditional parental regard is maintained

TABLE 4 Mean scores (standard errors) and equality tests of means across trajectory classes using the BCH procedure for academic outcomes.

	Class specification means			Wald χ^2 tests of mean equality		
	Increasing n=96	Declining n=70	Low stable n=610	Increasing vs. Declining	Increasing vs. Low stable	Declining vs. Low stable
Students' report						
Motivation	2.58(0.07)	2.73(0.09)	2.87 (0.03)	1.62	15.22***	1.95
Self-regulation	3.28(0.11)	3.46(0.12)	3.77 (0.04)	1.24	15.83***	6.09**
Anxiety	2.19(0.11)	2.18(0.10)	2.04 (0.04)	0.01	1.60	1.76
Dropout	2.10(0.09)	1.97(0.11)	1.74 (0.03)	0.72	13.47***	4.17*
Teachers' report						
Motivation	1.26(0.14)	1.38(0.14)	1.40 (0.05)	2.44	5.91**	0.11
Self-regulation	1.22(0.09)	1.36(0.09)	1.42 (0.03)	1.24	4.69*	0.46
Academic achievement	3.29 (0.20)	3.28 (0.27)	3.94 (0.27)	0.00	2.91~	2.98~

~ $p < 0.07$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

throughout high school, it adds to Hascoët (2016) who reported that the perception of conditional parental regard for academic success was generally low and stable over 2 years during the primary-secondary transition.

As we predicted, a trajectory known as "Increasing" includes students whose weak perception of conditional parental regard in grade 6 increases abruptly at their arrival at middle school, and again slightly in subsequent years. This trajectory shows a pattern similar to that reported by Seidah (2004) in her cross-sectional study, where students in the late years of secondary reported higher conditionality in their parents' regard than those starting secondary school. However, this pattern is far from being a general developmental fact and characterizes a minority of students. Without data to verify this, students in this group may have more academic difficulties, causing their parents to insist on the importance of having better academic results. This hypothesis is consistent with studies that have shown that parents of less competent children use more controlling strategies, which undermines their performance (Pomerantz and Eaton, 2001; Grolnick et al., 2002; Grolnick, 2003). The growing perception of conditional parental regard may also reflect the higher importance some parents put on academic performance when students arrive at secondary school (Midgley et al., 1995; Anderman and Midgley, 1997; Bouffard et al., 2001). Although some children may interpret parents' expectations of achievement and performance goals as reflecting their appreciation of their competence, others may interpret them as a condition for their love and acceptance. Finally, in contrast to the previous group, we observe an unexpected trajectory where students perceive high conditional parental regard already in Grade 6, which declines slightly thereafter but remains moderate. In this group, which includes 9% of the students in our sample, the perception of high conditional regard in Grade 6 fades slightly the following year and remains moderate in the following 3 years. This shows that even in elementary school, some students feel that their academic success is among the factors that matter to their parents' approval. Even if this feeling diminishes slightly afterward, it remains present throughout secondary school. The first explanation for this downward trend is that the perception of these students being quite high, there was a greater chance that it would decline rather than the reverse. However, it may also signal that student have internalized the criteria initially set by their parents (Rogers, 1959; Harter, 1999, 2012; Assor et al., 2004). They then focus their attention more on their perception of themselves and their emotional world rather than on the regard of their parents. A third possibility is that while parents remain the most important source of support for school issues during adolescence (Harter, 1999), some students are exceptions and instead seek this support from their peers.

All that said, it must be remembered that conditional support is not an objective measure, but that perceived by the youth. This leads to the question of whether some personal characteristics of students shape how they perceive parental reactions. Is optimism, adaptability, openness, etc., lead to positive and sustained view of the relationship with one's parents? Similarly, is the lability in the perception of the relationship with parents due to a personal factor like emotional instability and dysregulation, nevrotism, difficulty in interpreting relational information, etc.? To date, research that has examined the relationship between conditional parental regard and personality variables has generally taken a correlational perspective that does not determine the direction of the relationship. A notable exception is Otterpohl et al. (2021) who used cross-lagged analyses to examine paths from conditional parental regard and contingent self-esteem in two studies with adolescent students. The authors reported that in both studies, students' contingent self-esteem predicted their perception of conditional parental regard, which they said supports their assumption of reciprocal effects of the constructs. They proposed a perspective where children act in such a way that brings their parents to show how child's efforts and performance matter to appreciate the child.

Finally, past research suggest that perception of conditional parental regard may be linked to student's gender, academic ability, or parents' education (Laidra et al., 2007; Côté and Bouffard, 2011; Bornstein, 2013; Stull, 2013; Choi et al., 2015; Israeli-Halevi et al., 2015). In this study, none of these variables is involved in the belonging to trajectories. Thus, being a boy or a girl, having more or less academic ability or more or less educated parents do not modify the probability of belonging to the trajectories of perceived conditional parental regard.

Trajectories of perception of conditional regard and school functioning

Previous studies have shown that conditional parental regard linked to academic achievement affects student academic functioning (Roth et al., 2009; Assor et al., 2014; Bouffard et al., 2015). However, the concurrent measurement of perceived conditional regard and indicators of academic functioning and the fact that the student was also generally the sole informant limit the scope of these studies. These studies also did not make it possible to know whether a temporary or more lasting perception of conditional parental regard by students is differently related to their school functioning.

