The Roles of Need-Supportive Social Contexts and Autonomous Motivation in Teaching and Learning: A Self-Determination Perspective

by

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Statement of Originality

This is a folio-approach thesis that combined four independent but unified research project. I, HAW, Joseph Yap, hereby declare that, I am the sole author of the abstract, Chapter 1, and Chapter 6, and the lead author for all the studies published/submitted under this series of research. I further declare that I have followed the University's policies and regulations on Academic Honesty, Copyright and Plagiarism in writing the thesis and no material in this thesis has been submitted for any degree in this or other universities.

Abstract

Self-determination theory (SDT) foregrounds the critical role of need-supportive social contexts for optimal functioning. Such social contexts facilitate the satisfaction of basic psychological needs for autonomy, competence, and relatedness. The satisfaction of these needs is conducive to the development of autonomous motivation which then leads to optimal functioning and well-being. In the school setting, school leaders and classroom teachers are the typical providers of these need-supportive social contexts. Despite the large SDT literature, there is a lack of research on how SDT's core assertion generalizes across socio-cultural and economic contexts as much of the existing research has focused on Western middle-class settings. Furthermore, much of the SDT literature has focused on teachers and their need-supportive teaching practices. Less research has been conducted on the role of school leaders in facilitating the satisfaction of teachers' basic psychological needs. Such a gap has critical implications since the way teachers are supported by their school leaders may influence the way they support the students. To address these critical gaps in the literature, this doctoral thesis aimed at investigating the role of need-supportive contexts in facilitating optimal teaching and learning. Particularly, it focuses on two types of need-supportive social contexts: need-supportive teaching and need-supportive leadership. This thesis examined what need-supportive teaching can do for students and what need-supportive leadership can do for teachers. This research was conducted in the form of four independent yet inter-related studies. *Study 1* examined the generalizability of need-supportive teaching and its associations with students' academic achievement via autonomous motivation across eight world cultures using the 2018 Programme for International Student Assessment (PISA) data (76 regions; N = 578,168). *Study 2* used the 2018 PISA Philippine data (N = 7,233) and investigated whether need-supportive teaching's association with academic achievement held across different socioeconomic strata. *Study 3* tested the association of need-supportive

leadership with need-supportive teaching practices and the association of need-supportive teaching with student engagement using teachers (N = 581) and student (N = 2,283) samples from 14 high schools in the Philippines. *Study 4* employed both variable- and person-centered approaches to investigate the association of need-supportive leadership with teachers' well-being (N = 611). Study 1 found that need-supportive teaching was positively associated with achievement via intrinsic motivation. These results were broadly generalizable across eight cultures. Study 2 found that the positive role of need-supportive teaching on academic achievement was generalizable across socioeconomic strata. Study 3 demonstrated that need-supportive leadership was positively associated with need-supportive teaching via teachers' autonomous motivation. Furthermore, need-supportive teaching, in turn, was positively associated with student engagement via students' autonomous motivation. Study 4 suggested that need-supportive leadership also facilitated teacher well-being via autonomous motivation. The study's person-centered approach found two teacher subgroups in the sample that respectively exhibited high and low need support. The two groups were significantly different in their autonomous motivation and well-being profiles. Altogether, the studies make key contributions to SDT. They provide evidence of SDT's universality claim using fine-grained operationalization of cultures. Furthermore, they provide an integrative SDT perspective on both teachers and students and what facilitates their motivation and flourishing in teaching and learning. The research offers practical suggestions for teachers and school leaders.

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I have received bountiful gifts and blessings from God during this three-year EdD journey. Now I return them to Him with much praise and thanksgiving. May he dispose of them as He wills. My prayer is that He may give me the grace to continue loving and serving Him. *Ad majorem Dei gloriam*.

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List of Publications Presented in the Thesis

This doctoral thesis is a research project presented as a folio of four independent works. Two of these have already been published and two are currently under review. The contribution of the co-authors in these works are listed in Appendix H of this thesis.

Published works:

Chapter 1:

Haw, J. Y., & King, R. B. (2022). Need-supportive teaching is associated with reading achievement via intrinsic motivation across eight cultures. *Learning and Individual Differences*, *97*, Article 102161. https://doi.org/10.1016/j.lindif.2022.102161

Chapter 2:

Haw, J. Y., King, R. B., Eos, J., & Trinidad, R. (2021). Need supportive teaching is associated with greater reading achievement: What the Philippines can learn from PISA 2018. *International Journal of Educational Research*, *110,* Article 101864. https://doi.org/10.1016/j.ijer.2021.101864

Submitted and under review:

Chapter 3:

Haw, J. Y., & King, R. B. (2022). *Need-supportive leadership, need-supportive teaching, and student engagement: A self-determination perspective* [Manuscript submitted for publication in *Social Psychology of Education*]. The Education University of Hong Kong.

Chapter 4:

Haw, J. Y., Nalipay, Ma. J. N., & King, R. B. (2022). *Need-supportive school optimizes teacher well-being: Variable and person-centered approaches* [Manuscript submitted for publication in *Teachers and Teaching: Theory and Practice*]. The Education University of Hong Kong.

Chapter 1: Introduction

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) defined education as "the process of facilitating learning or the acquisition of knowledge, skills, values, beliefs, and habits." This definition highlights two pillars that act as anchors for determining educational quality. On one end is the quality of teaching or "facilitating" and on the other is the quality of learning or "acquisition". Hence, researchers have used various models to understand and explain the interplay between these two pillars. Hattie's (2008) landmark book of 800 meta-analyses suggested that "what teachers do matters". Teachers can shape students' learning outcomes, such as motivation, engagement, and academic achievement (Hattie, 2008, p. 22). His findings further revealed that motivation was one of the top high-impact correlates of student achievement that "good" teachers facilitated (Hattie, 2008). Indeed, the quality of instruction is a critical and necessary ingredient in facilitating optimal student motivation and learning (Hattie, 2008; Ryan & Deci, 2017).

The dynamic between teacher practices that facilitate optimal student dispositions and learning can be understood using Self-Determination Theory (SDT; Ryan et al., 2021; Ryan & Deci, 2000, 2020). SDT is a broad motivational theory that highlights the importance of need-supportive social contexts in facilitating motivation and optimal functioning. There is a vast body of empirical studies on teaching and learning underpinned by SDT's theoretical assumption (see, for example, Bureau et al., 2022; Slemp et al., 2020; Stroet et al., 2013, 2015). One of SDT's core strengths is that it offers a unified framework on teaching and learning. As the progenitors of SDT argued, it "represents both an expansive and expandable framework that provides a unified perspective on diverse phenomena that cut across many theories" (Ryan & Deci, 2020, p. 8). However, despite the integrative perspective offered by SDT, most past studies have not capitalized on this potential. Instead, past studies have only focused on a limited set of phenomena (Adams & Khojasteh, 2018; Ahn et al., 2021; Marshik

et al., 2017; van den Berghe, Vansteenkiste, et al., 2014). For example, need-supportive social contexts are typically fostered by teachers (need-supportive teaching) and school leaders (need-supportive leadership) in the educational setting. Van den Berghe and colleagues' systematic review plotted a motivational sequence starting from teacher antecedents to student outcomes from an SDT perspective and found several studies focusing only on specific sets of relationships (van den Berghe et al., 2014). The review did not record a study that encompassed relationships from teacher antecedents to student outcomes. Furthermore, recent studies that linked teacher motivation with student motivation did not look at need-supportive social contexts that could support such a link (Ahn et al., 2021; Marshik et al., 2017). This thesis addresses this shortcoming by considering how the role of need-supportive social contexts could facilitate autonomous motivation and optimal outcomes. Specifically, it examines how need-supportive school leadership practices could foster teachers' autonomous motivation leading to need-supportive teaching. It further investigates whether need-supportive teaching, in turn, could facilitate the students' autonomous motivation, leading to engagement and academic achievement.

Theoretical Framework

SDT's core assertion is that human beings have a natural propensity for growth and development. This natural inclination to seek growth and development is fueled by the satisfaction of three basic psychological needs: autonomy, competence, and relatedness. *Autonomy* is the sense of volition or willingness to accede to an externally endorsed value or behavior (Ryan & Deci, 2020). *Competence* refers to having a sense of effectiveness or meeting optimal challenge (Reeve, 2016; Vansteenkiste et al., 2020). *Relatedness* refers to the feeling of belonging (Niemiec & Ryan, 2009). SDT underscores that satisfying these basic psychological needs is necessary for one's optimal functioning and well-being. Basic psychological need satisfaction facilitates autonomous motivation that acts as a mechanism

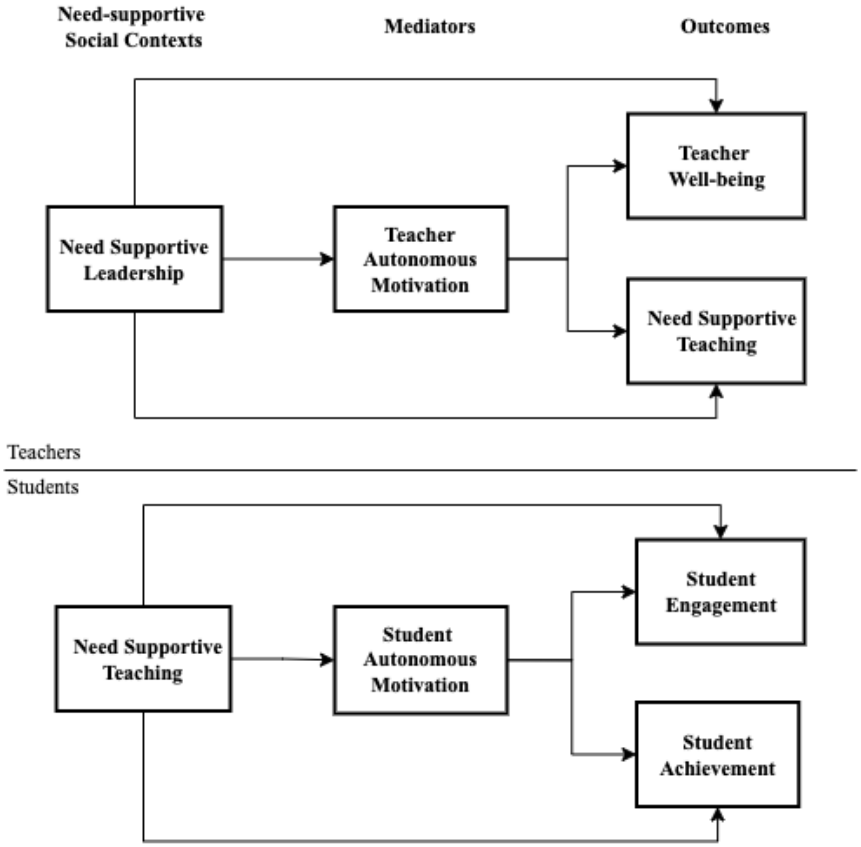
for various positive personal outcomes. Such satisfaction depends on the person's social context that could either support or thwart these needs (Ryan & Deci, 2017).

On the one hand, need-supportive social contexts create situations for basic psychological need satisfaction, propelling the individual's optimal growth and development. On the other hand, need-thwarting social contexts create conditions for controlled motivation that lead to maladaptive outcomes. Hence, need-supportive social contexts have a critical role in facilitating motivation and, in the long run, flourishing and well-being (Ryan & Deci, 2017). These theoretical assertions echo the educational sector's concern about the students' quality of motivation, engagement, and learning as well as the teachers' quality of teaching and well-being that could support the students (Ryan & Deci, 2017).

There are several social contexts that could multiply interact with both teachers and students. However, in the day-to-day school setting, the school leaders and classroom teachers are two proximal social contexts considered to have significant roles in facilitating motivation and optimal teaching and learning. This doctoral thesis explores these social contexts and how they facilitate optimal motivation from the SDT perspective. Specifically, need-supportive social contexts are operationalized as need-supportive teaching (from the perspective of students) and need-supportive leadership (from the perspective of the teachers). Figure 1.1 below graphically summarizes the relationships among need-supportive social contexts (i.e., need-supportive leadership and need-supportive teaching), autonomous motivation, and optimal outcomes.

Figure 1.1

Conceptual Framework of the Thesis



Intrinsic and Autonomous Motivation

Research suggests that intrinsic and autonomous motivation are primary predictors of flourishing and well-being in schools (Corpus & Wormington, 2014; Dickhäuser et al., 2016; Howard et al., 2020; Ryan & Deci, 2020; Taylor et al., 2014). SDT theorists delineate intrinsic motivation from autonomous motivation. *Intrinsic motivation* refers to the organic desire and enjoyment of doing an action, hence, indicates volition (Ryan & Deci, 2020).

However, real-life school contexts present situations where pure enjoyment may not be apparent. For example, some students may find excitement in doing their homework in reading because they enjoy reading or are intrinsically motivated. However, some students might not find reading as enjoyable but are still motivated to do their homework because they find it valuable for learning. In the same way, some teachers may spend time with students

because it is fun to be with them, whereas others would do it because they believe relating with students is a key to learning. In both cases, the students and teachers motivated to do things other than for pure enjoyment are driven by extrinsic motivation (Jang et al., 2012; Reeve, 2013).

In the SDT framework, extrinsic motivation can be autonomous or controlled, depending on what regulates the person's action (Ryan & Deci, 2017, 2020). SDT posits five types of regulations that indicate a spectrum of motivation from controlled to autonomous. External regulation refers to behavior or values endorsed by external pressure or demand (e.g., a threat of punishment or offering of reward). Introjected regulation prompts the person to act because of internalized pressure (e.g., facing shame for getting low marks). SDT classifies these types of regulation as controlled motivation because the exhibited action or behavior is not self-endorsed.

On the other hand, identified regulation refers to acceding to an externally endorsed behavior or value deemed essential and significant. Over time, these externally endorsed values or actions become part of one's value system. Integrated regulation refers to externally proposed behavior that has been internalized and becomes part of one's behavior (Jang et al., 2012; Ryan & Deci, 2020). These types of regulation manifest autonomous motivation, with integrated regulation as the most autonomous type of motivation.

Autonomous motivation propels an individual to act upon an externally proposed value or behavior because they identify with its value, or at certain times, it has become integral to one's value system. For example, autonomously motivated students may not necessarily read books out of sheer enjoyment but are still engaged and motivated to study because they see its importance in their day-to-day living. Autonomously motivated teachers may not find teaching to be always enjoyable but continue to teach because they value their

profession. Since autonomous motivation is considered "internalized", it shares the volitional character of intrinsic motivation.

Although distinct, these two types of motivation could simultaneously and multiply occur with other types of motivation (Ryan & Deci, 2017). Hence, many studies subsume intrinsic motivation under autonomous motivation (e.g., Vansteenkiste et al., 2009). Following empirical precedence, this doctoral thesis subsumes intrinsic motivation under autonomous motivation while mindful of their distinctions in the presented individual studies.

Need-Supportive Social Contexts

SDT underscores the critical role of need-supportive social contexts in fostering basic psychological needs satisfaction leading to autonomous motivation and various positive outcomes. In the educational setting, teachers are the primary providers of a need-supportive social context for students. At the same time, school leaders are primarily responsible for facilitating a need-supportive social context for teachers. Hence, from the SDT perspective, the teachers' and school leaders' need-supportive practices are essential factors in fostering both teachers' and students' autonomous motivation, leading to their growth and well-being.

Need-Supportive Teaching. Need-supportive teaching practices generally correspond with the three basic psychological needs (i.e., autonomy, competence, and relatedness). Specifically, *autonomy-support* refers to teaching practices that support students' need for autonomy by giving them a voice regarding tasks or lessons. Teachers support students' need for competence by providing them *structure* in learning, like setting clear expectations. Lastly, teachers support the students' need for relatedness through *involvement* or showing interest and availability.

There seems to be no consensus among scholars on how need-supportive teaching domains are associated with the satisfaction of three basic psychological needs (Ahn et al., 2021). For example, several studies found that autonomy-support is related to the satisfaction

of the three basic psychological needs (e.g., Furtak & Kunter, 2012; Leptokaridou et al., 2016; Patall et al., 2018; J. Wang et al., 2016). Some others have used other dimensions or combinations of each dimension: involvement (e.g., Klassen et al., 2012), structure (Guay et al., 2017), autonomy-support and structure (e.g., Hospel & Galand, 2016; Jang et al., 2010), or structure and involvement (Mendoza et al., 2022). However, Adams and Khojasteh (2018) argued for using the three dimensions to reflect the interdependency of the three basic psychological needs. The combined effects of the three dimensions of need-supportive teaching are worth exploring as empirical studies suggest that the combined effect size of the three dimensions has a greater magnitude than their individual effects (Olivier et al., 2021; Stroet et al., 2013).

Need-Supportive School Leadership.[1] Past studies suggest that the quality of the social context where the teachers are embedded could determine how they handle their classes (e.g., Pelletier et al., 2002; Pelletier & Rocchi, 2016; Roth, 2014; Roth et al., 2007). Notably, these empirical studies have found that what teachers experience from their school leaders influences their quality of motivation to support and motivate their students. However, SDT research that explores teachers' social context has been sorely missing, rare at best (Adams, 2021; Eyal & Roth, 2010; Niemiec & Ryan, 2009; Pelletier & Sharp, 2009). Hence, researchers underline the critical need to examine *need-supportive leadership* in light of its potential influence on teachers' motivation, their need-supportive teaching practices, and well-being (Adams, 2021; Burns et al., 2020; Collie et al., 2018; Roth, 2014).

Congruent with SDT's broad framework, *need-supportive leadership* involves supporting the teachers' three basic psychological needs. Rothman and Fouché (2018)

[1] As argued by Ryan and Deci (2020), SDT's framework fits well with other theoretical frameworks. For example, need-supportive leadership practices find congruence in the practices of transformational leadership theory (Trépanier et al., 2012). However, SDT by itself is not a separate leadership theory. Hence, this body of work refers to the "need-supportive practices" that may occur in different types of leadership. For brevity, however, this body of work will use the term "need-supportive leadership".

suggested that school leaders could support teachers' autonomy by listening to what teachers say about their work. They could support the teachers' need for competence through constructive feedback and helping them improve on their teaching practices and other roles in schools. School leaders also support competence when they take time to learn about the teachers' career goals, give credit to their contribution to the school, and set-up structures for training and development that will further their career or competence beyond the classroom. School leaders could support their teachers' need for relatedness by showing care and building a trustworthy relationship.

Need-Supportive Teaching's Association with Student Motivation and Learning

A key feature of SDT theorizing is its explanation of motivational dynamics in teaching and learning. Need-supportive teaching facilitates students' basic psychological needs satisfaction, leading to autonomous motivation. Autonomous motivation, in turn, leads to various positive and adaptive learning outcomes (e.g., Jang et al., 2012). Prior research has presented empirical evidence of the outcomes of this motivational dynamic (e.g., Bureau et al., 2022; Howard et al., 2021; Stroet et al., 2013, 2015). For example, there is a consensus among scholars that autonomous motivation has a significant positive relationship with students' engagement and academic achievement in various learning contexts (see meta-analytic studies of Hooper, 2018; Stroet et al., 2013; van den Berghe et al., 2014). Furthermore, research has found empirical evidence that associates need-supportive teaching with these motivational outcomes. Stroet et al.'s (2013) meta-analytic study found strong empirical evidence supporting the associations among need-supportive teaching, autonomous motivation, and engagement. Howard et al.'s (2021) meta-analytic study found the significant associations among need-supportive teaching, student motivation, and academic achievement.

However, the extant literature is predominantly drawn from affluent and developed societies. Iterating the investigation across the globe and especially covering rarely explored samples will provide the necessary information to continue reflecting on the complexities of learning climates across different cultures and contexts (Ryan & Deci, 2020).

Need-Supportive School Leadership's Association With Teacher Motivation, Need-Supportive Teaching, and Well-being

Need-supportive teaching does not occur in a vacuum (Niemiec & Ryan, 2009). The teachers' ways of supporting the students' basic psychological needs are influenced by how their school leaders support them. Research suggests that need-supportive leadership has been shown to facilitate the teachers' autonomous motivation through basic psychological needs satisfaction (Adams, 2021; Eyal & Roth, 2010; Roth, 2014). Eyal and Roth (2010) suggested that school leadership need-supportive practices were essential antecedents of the teacher's motivation to teach in a need-supportive way. Moreover, Adams' (2021) study found that need-supportive leadership was associated with students' experience of need support from their teachers.

More recently, several studies have investigated the links of teacher motivation with need-supportive teaching and their sequential influence on student motivation and learning (Ahn et al., 2021; Marshik et al., 2017; see also Bardach & Klassen, 2021). For example, Ahn and colleagues (2021) found empirical evidence linking teachers' autonomous motivation with need-supportive teaching and its impact on students' motivational dynamics. Given these empirically supported linkages, need-supportive leadership as a predictor of teacher motivation could also have potential, although indirect, associations with student motivation and learning outcomes. Such an indirect relationship has empirical precedents in other leadership studies outside SDT (e.g., Leithwood & Jantzi, 2006; Robinson et al., 2008). However, in the light of SDT, research investigating need-supportive school leadership and

its potential indirect link with student outcomes is still sorely missing. Exploring need-supportive school leadership practices and their impact on the "doubly motivational" dynamics of teachers and students could provide a more holistic SDT theorizing in the educational setting.

An equally important aspect of need-supportive school leadership but only recently explored is its impact on teacher well-being. Teacher well-being is essential for the teacher as an end itself. However, teacher well-being has implications for their teaching behavior and subsequently could be linked to the quality of their students' learning (Collie et al., 2015). Teachers with compromised well-being leave the profession, or if they stay, it could negatively affect their students (Burić & Frenzel, 2021; Hong, 2012). SDT's theoretical framework asserts that the leaders' support for subordinates' psychological needs would lead to motivation, leading to positive outcomes such as flourishing and well-being (Gagné et al., 2016; Ryan & Deci, 2017). In the educational context, several scholars have underscored the role of school leaders and their supportive behavior in fostering teacher well-being (Collie & Martin, 2017b; Hascher & Waber, 2021; Herman et al., 2021).

SDT's Universality

The relationships discussed above are underpinned by the much-debated claim to *universality* or generalizability. As mentioned earlier, SDT asserts that autonomous motivation ensues from basic psychological needs satisfaction. The term "basic" indicates that all people have psychological needs for autonomy, competence, and relatedness. They are necessary conditions for optimal functioning and well-being regardless of "age, gender, language, socioeconomic status, nationality, culture, ability level, special-needs status, or historical time period" (Reeve, Ryan, et al., 2018, p. 18). Hence, the relationships that allow for the satisfaction of these basic psychological needs could also be construed as universal. It is necessary then to test this claim within this doctoral thesis.

Various studies have questioned this theoretical assertion pointing out that the purported "universal" needs are not consistent with some cultural propensities (Iyengar & Lepper, 1999; Markus et al., 1996; Markus & Kitayama, 2003). Notably, a central contention is that autonomy may be a natural need in the West but not in the predominantly collectivist Eastern society (Iyengar & DeVoe, 2003; Iyengar & Lepper, 2000). SDT scholars have addressed this critique by empirically showing that autonomy makes sense to people from other cultures (e.g., Chen et al., 2015; Chirkov, 2009). Several researchers have also empirically demonstrated that autonomous motivation has associations with student outcomes in collectivist societies (Howard et al., 2021; Jang et al., 2016; Nalipay et al., 2020).

Nevertheless, many of the empirical studies supporting SDT's claim to universality were based on limited social constructs (e.g., nationality and ethnic background), which leaves its evidence base still open for expansion and critical reflection. For example, there seems to be no existing empirical evidence on SDT's universality using Schwartz's (2009) cultural value orientation grouping. Moreover, many SDT studies come from affluent and middle-class contexts and might reflect less relevant values for more economically disadvantaged groups (Cohen & Varnum, 2016). Hence, this doctoral thesis examines the association among need-supportive teaching, autonomous motivation, and student reading achievement from the perspective of cross-cultural generalizability using a fine-grained perspective of culture. As argued by several scholars, such a study would extend SDT literature to have a "culturally imaginative" evidence base for its claim to universality (Cohen & Varnum, 2016; King et al., 2018).

Practical Implications

The discussion above highlights the theoretical importance of examining how school leaders facilitate a need-supportive social context for teachers which could lead teachers to be being need-supportive and motivating their students towards learning. Empirical studies that

examine these relationships have significant and practical importance in the Philippines' cultural and socioeconomic context. SDT could provide empirical insights that could help improve what seems to be declining literacy in the Philippines. Hints of such a decline can be gleaned from the country's poor track record in several international large-scale assessments such as the Programme for International Student Assessments (PISA; OECD, 2019a) and Trends in International Mathematics and Science Study (TIMMS; Mullis et al., 2020).