We hypothesized that students with a low perception of conditional parental regard all over the 5 years from grade 6 to grade 10 would perform better academically than those in the other trajectories in grade 11. This hypothesis is only partially supported, as contrary to studies that reported an association between the perception of conditional parental regard and test anxiety (Bouffard et al., 2015; Otterpohl et al., 2019; Steffgen et al., 2022), in this study, there was no group difference in self-reported test anxiety and in academic achievement as judged by their teachers. It is likely that differences in the methodology of this study and prior studies are involved. In the study by Bouffard et al. (2015), the authors computed a mean score for students' perception of conditional parental regard from grade 5 to grade 7 and showed an indirect link between this perception and test anxiety in grade 8 mediated by the perception of competence in boys and by concern about errors in girls. In the two cross-sectional studies by Otterpohl et al. (2019) with single-time measurement in high school students (study 1) and university students (study 2), the problem of shared common variance prevents a good understanding of the nature of the relationships. That said, our results showed that students exposed over several years to conditional parental regard reported more positive attitudes toward dropping out of school. Thus, these students may see school dropout as an escape from the situation, which reduces their anxiety. Studies have shown that making educational and career choices that require abilities inferior to those possessed by the individual or choosing to drop out of school prematurely are strategies for reducing psychological illness (Kahn and Nauta, 2001; Bonneville-Roussy et al., 2017). With regard to academic achievement, the difference between the groups does not reach the conventional significance level and is only marginal ($p < 0.07$). We recall that the responding teachers were only in contact with the students for a limited amount of time each week and therefore may have lack information to judge accurately their general academic performance in all school subjects.

In line with the hypothesis, having low and stable perception of conditional parental regard all over the study is linked to the most positive pattern of outcomes: compared to students in the other two groups, they have higher scores on self-regulation and lower scores on positive attitudes toward dropping out. In addition, they report higher motivation than those whose perception of conditional consideration increases. Teachers corroborate this judgment and also rate them more positively on self-regulation than they did for those in the increasing group. Overall, these results are consistent with those of Steffgen et al. (2022) who reported that adolescent students with low perceived parental conditional regard exhibited the most adaptive configuration of academic and psychological outcomes.

Finally, students whose perception of conditional parental regard declines have generally similar scores to those of students whose perception increases. This finding may suggest that that the level of conditional parental regard of students in the declining group may still be high enough to contribute to similar low adaptive school functioning to that of students in the increasing group. Alternatively, this lack of difference between the increasing group and the descending group could be due to enduring educational costs for students of past exposure to high conditional parental support that would remain partly manifest even when the conditional aspect decreases. This seems particularly true for self-regulation and attitudes toward dropping out that are outcomes known to develop early (Archambault et al., 2009a,b; Bowers et al., 2011).

Altogether, findings of this study replicate those from variable-oriented studies reporting that students perceiving high conditional parental regard show unfavorable developmental outcomes (e.g., Roth et al., 2009; Roth and Assor, 2010, 2012; Assor and Tal, 2012; Wouters et al., 2018; Steffgen et al., 2022). According to Assor et al. (2004), Assor and Tal (2012), and Assor et al. (2014) unconditional regard allows children to see themselves as valuable individuals regardless of their academic performance. This helps them feel safe enough to be attentive to the task, interested in learning, take risks, be creative and bounce back if they fail. This study suggests that youths who receive such regard from parents on an ongoing basis report better school functioning over the long term. However, it must be remembered that conditional regard is not an objective measure, but that perceived by the youth. This leads to the question of whether students' personal characteristics shape how they perceive parental reactions. Is optimism, adaptability, openness, etc., lead to positive and sustained view of the relationship with one's parents and may explain the links with academic outcomes? Similarly, is the lability in the perception of the relationship with parents comes from a factor like emotional instability and dysregulation, a difficulty in interpreting the information that would also affect those in the school environment? To date, research that has examined the relationship between conditional parental regard and personality variables has generally taken a correlational perspective that does not determine the direction of the relationship. A notable exception is Otterpohl et al. (2021) who used cross-lagged analyses to examine paths from conditional parental regard and contingent self-esteem in two studies with adolescent students. The authors reported that in both studies, students' contingent self-esteem predicted their perception of conditional parental regard, which they said supports their assumption of reciprocal effects of the constructs. They proposed a perspective where children act in such a way that brings their parents to show how child's efforts and performance matter to appreciate the child.