PISA is an international large-scale assessment that measures the reading, mathematics, and science literacy of 15-year-old adolescents every three years (OECD, 2019b). In 2018, the Philippines joined PISA for the first time. The country lagged behind 78 other countries and regions, scoring last in reading assessments and second to last (i.e., the Dominican Republic) in mathematics and science assessments. The Philippines' dismal performance adds to the country's poor track record in international assessments (Bernardo et al., 2008). Philippine scholars attribute this poor performance to the country's past and present socioeconomic and political challenges (Bernardo et al., 2015; Reyes, 2010; Trinidad, 2020). However, there are also indications that the pervading quality of the socio-contextual environment of teaching and learning may have an influence on the decline of Filipino students' academic achievement and other educational outcomes (Banzon-Librojo et al., 2017; Bernardo et al., 2015; de Mesa & de Guzman, 2006; Trinidad, 2020).

The Philippine education system, in general, is still considered to be following a traditional approach where teachers and school leaders are the authorities that control the classroom and school environment (de Mesa & de Guzman, 2006; Trinidad, 2020). Moreover, there is still a dominant culture of employing extrinsic, even controlling, motivators (Banzon-Librojo et al., 2017; de Mesa & de Guzman, 2006). Nevertheless, studies have shown a laudable improvement in Philippine schools' learning climate despite several

challenges indicating the potential malleability of teachers' and school leaders' practices (de Mesa & de Guzman, 2006).

As evidenced by research, SDT provides a framework for teachers and school leaders to improve the quality of day-to-day teaching and learning experiences. Specifically, several empirical studies have documented that need-supportive teaching behavior can be learned (e.g., Cheon et al., 2018, 2020; Reeve & Cheon, 2016). Research further shows that students benefit (e.g., increased intrinsic motivation) when teachers learn to become need-supportive (Guay et al., 2016). This, in turn, had a reciprocal effect on teachers' motivation and practices (Skinner & Belmont, 1993; Y. Wang et al., 2019). These empirical studies suggest that teachers and school leaders in the Philippines may have better returns in positive school outcomes when need-supportive practices complement efforts in structural and curricular reforms (Haw et al., 2021).

Therefore, a systematic investigation of the influence of need-supportive social contexts (i.e., need-supportive leadership and need-supportive teaching) on school outcomes in the Philippine setting is of practical value. Specifically, these investigations could provide policymakers, school leaders, and teachers the empirical insights into adapting SDT in the Philippines' unique cultural, social, and economic context.

Aims and Objectives

This doctoral thesis aimed to address the gaps in literature identified above and extended SDT's critical contribution to education. Specifically, it investigated the associations among need-supportive leadership and teaching, autonomous motivation, student engagement and achievement, and teacher well-being. The following objectives and related research questions guided the course of the thesis:

1. to examine the cross-cultural generalizability of the relationship among need-supporting teaching, autonomous motivation, and academic achievement (*Study 1*)

RQ1: Does need-supportive teaching have positive associations with students' academic achievement via intrinsic motivation across eight cultural groups?

2. to investigate the generalizability of need-supportive teaching's association with academic achievement across socioeconomic strata (*Study 2*)

   RQ2: Does need-supportive teaching have positive associations with students achievement across Philippine economic strata?

3. to test the (a) the association of need-supportive school leadership with need-supportive teaching via autonomous motivation and (b) the association of need-supportive teaching with student engagement via autonomous motivation (*Study 3*)

   RQ 3. Does need-supportive school leadership predict need-supportive teaching via autonomous motivation? Does need-supportive teaching predict student engagement via autonomous motivation?

4. to explore (a) the association of need-supportive leadership with teacher well-being via autonomous motivation, and (b) differences in qualities of motivation and well-being among profiles of teachers (*Study 4*).

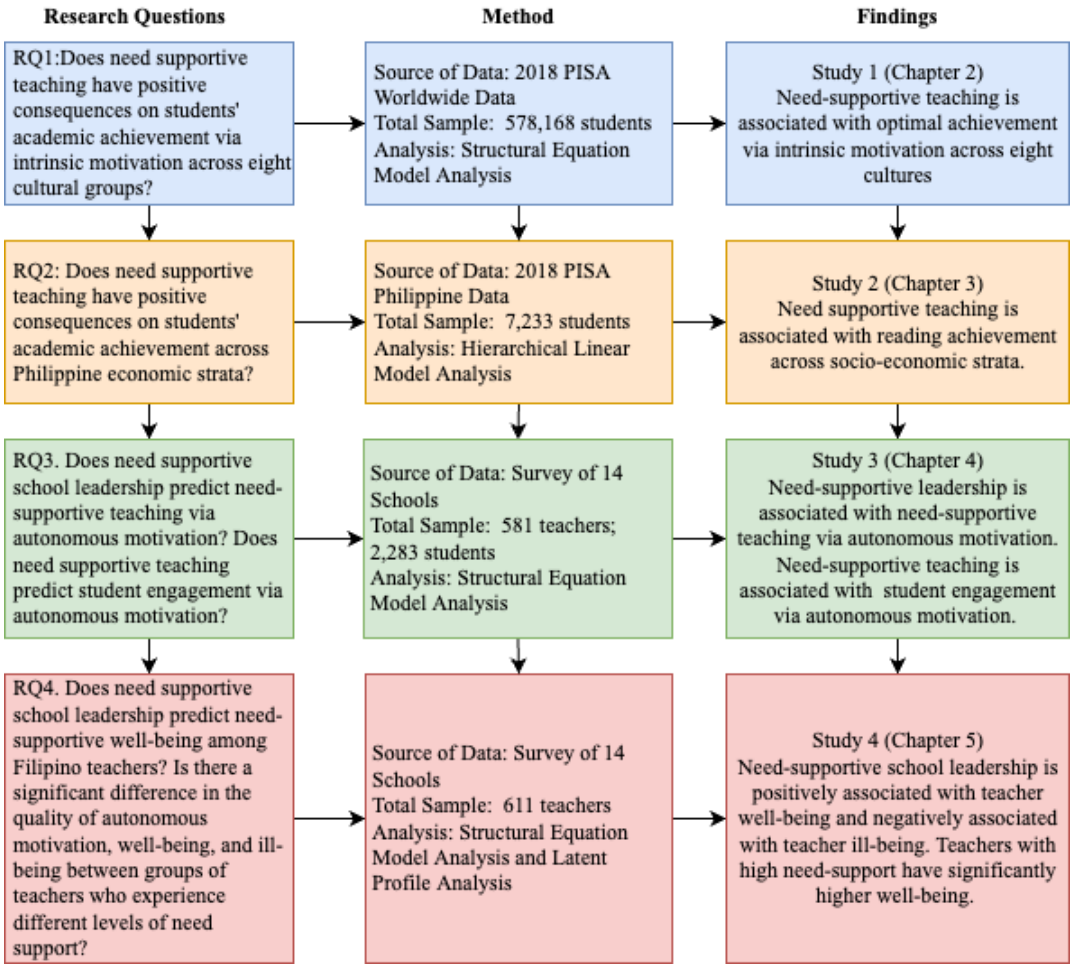
   RQ4. Does need- supportive school leadership predict higher well-being and lower ill-being among Filipino teachers? Is there a significant difference in the quality of autonomous motivation, well-being, and ill-being between groups of teachers who experience different levels of need support?

Thesis Structure

Four independent studies were conducted to respectively address the individual research questions. These studies are inter-related as they build on each other. Figure 1.2 maps the structure of this doctoral thesis. Table 1.1 summarizes the hypotheses tested and the key findings of the four studies presented in this thesis.

Figure 1.2

Thesis Structure



Chapter 2 presents an investigation on SDT's universality claim using Schwartz's (2009) cultural value orientation grouping (Study 1; Haw & King, 2022b). The conventional basis for many cross-cultural studies in SDT is the East-West divide or the individualistic versus collectivist societies (e.g., Nalipay et al., 2020). However, scholars call for research to be "culturally imaginative" by going beyond the East and West binary opposition (King et al., 2018). Categorizing societies either as collectivist or individualistic cultures glosses over the nuances in culture. For example, Schwartz's (2009, 2014) study found at least eight cultural groupings based on their value orientations. The study applied this value orientation grouping in a fine-grained investigation of SDT's cross-cultural generalizability. The study posited that

SDT's mediation model of need-supportive teaching predicting student achievement via intrinsic motivation would generalize across eight cultures.

Chapter 3 builds on the empirical evidence presented in the preceding chapter. SDT asserts that its core tenets apply to all regardless of cultural contexts (Reeve, Ryan, et al., 2018). Cohen and Varnum (2016) argue that socioeconomic status is a type of culture that researchers still need to explore. The study presented in this chapter pursued the investigation of SDT's universality across the Philippines' socioeconomic strata (Study 2; Haw et al., 2021). The study argued the need to investigate this claim in the context of a developing country since many SDT studies come from affluent societies (Haw et al., 2021). In this study, the researchers found empirical support for the generalizability of need-supportive teaching's association with Filipino students' academic achievement across socioeconomic status, school type, and school location.

The applicability of SDT tenets in the Philippines' wide socioeconomic strata scaffolds the next two studies which reiterates the investigation done in Chapter 2 using longer measures of need-supportive teaching and different learning outcomes. It also sets the tone for testing the impact of a supportive social context on teachers.

Chapter 4 presents a two-pronged study that explores the potential downstream consequences of teachers' motivational dynamics on their students' motivation and engagement (Study 3; Haw & King, 2022a). Recent research links teacher motivation and need-supportive teaching practices with student motivation and positive learning outcomes such as engagement and achievement (e.g., Ahn et al., 2021; Marshik et al., 2017). Based on SDT's extensive literature, the researchers argued that the school leaders' role in facilitating a need-supportive learning climate is rarely explored and even "almost non-existent" (Adams, 2021; Haw & King, 2022a). Hence, the researchers foregrounded the role of school leaders and examined need-supportive school leadership as an antecedent of need-supportive

teaching. The study further investigates whether need-supportive teaching is perceived by students and is associated with their motivation and engagement to explore the potential downstream consequences of need-supportive leadership on student engagement.

Chapter 5 presents a study that examined the role of need-supportive leadership with teacher well-being (Study 4; Haw et al., 2022). The researchers argued that teacher well-being is a critical antecedent of teachers' instructional quality and behavior but is still underexplored. At best, many studies explore teacher well-being from a negative perspective (e.g., stress and burnout; see, for example, Burić et al., 2019; Ford et al., 2019; R. Richards et al., 2018). Haw et al. (2022) further argued that SDT studies are prevalently variable-cantered, which glosses over specific characteristics of sub-groups in a sample. Hence, to extend the findings in Chapter 4, the researchers explored the potential associations of need-supportive school leadership and teacher autonomous motivation with teacher well-being. A vital feature of this study is a person-centered approach which provided more nuanced evidence of the influence of need-supportive school leadership on teacher well-being.

Taken altogether, these chapters represent a unified research project informed by SDT's integrative framework that aims to have theoretical and practical contributions to "what really matters to students, teachers, and administrators" (Ryan & Deci, 2020).

Table 1.1

Summary of Thesis Hypotheses and Key Findings

Objective	Study	Hypotheses	Key Findings
1. to examine the cross-cultural generalizability of the relationships among need-supporting teaching, autonomous motivation, and reading achievement	(Haw & King, 2022a) presented in Chapter 2	H1. Need-supportive teaching will positively predict student achievement. H2. Intrinsic motivation will positively predict student achievement. H3. Need-supportive teaching will indirectly predict reading achievement via reading intrinsic motivation.	• Evidence supported H1 in six cultural groups with varying magnitudes of effect sizes. • Evidence supported H2 and H3 across eight cultures with varying magnitudes of effect sizes. • Evidence suggested broad but not unanimous support for SDT's cross-cultural generalizability (see Table 2.2).
2. to investigate the generalizability of need-supportive teaching's association with reading	(Haw et al., 2021) presented in Chapter 3	H1. Need-supportive teaching will be associated with students' reading achievement. H2. Need-supportive teaching's association with reading achievement will generalize	• Evidence supported H1 and H2 • Evidence suggested support for SDT's generalizability across socioeconomic strata and school types (see Table 3.1).

Objective	Study	Hypotheses	Key Findings
achievement across socioeconomic strata		to students from different socioeconomic contexts and school types (public vs. private; urban vs. rural).	
3. to test the (a) the association of need-supportive school leadership with need-supportive teaching via autonomous motivation and (b) the association of need-supportive teaching with student engagement via	(Haw & King, 2022a) presented in Chapter 4	*Antecedents of need-supportive teaching* H1a. Need-supportive school leadership practices will positively predict need-supportive teaching practices. H1b: Autonomous motivation will partially mediate the association between need-supportive leadership practices and need-supportive teaching. *Consequences of need-supportive teaching* H2a: Need-supportive teaching will be positively associated with student engagement.	• Contrary to H1a and H1b, evidence suggested autonomous motivation fully mediated the association between need-supportive leadership and need-supportive teaching (see Figure 4.3). • Evidence supported H2a and H2b (see Figure 4.4) • Although not tightly linked, the evidence from the two studies showed a potential motivational sequence from need-supportive leadership to need-supportive teaching and from need-supportive teaching to student

Objective	Study	Hypotheses	Key Findings
autonomous motivation		H2b: Students' autonomous motivation will partially mediate the association between need-supportive teaching and student engagement.	engagement with autonomous motivation as the underpinning mechanism.
4. to explore (a) the association of need-supportive leadership with teacher well-being via autonomous motivation, and (b) differences in qualities of motivation and well-being among profiles of teachers	(Haw et al., 2022) presented in Chapter 5	*Variable-centered approach:* H1a: Need-supportive leadership practices will be positively associated with teachers' well-being. H1b: Need-supportive leadership practices will be negatively associated with teachers' ill-being H2a: Autonomous motivation will partially mediate the associations between need-supportive leadership and well-being.	• Evidence supported H1a,b and H2a,b (see Figure 5.1) • Latent profile analysis showed two distinct teacher profiles: high-need support and low-need support. Teachers with high need-support had significantly higher well-being and lower ill-being compared to teachers with low-need support (see Figure 5.2 and Table 5.3)

Objective	Study	Hypotheses	Key Findings
		H2b: Autonomous motivation will partially mediate the associations between need-supportive leadership and ill-being. *Person-centered approach* No stated hypothesis for number of profiles.	

Note: The "high need-support" refers to the profile of teachers who reported that they have higher need-supportive school leaders whereas "low need-support" refers to the profile of teachers who reported they experienced lower need-supportive school leadership.

Chapter 2: Need-Supportive Teaching is Associated With Reading Achievement via Intrinsic Motivation Across Eight Cultures

[Joseph Y. Haw and Ronnel B. King]

Abstract

Self-determination theory (SDT) emphasizes that need-supportive teaching, which includes support for autonomy, competence, and relatedness, facilitates motivation and achievement across cultures. However, prior evidence of SDT's cross-cultural generalizability was drawn from a limited set of cultural contexts. Furthermore, prior work has mainly focused on autonomy-support. This study used data from the 2018 Programme for International Student Assessment (*N*=578,168). Countries were grouped following Schwartz's (2009) eight cultural clusters. Results showed that need-supportive teaching predicted achievement via intrinsic motivation across the eight cultural groups. However, the magnitude of the associations among the variables varied across cultures. Findings also indicated a positive association between need-supportive teaching and achievement in six out of the eight cultural groups. However, a different pattern was observed in East-Central Europe (non-significant association) and Africa and the Middle East (negative association). This study offers broad, though not unanimous, support for SDT's cultural generalizability.

Keywords: self-determination theory, need-supportive teaching, reading achievement, intrinsic motivation, cross-cultural

For more than three decades, hundreds of studies on self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000, 2020) have been published that yielded important insights into student motivation, learning, and well-being (Howard et al., 2021; Stroet et al.,

2013; Yu et al., 2018). A key finding of these studies is the positive influence of need-supportive teaching on students' academic achievement by facilitating intrinsic motivation. When teachers and contexts support students' basic needs for autonomy, competence, and relatedness, students flourish. SDT asserts that the association of need-supportive teaching with students' positive learning outcomes is cross-culturally generalizable (Reeve, Ryan, et al., 2018; Ryan & Deci, 2000). There is extensive empirical evidence that need-supportive teaching promotes student motivation and various positive learning outcomes across different socio-cultural contexts (e.g., Chen et al., 2015; Reeve et al., 2018; Ryan & Deci, 2020; Stroet et al., 2013).

However, many SDT cross-cultural studies only examined SDT tenets in a single non-Western country (e.g., Jang et al., 2012; Zhou et al., 2019) or compared groups of countries in terms of Western and Eastern cultures (e.g., Chirkov et al., 2003; Jiang et al., 2021; Nalipay et al., 2020). Researchers found these studies to be limited by a simplistic operationalization of culture (e.g., Cohen & Varnum, 2016; King et al., 2018; King & McInerney, 2014). For example, Schwartz (2006) proposed a cultural grouping based on value orientation. As of this current writing, there has been no research that tested SDT's cross-cultural generalizability using this lens. Furthermore, existing research has mainly focused on autonomy support (e.g., Diseth & Samdal, 2014; Haerens et al., 2015; Kaplan, 2018; Patall et al., 2018). Relatively fewer studies have investigated teachers' support for other basic needs such as competence and relatedness (Stroet et al., 2013). Hence, there is a need for studies that examine the three need-supportive practices altogether with a more fine-grained cross-cultural testing.

The presence of large-scale international assessments such as the Programme for International Student Assessments (PISA) affords researchers the means to investigate SDT's generalizability across a broader group of countries from different sociocultural contexts

(e.g., Jiang et al., 2021; J. Lee, 2014). The present study aimed to investigate the role of need-supportive teaching in students' motivation and achievement across a wide range of cultures. The current study drew on data from the Program for International Student Assessment (PISA), consisting of samples from 76 regions or societies. These regions were grouped into eight distinct cultural groups: Western Europe, Eastern Central Europe, Eastern Europe, Latin America, English speaking, Confucian, Southeast Asia, and Africa and the Middle East (Schwartz, 2006). The study tested whether students' perceived need-supportive teaching would stimulate intrinsic motivation, which in turn would predict optimal achievement.

Theoretical Background

Perceived Need-Supportive Teaching

SDT presupposes that everyone has basic psychological needs for autonomy, competence, and relatedness. The satisfaction of these needs is dependent on the socio-contextual environment. Autonomy means having a sense of volition or self-regulation in one's behavior or subjective experience. Competence relates to having the feeling of being able to meet an optimal challenge. Relatedness is having the sense of being connected to an individual or group (Ryan & Deci, 2000, 2017). Supporting and satisfying these psychological needs facilitates intrinsic and autonomous motivation, leading to positive cognitive, affective, and behavioral outcomes (Reeve, 2012). On the other hand, thwarting these needs leads to controlled motivation, maladaptive behaviors, and even amotivation (Ryan & Deci, 2017).

In the educational context, the teacher is the students' proximal social context who can either support or thwart their students' needs (Ahn et al., 2019; J. Wang et al., 2016). Hence, the quality of the teacher's support influences the students' quality of motivation, which in turn affects the student's engagement and other learning outcomes (Jang et al., 2016; Reeve, 2016). Researchers have specified key teacher practices that could demonstrate autonomy

support, competence support or structure, and relatedness support or involvement (Ahn et al., 2019; Niemiec & Ryan, 2009; Skinner & Belmont, 1993). Autonomy support allows students to be more self-directed. It comes in the form of explaining the rationale or importance of learning materials or activities, providing meaningful choices, acknowledging students' emotions, avoiding controlling language, and nurturing inner motivational resources (Ahn et al., 2019; Niemiec & Ryan, 2009; Reeve, 2016). Competence support involves creating a structure that fosters a conducive learning environment where students can focus and develop themselves to meet learning challenges. Teachers create structure by setting clear goals and expectations, offering tasks with moderate difficulty to expand students' academic capability, and offering feedback to promote a sense of efficacy and success (Ahn et al., 2019; Niemiec & Ryan, 2009; Reeve, 2016). Relatedness support involves making students feel they belong and are connected through the teachers' involvement (Niemiec & Ryan, 2009). Teachers show involvement by communicating interest, appreciation, and concern for students (Ahn et al., 2019; Niemiec & Ryan, 2009).

Studies have shown that need-supportive teaching has beneficial effects on key student outcomes. Need-supportive teaching has been associated with higher resilience (Pitzer & Skinner, 2017), greater enjoyment, and lower fear of failure (Leptokaridou et al., 2016). Students become more engaged, learn more, and attain higher performance when taught in a need-supportive way (Jang et al., 2016; Reeve, 2013; Taylor et al., 2014). However, many of these studies have focused only on limited aspects of need-supportive teaching. For example, Jang et al. (2012) focused only on teachers' autonomy support and found it was associated with greater engagement among Korean students. Other researchers have focused on the effects of structure in supporting the need for competence (e.g., Eckes et al., 2018; Guay et al., 2017). Some other studies simultaneously examined autonomy and competence support on students' psychological outcomes (e.g., Hospel & Galand, 2016; Oga-

Baldwin & Nakata, 2015; Olivier et al., 2020). A few studies also investigated the role of supporting relatedness and found its association with greater engagement and achievement (e.g., Furrer & Skinner, 2003; King, 2015). Taken altogether, these studies showed that each of the dimensions of need-supportive teaching seems to be associated with optimal outcomes. However, research that simultaneously examines all three needs seemed lacking, signifying a gap in the knowledge base (Stroet et al., 2013). The present study aimed to address this gap by taking support for all three needs simultaneously.

Intrinsic Motivation

Supporting the three basic psychological needs creates an environment that stimulates intrinsic motivation. Intrinsic motivation refers to the natural propensity to do an action because it is enjoyable and does not depend on external contingencies (Ryan & Deci, 2017). SDT links intrinsic motivation directly with optimal learning outcomes, as supported by various studies (Dickhäuser et al., 2016; Ryan & Deci, 2020; Taylor et al., 2014; Vansteenkiste et al., 2009). For example, studies have shown that intrinsically motivated students have higher academic achievement in different learning domains such as reading (Froiland & Oros, 2014; Hebbecker et al., 2019) and mathematics (Froiland & Davison, 2016; Garon-Carrier et al., 2016). In recent years, studies using large-scale assessments such as PISA have also provided evidence linking intrinsic motivation with student achievement (J. Lee, 2014).

Past research has also shown that intrinsic motivation mediates the influence of need-supportive teaching on engagement and academic achievement (de Naeghel et al., 2014; Fan & Williams, 2018; Hofferber et al., 2016; Yildirim, 2012). For example, Hofferber et al.'s (2016) quasi-experimental study found support for the indirect association of need-supportive teaching on students' engagement in a biology class via greater intrinsic motivation. Moreover, Fan and Williams's (2018) study found that the perception of teacher-student

relationships, which closely approximates relatedness support or involvement in class, influenced students' academic achievement in math and reading through intrinsic motivation. These studies demonstrate that need-supportive teaching stimulates intrinsic motivation, and intrinsic motivation, in turn, leads to better academic achievement (see also Ryan et al., 2019; Skinner et al., 1990; Vansteenkiste et al., 2020).

Cross-Cultural Universality

A fundamental assertion within SDT is that the three basic psychological needs are crucial for all individuals regardless of cultural background (Ryan & Deci, 2000, 2017, 2020). However, some cultural scholars have argued that SDT's basic propositions, especially concerning autonomy, are Western-centric (Iyengar & Lepper, 1999, 2000; Markus et al., 1996; Markus & Kitayama, 2003; Miller et al., 2017). For example, Miller et al. (2017) argued that SDT's universal claim does not consider cultural nuances and variability. Furthermore, Markus and Kitayama (2003) suggested that freedom of choice might be more relevant to Western cultures but less so for collectivist cultures. For Eastern cultures, restricting choice does not always lead to negative effects if done by a trusted authority or figure (e.g., Iyengar & Lepper, 2000). Hence, the debate on autonomy vs. choice revolves around whether it applies to all cultures. Most SDT theorists address the debate by zeroing in on the misinterpretation of autonomy as choice or independence. More importantly, they also clarified the misinterpretation of universality as mere uniformity (e.g., Reeve et al, 2018).