Limitations, future studies and conclusion

The findings of our study are promising, but there are several limitations. First, the measure of conditional parental regard relates strictly on students' assessments. Although previous research (Roth et al., 2009) has also documented the negative correlates of conditional parental regard measures taken from other informants, associations between trajectory membership and indicators of school functioning may be overestimated. It may be misleading to believe that students' perceptions accurately

reflect parental behavior. As stated earlier, certain personal characteristics of young people may shape their judgment of their parents' love and play a greater role in their academic functioning. This possibility appears to offer a promising avenue for research to better understand the antecedents of children's perception of parental regard and clarify its role in children development. Second, since 88% of the students referred to their mother in responding to the conditional parental regard questionnaire, it was impossible to distinguish between father and mothers. Some studies found associations that varied with parent type (Assor et al., 2004; Roth, 2008). Third, despite its longitudinal approach, our design does not allow us to determine whether or not the hypothesized mechanisms are in fact, operating the way we assume they did. The correlational nature of the data makes it difficult impossible to determine the direction of causation among the variables included in this study. An appropriate design for doing this would be to longitudinally assess the two constructs and examine whether their relationships are reciprocal and whether one of the constructs predicts the other. This study included a number of covariates but cannot exclude the possibility that unmeasured variables play a role on the observed associations. Thus, future studies should assess whether there are characteristics of children such as perfectionism, low self-esteem, negative emotionality, etc., that make them prone to perceived conditionality in their parents' regard. Moreover, since several young students already had a fairly high perception of a conditional parental view from the start of the study, future research should also look at this phenomenon earlier in the students' schooling to understand when this perception emerges. Finally, our sample is normative and by no means representative of students from migration backgrounds, socially disadvantaged, disabled, or neuro atypical students.

Unless mistaken, this study is the first that examined conditional parental regard using a person-centered approach and a longitudinal design with multiple measurement times over a long period. This innovative aspect allowed us to observe that students' perceptions of conditional parental regard follow distinct patterns of evolution. Relatively low among the majority of students from the end of elementary school to the penultimate year of secondary school, the perception of conditional regard increases quite strongly for some but declines while remaining moderate for others. This study is also the first to have examined the links between the different patterns of change in the perception of conditional regard from parents over a 5-year period and students' academic functioning 1 year later. This makes it possible to affirm that the links observed are not due to the contemporary nature of the measurement of the phenomena while the multi-respondent approach for academic outcomes limits the problem of shared variance. The results indicate that a steady perception of being unconditionally loved seems the most favorable context for good school functioning. On the other hand, the high and transitory perception that parental regard and love are not acquired but depend on the fulfillment of their expectations is associate with less good students' academic functioning. More specifically, students who feel that their parents' support is conditional on their success tend to have weaker motivation and self-regulation and cultivate ideas of dropping out of school. The importance of the sample size, the balanced distribution between boys and girls, and the relatively low attrition rate are among strengths of this study.

Parents generally want the best for their children and want to be good parents. In an academic context, they want to foster their child's learning and intellectual development and provide an environment that will help them navigate through the challenges of their school adventure. Showing interest in the child's academic success and letting them know that we believe they can succeed is not in itself detrimental. These expectations indicate to them that we believe they are competent. However, parents need to make sure that their children understand that their emphasis on academic success is meant to be benevolent and in the best interest of their future, not a means of controlling them and certainly not a condition for earning their love. By focusing on the learning processes rather than the outcomes, by supporting the child in defining and achieving their personal goals, and by valuing their choices and commitment to their interests, parents contribute to the development of their child's autonomy. In so doing, they allow the child to discover, and nurture their own identity and thus flourish and develop their full potential.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Comité Institutionel d'Éthique de la Recherche avec des Êtres Humains (CIEREH), Université du Québec à Montréal. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

TB is the principal investigator of the large-scale longitudinal project from which the data for this study were drawn. TB and AM-T organized the material preparation, data collection and analysis, wrote the draft of the theoretical part and discussion, and commented by other authors. AM-T carried out and reported the statistical analyzes. All authors contributed to the study conception and design, read, and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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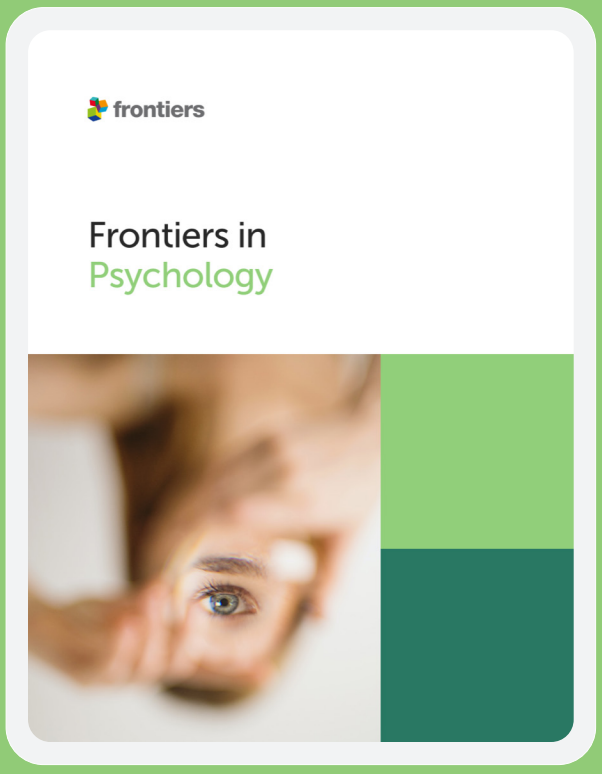

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