Cultural Universality without Uniformity. Scholars argue that there are two extreme positions in cross-cultural studies (King & McInerney, 2014; Pintrich & de Groot, 2003; Shweder & Sullivan, 1993; Zusho & Clayton, 2011). On the one hand, there are *absolutists* who assume that there are motivational values and processes that are essentially culture free. On the other hand, there are the *relativists* who argue that motivational constructs should be studied in the local context and that everything is relative. In between

these polarities are the *universalist*s who see some basic processes that are universal but their expression differs across cultures (Zusho & Clayton, 2011). In line with the universalist view, SDT theorists recognize that the basic psychological needs support and satisfaction have cross-cultural significance while expecting cultural and individual variations in how they are expressed or valued (Reeve, Ryan, et al., 2018; Ryan et al., 2021; Ryan & Deci, 2019). Some SDT theorists use Shweder and Sullivan's (1993) term "universality without uniformity" or "moderate universality" to delineate it from absolutism (e.g., Soenens et al., 2015; van Assche et al., 2018; Vansteenkiste et al., 2020). This study adopts a *universalist* stance in this research in line with SDT theorizing and findings from motivation science (King & McInerney, 2014; Pintrich & de Groot, 2003; Soenens et al., 2015; van Assche et al., 2018; Vansteenkiste et al., 2020; Zusho & Clayton, 2011).

Evidence from various studies has provided empirical support for SDT's cross-cultural universality. For example, Chirkov (2009) cited various empirical findings that showed autonomy as a valid construct among non-Western students. He specifically showed that autonomy support was positively associated with students' well-being in Eastern cultures (e.g, China, Japan, and South Korea). Nalipay et al.'s (2020) study investigated the 2009 PISA participating countries and demonstrated that autonomy was essential both for Eastern and Western countries. Researchers have also shown that need support facilitates positive outcomes among collectivist societies. Oga-Baldwin and Nakata (2015) found that need-supportive teaching was associated with sustained engagement over time among Japanese students. In another study, Zhang et al. (2020) demonstrated that Chinese students became more intrinsically motivated to study when their teachers shifted to a need-supportive style.

Several studies have also examined the core aspects of SDT in other Asian countries such as the Philippines (e.g., Haw et al., 2021; Mendoza et al., 2022), Indonesia (e.g., Maulana et al., 2016), Thailand (e.g., Kaur et al., 2015), and South Korea (e.g., Reeve et al.,

2004), among others. These studies have demonstrated broad support for SDT's core postulates in non-Western cultures. Congruent to the moderate universality (Shweder & Sullivan, 1993; Zusho & Clayton, 2011), SDT research had reported significant findings across cultures and their variations (Deci et al., 2001; Hagger & Chatzisarantis, 2016; Lam et al., 2016; Marbell-Pierre et al., 2019).

However, many of the studies above only focused on individual countries representing a specific cultural context. Moreover, SDT comparative studies tend to use a less nuanced definition of culture, such as the binary opposition of East and West. Such comparison is limiting because sociocultural contexts overlap with but are not entirely synonymous with nationality, ethnicity, or race (Cohen & Varnum, 2016; King et al., 2018; King & McInerney, 2014). These methodological limitations also limit empirical testing of SDT's cross-cultural generalizability hypothesis. There is a need to sift the more fine-grained aspects of culture that could explain similarities or differences in students' motivational dynamics and outcomes. One way to do this is to test SDT's claims across a broader range of cultural groups.

Cultural Value Orientation. Schwartz's (2006) cultural value orientation theory proposed that cultures can be distinguished by the values they espouse. These value preferences are based on three polarities: embeddedness vs. autonomy, hierarchy vs. egalitarianism, and mastery vs. harmony. These polarities simultaneously pull a cultural dynamic and create the direction of their values. We elucidate these dimensions below.

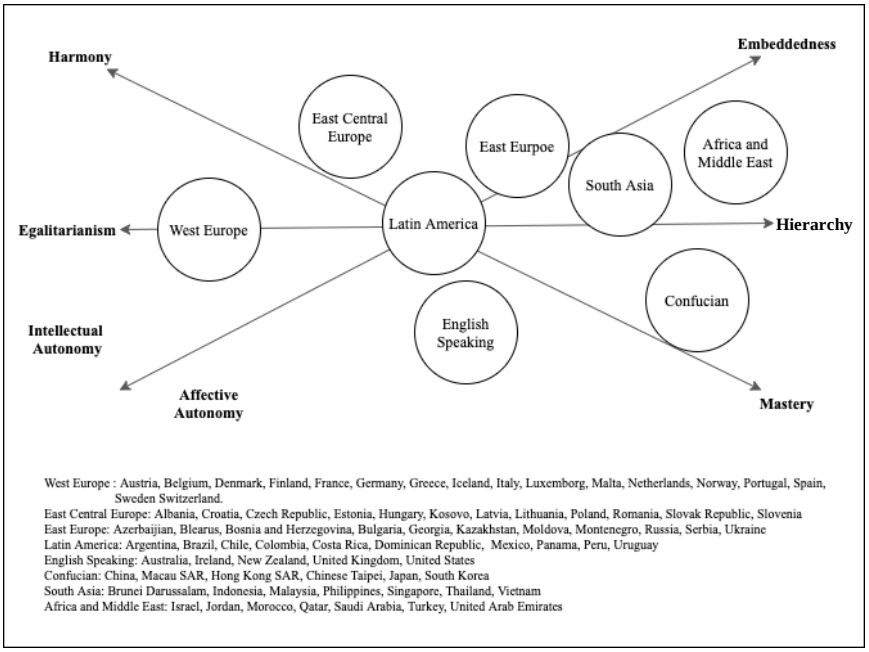
The first polarity of embeddedness vs. mastery pertains to the nature of the relationship between the person and the group. In cultures that emphasize embeddedness, people are viewed as embedded in the larger collective, with meaning in life derived primarily through social relationships. On the other hand, in cultures that emphasize autonomy, people are considered autonomous bounded entities and are encouraged to find

meaning in their uniqueness. The second polarity of hierarchy vs. egalitarianism focuses on the issue of how people must behave toward one another to preserve the social fabric. Hierarchical cultures emphasize the importance of ascribed roles and responsibilities, with people taking the unequal distribution of power for granted. Social power, authority, humility, and wealth are considered primary. Egalitarian cultures, on the other hand, recognize people as equals who share a common interest. Cooperation and concern for everyone's welfare are emphasized. The third polarity of mastery vs. harmony focuses on how people should manage their relations to the natural and social worlds. Mastery cultures encourage active self-assertion and value ambition, success, and competence. On the other hand, harmony cultures emphasize fitting into the world and trying to understand and appreciate what is. World peace, unity with nature, and environmental protection are highly valued.

Using these three dimensions, Schwartz (2006, 2009) analyzed samples from 76 countries, plotted them according to their cultural value orientation, and generated eight cultural regions. These eight groups were Western Europe, Eastern Central Europe, Eastern Europe, Latin America, English speaking, Confucian, Southeast Asia, and Africa and the Middle East. Figure 2.1 shows these groupings plotted using their polar preferences.

Figure 2.1

A Typology of Schwartz's (2009) Transnational Grouping Based on Cultural Value Orientation



Note: Countries included in the legend are those that matched the sample used in the study.

Schwartz (2006) argued that each group are culturally distinct in emphasizing or de-emphasizing a value orientation. For example, Western Europe's (e.g., France and Germany) high emphasis on autonomy characterizes the culture as individualistic. However, its heightened focus on egalitarianism and harmony goes beyond "conventional views of individualism" (p. 55). Confucian and South Asian cultures emphasize hierarchy, yet they differ by emphasizing mastery and embeddedness, respectively.

Schwartz's value orientations show the multi-dimensionality of culture, which goes beyond country, ethnicity, and geographical location. He argued for a fine-grained understanding of culture and challenged the typical broad cultural differentiations (i.e., West as individualistic vs. East as collectivist). Testing SDT's theoretical assumptions across Schwartz's eight cultural groups, therefore, has critical implications for a stronger test of self-determination theory's cross-cultural validity. As of this current writing, we are not aware of

prior empirical studies that have tested the relations among need-supportive teaching, intrinsic motivation, and achievement among all eight cultural groups.

Gender and Socioeconomic Status (SES)

Studies have consistently documented that gender and socioeconomic status affect student motivation and reading achievement (e.g., Vecchione et al., 2014). For example, several studies have found that girls do better than boys in school overall though there are subject-specific differences (Guo et al., 2015; King, 2016; Voyer & Voyer, 2014). In terms of SES, several studies have found that students from advantaged families do better in school than their less advantaged counterparts. Motivational differences have also been documented, with children from higher SES families exhibiting more adaptive motivational outcomes (Benner et al., 2016; King & Trinidad, 2021; Sirin, 2005). Hence, we added gender and SES as covariates to control their possible confounding effects and ensure a more robust test of our core hypotheses.

The Current Study

The existing evidence base highlighted the importance of need-supportive teaching and intrinsic motivation for student achievement. Given SDT's assertion on moderate universality, we aimed at examining these core tenets against Schwartz's (2006) cultural value orientation grouping *(i.e., Western Europe, Eastern Central Europe, Eastern Europe, Latin America, English speaking, Confucian, Southeast Asia, and Africa and the Middle East)*. Specifically, we investigated the following hypotheses across the eight groups:

H1: Need-supportive teaching will positively predict student achievement.

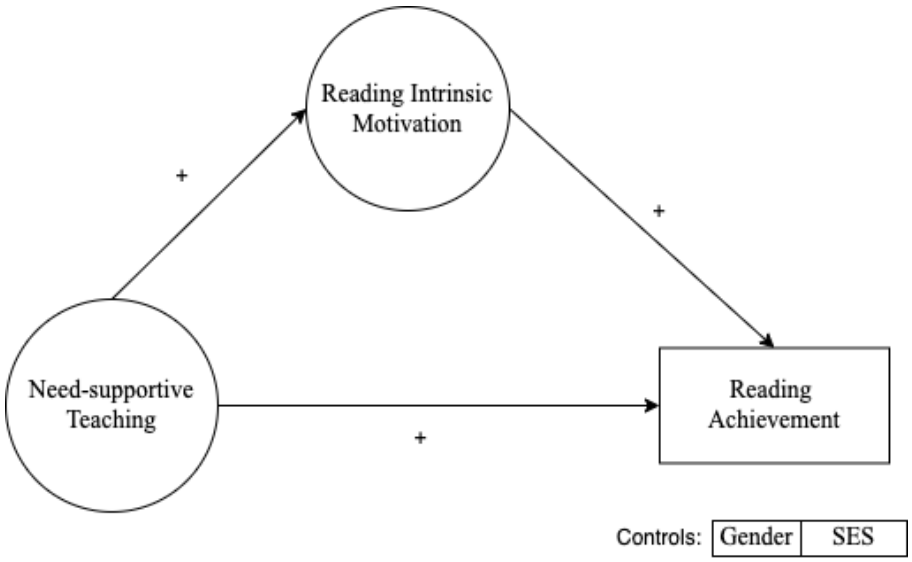
H2: Intrinsic motivation will positively predict student achievement.

H3: Need-supportive teaching will indirectly predict reading achievement via reading intrinsic motivation.

Figure 2.2 shows the hypothesized conceptual model of the study.

Figure 2.2

Conceptual Model of the Relationships Between Need-Supportive Teaching and Reading Achievement via Intrinsic Motivation in Eight Cultures



Method

Data and Participants

We conducted the study following ethical guidelines for human subjects and the study was approved by the relevant human research ethics review board. We utilized the publicly available data from the 2018 Programme for International Student Assessment (PISA) organized by the Organization for Economic Cooperation and Development (OECD) in this study (OECD, 2021). PISA is a triennial program that assesses 15-year-old students across OECD's 79 countries and regions in the following literacy domains: reading, math, and science. PISA focuses on one subject as its main assessment domain every cycle. In 2018, PISA's focus of assessment was reading. Hence, the study also focused on reading-related student data.

PISA 2018 has more than six hundred thousand nationally representative 15-year-old student participants across 79 countries and regions (OECD, 2021). However, samples from

Canada, Lebanon, and Northern Macedonia were excluded since they did not have data on the study's key variables, which limited the sample to a total of 578,168 students (51% females) across 76 regions. The remaining data were clustered based on Schwartz's (2009) eight cultural groupings (see Table 1 for the grouping): Western Europe (*n* = 13,4198; 49% females), East Central Europe (*n* = 70,747; 50% females), East Europe (*n* = 89,563; 49% females), Latin America (*n* = 75,622; 51% females), English Speaking Countries (*n*= 41,872; 49% females), Confucian cultures (*n* = 40,499; 49% females), South East Asia (*n* = 52,956; 52% females), and Africa and Middle East (*n* = 68,531; 49% females).

PISA used a complex two-stage sampling method which consists of sampling various types of schools and subsequently sampling the students within schools. The PISA dataset assigned 80 replicate weights and a final weight for each student to account for potential sampling variances and errors. The current study utilized these replicate weights to ensure the computation of unbiased statistical estimates (OECD, 2009b).

Measures

PISA includes a questionnaire on various demographic, non-cognitive, and schooling (i.e., teaching and learning) factors associated with the students' performance (OECD, 2019b). One of the vital non-cognitive constructs measured by PISA is reading intrinsic motivation or reading enjoyment. PISA also measured teaching and learning constructs (e.g., need support) that have important implications for motivation, engagement, and achievement (OECD, 2019b). The measurements of these constructs were all focused on reading. For example, the questions related to need-supportive teaching referred to students' perception of their test language teacher. Hence, our study variables were drawn from measures of need support, intrinsic motivation for reading, and reading achievement.

Independent Variable. SDT is one of the broad theories that guided PISA 2018's questionnaire on teaching practices that support reading motivation and engagement (OECD,

2019b). Hence, there are various SDT-related items on need-supportive teaching (e.g., ST102 could indicate competence support). However, these items measure class experience and not the individual's experience (e.g., ST102, ST100). We limited our measure to items that related only to the individual student since the study was investigating the individual-level relationship between need-supportive practices and reading achievement.

We found a three-item question (ST212) that measured need support from the language of test teacher as experienced by the student. The question's stem asked the student, "Thinking of your past two <test language lessons>: how much do you disagree or agree with the following statements?" Three items followed: "The teacher listened to my view on how to do things" (*autonomy support*), "The teacher made me feel confident in my ability to do well in the course" (*structure or competence support*), and "I felt that my teacher understood me" (*involvement or relatedness support*). These items seemed to best approximate the individual experience and represent perceived need support. Hence, we selected them to represent *need-supportive teaching* (NST). All items were rated on a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The Cronbach's alpha coefficients across countries ranged from 0.71 to 0.91 indicating adequate levels of reliability across 76 regions (see Table A2 in Appendix A for details).

There is no consensus among past studies on how need support is perceived (Ahn et al., 2021). Katz et al.'s study (2009) showed that students generally do not distinguish which practices support specific needs but perceive them more globally. Hence, several studies have combined the three dimensions into a composite variable (Leo et al., 2022; Mouratidis et al., 2011) and a single latent factor construct (Ahn et al., 2019). However, other researchers distinguished among the different need-supportive practices in their studies (Kurdi et al., 2018; Leenknecht et al., 2017). Evidence of the unique importance of each dimension is relatively scarce, with mixed findings (Stroet et al., 2013). Furthermore, Stroet et al. (2013)

found that a global measure of need support had a larger effect on key outcomes than the individual dimensions. Taking these prior studies into account and the pragmatic realities of the secondary PISA data, we operationalized these three items into a single-factor latent variable. This was also more aligned with the limitations of the PISA dataset as each construct of need support was only indexed by one item. Hence, combining them into one construct seemed more theoretically and empirically reasonable.

Dependent Variable. We focused on students' *reading achievement* as our key dependent variable since PISA 2018's main assessment domain was reading. PISA 2018 reported ten plausible values for each assessment domain; each scaled to have a mean of 500 and a standard deviation of 100 using the Rasch model (for the details of the treatment of plausible values, please see OECD, 2018; Rutkowski et al., 2010). Plausible values are not meant as individual scores but used to draw estimates at the population level. Nevertheless, they represent the students' range of possible abilities (OECD, 2009). Hence, consistent with past research that used PISA data, we used the ten plausible values to represent students' reading achievement.

Mediator. *Reading intrinsic motivation* is the key mediator in this study. We used PISA's five-item question that measured the student's enjoyment of reading to represent reading intrinsic motivation. A sample item is "Reading is one of my favorite hobbies." All items were rated on a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Negatively stated items were reverse coded to follow a positive direction. These items have been used in several past studies to represent intrinsic motivation in reading (e.g., de Naeghel et al., 2014; J. Lee, 2014). The five-item measure's internal reliability across the 74 countries and region ($0.61 \leq \alpha \leq 0.88$) were within the range of acceptable cut-off values (for basis of acceptable alpha coefficient, see Taber, 2018; van Griethuijsen, 2015; Vaske et

al., 2016). The Cronbach's alpha coefficients for Jordan and Morocco were below 0.60 (see Table A1 in Appendix A for details).

Covariates. PISA uses an economic, social, and cultural status index as a composite indicator of socioeconomic status (OECD, 2014, 2016a, 2019a). This index was operationalized as individual students' socioeconomic status (SES). Gender and SES are significant predictors of student achievement in PISA 2018 (OECD, 2019a). To control the confounding effects of these variables, we included gender and SES as covariates.

Analytic Strategy

Missing Data. The dataset had less than 6% missing data per case based on the study variables. We conducted multiple imputation of missing data using Markov Chain Monte Carlo methods (van Buuren & Groothuis-Oudshorn, 2011).

Preliminary Analysis. We generated the descriptive statistics of our key variables and covariates and proceeded with the bivariate correlation analysis. We conducted our preliminary analysis at the cultural value orientation grouping (Schwartz, 2009) and added a supplementary examination across the 76 regions. Following the PISA data analysis manual (see OECD, 2009), estimates were computed using the plausible values and the 80 replicate weights embedded in the dataset (Caro & Biecek, 2017; Long, 2021; Lumley, 2021).

Primary Analysis.

Testing the measurement model. We conducted a multigroup confirmatory factor analysis (MGCFA) to hierarchically test the configural, metric, and scalar invariance across the 76 regions and eight cultural groups. This process ensures meaningful cross-cultural comparison (He et al., 2019; Milfont & Fischer, 2010). We first examined measurement invariance across the 76 countries/regions. We also tested the measurement invariance across individual countries/regions within each cultural group.

We ascertained the model to data fit at each test following alternative fit indices of model fit based on Hu and Bentler's (1995) suggested metrics (i.e., CLI and TLI ≥ 0.95 indicates a good fit while CLI/TLI ≥ 0.90 is acceptable; RMSEA/SRMR ≤ 0.05 indicates a good fit while a value ≤ 0.08 is acceptable) since the chi-square test is sample size sensitive. In the same way, we focused on ΔCFI and ΔRMSEA in testing for invariance. A more relaxed heuristic for metric invariance (ΔCFI ≤ 0.02; ΔRMSEA ≤ 0.03) was adopted, whereas the traditional cut-off point (≤ 0.01) was retained for scalar invariance (He et al., 2019).

Testing the structural equation model. We constructed a structural equation model (SEM) wherein perceived need-supportive teaching predicted students' reading achievement via reading intrinsic motivation. We treated our cluster-dependent data in our statistical inferences using the PISA weights and replicates (F. Huang, 2016; McNeish, 2017; Stapleton et al., 2016). Our study employed Anderson and Gerbing's (1988) two-step approach in structural equation modeling using *lavaan* package (Rosseel, 2020). We independently conducted a confirmatory factor analysis for each cultural group. After evaluating the model-data fit, we then fitted our full structural model. In both steps, we re-fitted our model in a pooled within-cluster covariance matrix to account for the sampling design (Lumley, 2021; Oberski, 2014). The structural model's data fit was evaluated with the same fit indices threshold as for the confirmatory factor analysis.

The SEM analysis consisted of drawing regression estimates on students' reading achievement indicated by ten plausible values. We estimated separate regressions for each plausible value and aggregated them at the last stage (see OECD, 2009). This process was repeated across the eight cultural groups. We first analyzed a structural model without covariates. Then we added sex and SES as covariates to test the robustness of our model.

Supplementary Analyses. We conducted two supplementary analyses to further test our hypotheses. First, we tested the regression invariance across the eight groups to examine the equality in the magnitude of relations among variables in the SEM. We examined a multi-group SEM with a sequential imposition of constraints (i.e., forward approach) across eight groups (Bollen, 1989; Davidov et al., 2012; Deci et al., 2001; Sass & Schmitt, 2013). We used an SEM model having a measurement equality constraint, but no constraints on the regression paths, as our baseline model (Deci et al, 2001; Sass & Schmitt, 2013). Then, we sequentially imposed equality constraints on each path and compared it with the baseline model using the $\Delta\chi^2$. A significant $\Delta\chi^2$ indicates significant difference in the magnitude of path coefficients across the compared cultural groups (Bollen, 1989; Deci et al, 2001; Sass & Schmitt, 2013). Finally, having imposed equality constraints in all paths, we investigated whether indirect effects had similar magnitude across cultures via a likelihood ratio test (Bollen, 1989; Ryu & Cheong, 2017). Second, we individually examined all the hypotheses (H1 to H3) for each of the 76 regions to explore patterns in the path coefficients.

Results

Preliminary Analysis

Table 2.1 shows the descriptive statistics and bivariate correlations by cultural value orientation grouping, respectively. Reading intrinsic motivation showed a strong positive and significant correlation with reading achievement across all groups. Results further showed that need-supportive teaching correlated positively with reading intrinsic motivation across all eight cultural groups with a relatively small effect size. Likewise, the correlation between need-supportive teaching and reading achievement was positive and statistically significant across the eight groups but had small to very small effect sizes ($0.01 \leq \alpha \leq 0.14$). The results showed some variations in the correlation when need support was disaggregated to its three dimensions. For example, results showed that reading achievement did not have

significant correlations with (a) autonomy-support among East-Central Europe and Eastern Europe samples, (b) involvement in South (East) Asian samples, and (c) structure and involvement among the African and Middle Eastern sample. The descriptive statistics and bivariate correlations across the 76 regions are presented in Table A2 in Appendix A.

Primary Analysis

Multi-group CFA. MGCFA of the overall model (76 regions) showed a good model-data fit, providing evidence of configural invariance ($\chi^2(1463) = 53998.56$, CFI = 0.97, TLI = 0.95, RMSEA = 0.07, SRMR = 0.05). Changes in CFI and RMSEA were within the acceptable cut-off for metric invariance (ΔCFI = 0.01, ΔRMSEA = 0.00). Meaningful comparison of relationships between countries (e.g., regression effects) can already be established with the metric invariance (van de Vijver et al., 2018). Hence, we did not proceed further with the stricter test.

We conducted separate MGCFA for regions within their respective cultural grouping. Since we were pooling regions within cultural groups, we aimed at testing scalar invariance to ensure that measurement items had the same psychological meaning within the group. Full scalar invariance was not present in some of the cultural groupings. This is quite expected since such condition is almost impossible to achieve, especially in large-scale assessments such as PISA (Milfont & Fischer, 2010; van de Vijver et al., 2018). However, scholars suggest that a partial scalar invariance may be achieved and would suffice to compare latent means (Steenkamp & Baumgartner, 1998). Following Steenkamp and Baumgartner (1998), we relaxed the equality constraints of three parameters for need-supportive teaching and one parameter for reading intrinsic motivation; at least two parameters were constrained to be equal for each construct. We found partial scalar invariance after freeing the parameters (see Appendix A Table A3 for the measurement invariance tests).

Table 2.1

Descriptive Statistics and Bivariate Correlations of Need-Supportive Teaching, Reading, Intrinsic Motivation, and Reading Achievement Across Eight Cultural Groups

Cultural Group (Schwartz, 2009)	*n*	Means and Standard Deviation						Correlation with Reading Intrinsic Motivation				Correlation with Reading Achievement				
		Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation	Reading Achievement	Structure	Autonomy	Involvement	NST	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation
Western Europe	134198	2.74 (0.89)	2.67 (0.89)	2.73 (0.90)	2.72 (0.79)	2.43 (0.87)	488.47 (101.29)	0.11	0.09	0.09	0.11	0.08	0.07	0.09	0.09	0.28
East Central Europe	70747	2.79 (0.86)	2.64 (0.86)	2.78 (0.86)	2.74 (0.75)	2.58 (0.80)	476.71 (103.75)	0.11	0.09	0.09	0.11	0.02	~~0.01~~	0.03	0.02	0.29
Eastern Europe	89563	2.75 (0.87)	2.61 (0.88)	2.82 (0.89)	2.73 (0.78)	2.78 (0.66)	460.82 (96.60)	0.14	0.12	0.14	0.15	0.07	~~0.00~~	0.07	0.06	0.25
Latin America	75622	2.86 (0.88)	2.79 (0.86)	2.81 (0.88)	2.82 (0.77)	2.73 (0.69)	412.42 (94.02)	0.08	0.07	0.07	0.09	0.10	0.06	0.06	0.08	0.21
English Speaking Countries	44679	2.97 (0.82)	2.81 (0.84)	2.83 (0.86)	2.87 (0.76)	2.41 (0.681)	505.18 (106.74)	0.10	0.09	0.10	0.11	0.15	0.10	0.13	0.14	0.30
Confucian Countries	41872	2.78 (0.83)	2.75 (0.86)	2.73 (0.86)	2.75 (0.77)	2.86 (0.77)	523.96 (97.88)	0.19	0.16	0.14	0.18	0.10	0.09	0.09	0.10	0.39
South Asia	52956	3.06 (0.76)	2.98 (0.72)	2.90 (0.75)	2.98 (0.64)	2.83 (0.54)	387.52 (92.29)	0.15	0.13	0.12	0.16	0.04	0.10	~~0.00~~	0.05	0.20
Africa and Middle East	68531	2.87 (0.92)	2.74 (0.91)	2.75 (0.95)	2.76 (0.81)	2.88 (0.68)	428.07 (98.22)	0.09	0.08	0.07	0.09	~~0.00~~	0.02	~~0.00~~	0.01	0.24

Note: Values in parentheses are standard deviations. Correlation coefficients in regular typeface are statistically significant with at least $p<.05$; coefficients in strike-through typeface are statistically non-significant.

SEM. We created two structural models to test our hypotheses. Model 1 had no covariates and Model 2 with sex and SES as covariates. For brevity, we present only the results of Model 2 in here (please see Model 1 results in Appendix A Table A4). Table 2.2 shows the cross-cultural comparison of Model 2. Table 2.3 summarizes the hypothesis test across the eight groups.

The structural model had excellent fit across the different samples. The results showed that there was a significant positive association between need-supportive teaching and intrinsic motivation across eight cultures. This finding fully supported H2. Our findings further revealed that the indirect effect of perceived need-supportive teaching on reading achievement via intrinsic motivation was statistically significant across the eight groups albeit with a small effect size. The results fully supported H3. However, our results indicated only partial support for H1. In particular, H1 did not hold in the East-Central European and African and Middle Eastern samples. Need-supportive teaching had no significant direct effect on the former, whereas it had a negative (although small) direct effect on the latter.

Table 2.2

SEM of the Relationship Between Need-Supportive Teaching and Reading Achievement via Reading Intrinsic Motivation With Sex and SES as Covariates

	West Europe	East Central Europe	East Europe	Latin America	English Speaking	Confucian Countries	South Asia	Africa and Middle East
A. Structural Equation Model Fit Indices								
$\chi^2(38)$, *p<.001*	1198.86	1747.40	1384.68	1681.09	437.76	1644.27	1316.81	1384.59
Scaling Correction Factor	4.03	3.23	5.37	3.00	7.11	2.49	4.73	3.24
Robust CLI	0.99	0.98	0.97	0.98	0.99	0.98	0.95	0.98
Robust TLI	0.98	0.97	0.96	0.97	0.98	0.97	0.92	0.96
Robust RMSEA (90% CI)	0.04 (0.03, 0.04)	0.05 (0.04, 0.05)	0.05 (0.04, 0.05)	0.04 (0.04, 0.04)	0.04 (0.04, 0.05)	0.05 (0.05, 0.05)	0.06 (0.05, 0.06)	0.04 (0.04, 0.04)
SRMR	0.02	0.03	0.04	0.03	0.03	0.04	.05	0.04

	West Europe	East Central Europe	East Europe	Latin America	English Speaking	Confucian Countries	South Asia	Africa and Middle East
B. Standardized Path Estimates								
NST → INT	0.11***	0.10***	0.16***	0.07***	0.10***	0.18***	0.12***	0.04***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)	(0.65)
Covariate: Sex	0.31***	0.37***	0.33***	0.27***	0.24***	0.13***	0.20***	0.33***
	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.35)
Covariate: SES	0.13***	0.19***	0.17***	0.08***	0.15***	0.05***	0.04**	0.02*
	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)	(0.03)	(0.69)
INT →ACH	0.27***	0.26***	0.24***	0.24***	0.28***	0.42***	0.28***	0.31***
	(0.75)	(1.10)	(1.46)	(1.05)	(1.78)	(1.05)	(2.10)	(1.88)
NST →ACH	0.06***	0.00	0.04***	0.07***	0.09***	0.04***	0.04**	-0.02*
	(0.99)	(1.25)	(1.14)	(0.98)	(2.00)	(1.23)	(1.59)	(1.09)
Covariate: Sex	0.04***	0.07***	0.07***	0.04***	0.04***	0.03**	0.09***	0.08***
	(1.32)	(1.69)	(1.35)	(1.16)	(2.63)	(1.83)	(1.84)	(2.08)
Covariate: SES	0.33***	0.35***	0.31***	0.36***	0.29***	0.20***	0.27***	0.33***
	(0.79)	(1.36)	(1.46)	(0.81)	(2.00)	(1.10)	(1.42)	(1.20)
Indirect Effect	0.03***	0.05***	0.04***	0.02***	0.03***	0.07***	0.03***	0.01***
	(0.34)	(0.36)	(0.34)	(0.36)	(0.67)	(0.68)	(0.69)	(0.45)
Total Effect	0.09***	0.15**	0.07***	0.09***	0.12***	0.11***	0.07***	-0.01
	(0.95)	(1.36)	(1.13)	(0.98)	(1.94)	(1.25)	(1.10)	(1.07)
Reading achievement R^2	0.22	0.24	0.19	0.22	0.21	0.23	0.18	0.23
Intrinsic motivation R^2	0.13	0.18	0.16	0.08	0.09	0.06	0.06	0.11

Note: NST- perceived need-supportive teaching, INT: reading intrinsic motivation; ACH: reading achievement. For brevity, the measurement model fit indices were no longer included. The large sample rejected all chi-square statistics. See Supplementary Tables A6a, A6b, A6c in Appendix A for test of invariance in path regression effect size. Confucian countries have consistently shown highest performance in reading in the past two PISA cycles with reading as main assessment, overtaking most of Western countries (OECD, 2009; OECD, 2018). These countries have also reported very high enjoyment in reading which probably explains a significant point of difference in the association between intrinsic motivation (enjoyment of reading) and reading achievement (see Cheema, 2018).

****p < .001 **p < .01 *p < .05*

Table 2.3

Results of Hypothesis Testing Across Eight Cultures

Cultural Group	H1: Need-supportive teaching will positively predict student achievement	H2: Intrinsic motivation will positively predict student achievement	H3: Need-supportive teaching will predict reading intrinsic motivation, which in turn will predict reading achievement.
Western Europe	supported	supported	supported
East Central Europe	not supported	supported	supported
East Europe	supported	supported	supported
Latin America	supported	supported	supported
English Speaking	supported	supported	supported
Confucian Countries	supported	supported	supported
South Asia	supported	supported	supported
Africa & Middle East	not supported	supported	supported

Note: Based on SEM results in Table 2.

Supplementary Analyses

We conducted two supplementary analyses to explore some patterns of similarities and variations across the eight cultures: (1) multigroup path invariance analysis and (2) SEM across 76 regions. The multigroup path invariance test showed that the magnitude of relationships differed across the cultural groups (see Appendix A Table A5). Further invariance tests using two cultures showed varying patterns of similarities and differences in the magnitude of variable relationships (see Tables A6a, A6b, and A6c in Appendix A). Likelihood ratio test results revealed that the magnitude of the indirect effect of need-supportive teaching on reading achievement via intrinsic motivation were statistically different across the eight cultures ($\Delta\chi^2$(df) = 52415 (374); $p < 0.001$). The partial support for H1 together with the differences in the magnitude of the relationships suggested a variation that could potentially be attributed to the socio-cultural context. These variations are

somewhat expected in SDT cross-cultural studies. However, we did not extensively explore the moderating cultural contexts as this was not the focus of the study.

We tested all our hypotheses across the 76 regions by SEM analysis. Results revealed that H2 was fully supported in all the regions examined. Moreover, H1 and H3 were fully supported in 57 regions. Meanwhile, need support either had direct (H1) or indirect (H3) associations with achievement in 19 regions (see Appendix A Table A7).

Discussion

We aimed to investigate whether the associations among need-supportive teaching, intrinsic motivation, and achievement would hold across cultures. We used Schwartz's (2009) model to classify different regions into eight cultural groups. First, we hypothesized that need-supportive teaching would predict reading achievement (H1). Second, we posited that intrinsic motivation would predict achievement (H2). Lastly, we hypothesized that need-supportive teaching would predict intrinsic motivation, which, in turn, would predict reading achievement (H3). The findings suggested an overall pattern that was broadly consistent with our hypotheses but with some cultural variations.

A key finding in this study was that H2 and H3 consistently held across the eight cultural groups after controlling for the covariates. Our findings together with the evidence from the 76 regions aligns with prior SDT research. First, we found that intrinsic motivation positively predicted reading achievement, albeit with varying effect sizes, for all the eight cultures and all the 76 regions/countries included. Our results demonstrated that among the study variables, reading intrinsic motivation had the largest positive effects on student achievement. The effect size was consistent with the findings from other research and meta-analytic studies on similar constructs (Artelt, 2005; Dickhäuser et al., 2016; Hulleman et al., 2010). This evidence emphasized intrinsic motivation's role as a powerful resource for facilitating students' learning and development (Niemiec & Ryan, 2009). Second, the

evidence also revealed that need support positively predicted intrinsic motivation across different cultural groups. This finding reinforces the critical function of the teachers' need-supportive practices in stimulating student intrinsic motivation (Ryan & Deci, 2020). The evidence indicated that in most cultures and regions, students know the quality of teacher practices that are relevant to their needs (Stroet et al., 2013). Third, we found evidence that the potential of need-supportive teaching in facilitating achievement through intrinsic motivation was cross-cultural. By and large, the pattern was consistent among the regions and vast majority of countries. Analyses across regions and countries showed some degree of variation in effect sizes. Some researchers suggest that these variations should only be minimal (e.g., Howard et al., 2021). However, SDT cross-cultural studies have no consensus regarding the effect size homogeneity (c.f., Chen et al., 2016; Howard et al., 2021; Lam et al., 2016; Nalipay et al., 2020; Yu et al., 2018; see also Church et al., 2013).

In line with prior SDT research, our findings underscore that students who experience their teachers to be supportive of their needs are more intrinsically motivated and show better academic performance (e.g., Ahn et al., 2021; Katz et al., 2009; Ma et al., 2021; Stroet et al., 2015). In this light, the dynamics between students' intrinsic motivation in reading and teachers' need-supportive practices cannot be overemphasized.

However, our results revealed a small effect size in the mediated relationship. It is important to note, though, that the effect sizes we found for need support were comparable to the effect sizes from past SDT studies (see Froiland & Oros, 2014; Roth et al., 2007; You et al., 2016) and psychological literature (Bosco et al., 2015; Funder & Ozer, 2019; Gignac & Szodorai, 2016). Furthermore, researchers have recently demonstrated that smaller effect sizes are more realistic in the social sciences (Bosco et al., 2015; Funder & Ozer, 2019; Gignac and Szorodai, 2016). These insights could provide the context in interpreting our results. Need-supportive teaching is not a silver bullet but may have meaningful

consequences in the long run when it is consistently experienced over time (Funder & Ozer, 2019; Gignac & Szodorai, 2016).

We also note that even though our hypothesis on the positive association between need-supportive teaching and reading achievement was supported in most cultural groups (and regions), it was not supported in two cultural groups (i.e., East-Central Europe and Africa and the Middle East). One probable explanation could be attributed to whom need-supportive teaching was directed. For example, PISA 2018 recorded significant negative differences in teacher support between advantaged schools (who tend to perform better) and disadvantaged schools (who tend to perform less) students corroborating that "in many countries and economies socioeconomically disadvantaged students were more likely to receive teacher support, and also tended to score lower in the reading assessment" (OECD, 2020, p. 102). Majority of the regions in the two cultural groups were reported to have negative differences in teacher support between advantaged and disadvantaged schools (see OECD, 2020, p.101). Hence, it is possible that in East-Central Europe and Africa and the Middle East, the more disadvantaged students perceived greater need-support from their teachers which could account for the counter-intuitive results.

We also speculate that another plausible explanation could be attributable to the polarities present in the cultural group's value orientation (see Schwartz, 2009). For example, East-Central Europe's emphasis on egalitarianism could be a plausible reason why need-supportive teaching has no apparent effect on reading achievement in this group. Egalitarianism assumes that people are capable and responsible for their actions (Schwartz, 2009). Hence, students may take more responsibility for their actions and rely less on teachers' need-supportive practices. Countries from Africa and the Middle East have high embeddedness, emphasizing the pursuit of a common social goal (King et al., 2017; Schwartz, 2009). Given such emphasis, it is plausible that teachers in highly embedded

societies would give more support to socially disadvantaged students. This could be a probable reason for the negative association between need-support and achievement in this cultural group. Furthermore, the cultural value orientation also seems to explain the patterns in the similarities and differences in the magnitude of effect size across the eight groups. For instance, the English-speaking countries had higher need support to reading achievement associations (i.e., regression and correlation) among the eight groups. These results fit well with the cultural group's high emphasis on autonomy and mastery (Schwartz, 2006). However, we did not test the moderating effects of cultural value orientation in this study. Hence, these assumptions remain speculations at best. Future research is needed to uncover why need-supportive teaching was not positively associated with achievement in two out of the eight cultural regions.

These plausible explanations taken together with the above key findings seem to provide broad, though not unanimous, support for SDT's moderate universality assumption (e.g., Chen et al., 2015; Deci et al., 2001; Hagger & Chatzisarantis, 2016; Marbell-Pierre et al., 2019). Recall that while SDT presumes that its core tenets (i.e., basic psychological needs and intrinsic motivation) have universal significance, it also recognizes that these processes may be communicated and experienced variably across sociocultural contexts (Reeve et al., 2018; Ryan & Deci, 2017). The evidence indicates that need support is associated with reading achievement across the eight cultures but may occur in different ways. For example, our key finding mentioned above suggests that need-supportive teaching's indirect effect is generalizable across the eight cultures whereas its direct effect may not occur in all (e.g., East-Central Europe). The same pattern could also be gleaned from the 76 regions.

Nevertheless, the inherent limitations of the abovementioned plausible explanations taken together with other limitations inherent in using the PISA dataset (see further discussion in the succeeding section) leaves much room for future researchers to further

investigate and critically examine SDT's claim of moderate universality. Our evidence from the more fine-tuned cultural grouping suggests that SDT may need to reconsider the moderate universality hypothesis more closely.

This study has certain features that contribute to SDT's broad evidence base. We investigated the combined effects of need-supportive teaching practices. Many studies have focused only on either autonomy support or autonomy support and structure but paid very little attention to need-supportive teaching as a whole (Stroet et al., 2013). A vital feature of this study is the data from the 2018 PISA database, which afforded the examination of a large and nationally representative sample size. Past studies have been limited by drawing on a limited sample of cultural contexts. Moreover, this study, to the best of our knowledge, is the first to investigate the empirical relationships among need-supportive teaching, motivation, and achievement across a wide range of cultural groups. Lastly, we employed methods consistent with the PISA analytic strategy. Our cross-cultural study involved students nested within schools and schools nested within countries. We took into account the nested structure of our data through the use of weights, replicates, and plausible values built into the dataset. This method allows our analysis to draw unbiased estimates from PISA's complex sampling design, adding to the body of literature of more robust secondary data analysis of large-scale international assessments (e.g., He et al., 2019; Ma et al., 2021).

Limitations and Directions for Future Research

PISA 2018 dataset afforded this study the benefit of simultaneously analyzing large representative samples from different countries and regions. However, we also had to contend with the apparent issues and limitations in conducting secondary analysis using data from large-scale assessments: (a) causal relationships in PISA, (b) measurement, and (c) its limited generalizability. Hence, our findings should be interpreted with caution.

First, PISA is a cross-sectional survey from which causal conclusions cannot be drawn. PISA is not designed and intended for causal conclusions (Gustafsson, 2008; Rutkowski et al., 2010). Aware of this limitation, we avoided using language that communicates causality (Rutkowski et al., 2010). Furthermore, PISA sampled 15-year-old students within a school rather than a class which did not allow us to measure class-level perceptions of need-supportive teaching. Moreover, PISA did not have objective indicators of teaching practices but relied on students' self-reports. These methodological limitations necessitate caution in the interpretation of our findings. In the light of these limitations, we encourage future researchers to conduct experimental and longitudinal studies that will enable them to make causal conclusions.

Second, our study was limited in using the SDT three-item question in PISA, whereas SDT researchers have used longer and more robust psychometric instruments to measure need-supportive teaching (e.g., Ahn et al., 2019; Jang et al., 2016). The PISA background questionnaire items relied on self-report measures, which exposes our study to potential biases despite PISA 2018's careful efforts to reduce them. The impossibility of eradicating sources of bias in the PISA 2018 questionnaire (OECD, 2019b) may have implications in our study. Another setback is that we did not investigate the potential negative effects of need-thwarting practices on motivation and reading achievement. Furthermore, we were not able to explore other possible factor structures that could best measure need support (e.g., Olivier et al., 2021; Sánchez-Oliva et al., 2017). We encourage researchers to use more robust psychometric instruments in the future to address these limitations in replicating our results.

Third, the secondary analysis of the PISA dataset affords us only limited generalizability. Despite the steady growth in the number of economies that participated in PISA, other countries within the eight cultures have not participated. As SDT acknowledges variations in cultural and individual differences, including as many countries as possible in

the empirical test will provide more avenues to find evidence supporting SDT's cultural universality without uniformity. Our study's scope also limited our attempts to explore the moderating cultural factors of need support in East-Central Europe and Africa and the Middle East. Interestingly, not much research has been done on need-supportive teaching from these cultural settings. This opens an avenue for future researchers to investigate what moderates the experience of need support in various cultural groups. Particularly, we recommend further investigation of cultural value orientation as a potential moderator of intrinsic motivation and need-supportive teaching. Given these limitations, we encourage future researchers to utilize our results as a springboard for more in-depth contextual investigation.

Finally, only intrinsic motivation was measured as the critical mechanism in this study. SDT researchers recognize that other forms of motivation with varying degrees of internalization (e.g., external, introjected, identified, integrated) might also be relevant (Ryan & Deci, 2017). Future research can examine whether these different forms of motivation also mediate need-supportive teaching's effects on achievement. Behavioral observations of need-supportive teaching are critical for researchers and practitioners. A survey of research on need-supportive teaching indicated that very few studies use observational data and evidence from these few studies are still mixed (Stroet et al., 2013). We recommend future researchers to include both self-reported student perceptions, as we did in our research, alongside observational data.

The known limitations of secondary data analysis using the PISA dataset, the lacuna in the literature, and the other limitations stated above open an opportunity for further investigation and validation of SDT's core tenets in different sociocultural contexts.

Conclusion

The present study demonstrates the potential benefit of need-supportive teaching in fostering students' achievement in reading through intrinsic motivation. Despite some

limitations, the models tested held across the majority of the sampled cultural groups and regions. The study's test of SDT's core tenets found broad—though not unanimous—support for the idea that students across the globe could benefit from teachers' need-supportive practices.

Chapter 3: Need-Supportive Teaching is Associated With Greater Reading Achievement: What The Philippines Can Learn From PISA 2018

[Joseph Y. Haw, Ronnel B. King, and Jose Eos R. Trinidad]

Abstract

The Philippines participated for the first time in the Programme for International Student Assessment (PISA) in 2018. PISA 2018 focused on reading proficiency and Filipino students ranked lowest in the world. We examined whether need supportive teaching would be associated with student reading achievement using 2018 Philippine data (N = 7,233). We further tested if the association was generalizable across school types and socioeconomic strata. Results revealed that need supportive teaching positively predicted student reading achievement across different types of school and socioeconomic contexts. Results suggested the potential importance of enhancing need supportive teaching as an evidence-based approach to improve students' reading achievement. This empirical insight shows how reforms that improve teaching and learning present more significant promise in increasing reading achievement.

Keywords: educational policy, international assessment, international education, educational improvement, Philippine education, self-determination theory

Participation in international large-scale assessments has increased over the past three decades especially among developing countries (Ganimian & Murnane, 2016; Tobin et al., 2015). This increased participation goes hand in hand with the demand for evidence-based educational policy and decision making. One of the most important international assessments is the Programme for International Student Assessment (PISA). For the first time, the Philippines participated in PISA 2018, and this provided the Philippines' Department of

Education (DepEd) baseline data on the country's quality of education. The Philippines scored lowest in reading, and second to the lowest in science and math among 79 participating countries. The dismal performance prompted the Philippine government to roll out policies to address "the urgency of improving the quality of basic education in the Philippines" (Department of Education, 2019, p. viii).

The Philippine government has crafted proposals targeted at the system level (e.g., curriculum reform) and focused on resource allocation (increasing funding for teacher pay and building infrastructure). The current policy proposals entail financial investments from limited government economic resources. However, studies have shown that the impact of system-level and resource allocation policies on student learning outcomes among developing countries is relatively low (Mbiti, 2016). On the other hand, there has been a substantial body of research showing that teaching and learning interventions significantly impact student learning (Glewwe & Muralidharan, 2016; Hattie, 2008).

PISA has relevant data on these pedagogical factors, which can be linked to students' achievement. PISA 2018 specifically focused on reading literacy, supplemented by math and science, in assessing 15-year-old adolescents at the end of their junior high school education. PISA also included a survey about the students' contexts that could influence the students' reading literacy. Hence, PISA provides rich information that could help school leaders and policymakers explore interventions that impact the students' achievement in reading. However, to our knowledge, Philippine policymakers have not utilized this information (Tobin et al., 2015).

Informed by self-determination theory (Ryan & Deci, 2017, 2020), we examined whether teaching practices that support students' basic psychological needs for autonomy, competence, and relatedness would predict student reading achievement. Drawing on the Philippine PISA 2018, which contained responses from 7,233 students across 187 schools,

we tested whether need-supportive teaching predicted reading achievement. We also tested whether this relationship generalized across socioeconomic contexts (family and school socioeconomic status) and across different types of schools (public vs. private; urban vs. rural). We hypothesized that need-supportive teaching would facilitate students' reading achievement across different school types and socioeconomic contexts providing evidence of its universal applicability.

Theoretical Background

PISA and Education Policies

Introduced by the Organization for Economic Cooperation and Development (OECD) in 2000, the Programme for International Student Assessments (PISA) was designed to measure education outcomes by assessing 15-year-old students in reading, science, and math. PISA focuses on one learning area as a primary assessment domain every three years. In 2018, PISA's main assessment domain was reading, with math and science as its sub-domain. PISA last focused on reading as an assessment domain in 2009. OECD publishes the PISA results, ranking countries from high performer to low performer, with a specific purpose to leverage peer pressure and push for the global agenda for quality of education (OECD, 2019a). The OECD intended to provide information and direction to underperforming countries on how to improve their education systems by showing information on the best practices from the highest performing education systems and those that have demonstrated rapid improvement (OECD, 2016a).

Studies have documented how PISA has impacted policy formulation and implementation in the education systems of participating countries. The classic example was Germany's reform of its secondary education system after a disappointing PISA ranking. The German policy makers overhauled their curriculum with a competency-based approach, following the OECD's literacy model and framework (Niemann et al., 2017). Japan's low

PISA standing shocked the nation about the state of their education system and led the government to explore migrating technology from high-performing Finnish schools (Takayama, 2010). Turkey has referred continuously to their PISA standing to warrant an overhaul of their education system (Gür et al., 2012).

However, scholars noted that the use of PISA data in informing policymaking and its actual impact on education systems were mostly anecdotal. There was little evidence on how PISA had helped developing countries improve their education policies and practices despite their growing participation in the past few years. Lietz et al.'s (2016) study on the impact of international large-scale assessments like PISA found that middle to low-level income economies explicitly report that these assessments do not affect their policies or practices. Developing countries seemed to have used the assessment data for engaging the media, forming public opinion, and evaluating the quality of the education systems and programs (Lietz et al., 2016). At best, many countries used the initial shock of their PISA standing to rationalize a pre-existing reform agenda (Baird et al., 2016; Bonal & Tarabini, 2013; Gür et al., 2012; Hopfenbeck et al., 2018). Many state policymakers and decision-makers from different countries reacted to their low ratings in PISA with a knee-jerk reaction without paying attention to the knowledge base offered by the PISA data (Pons, 2012). We aimed at addressing this gap by examining how need-supportive teaching, a key factor in self-determination theory, was associated with student reading achievement using the Philippine PISA 2018 data.

The rapid growth of participants in large-scale international assessments from developing countries was driven by the trend in adopting policies in education that have a measurable and accurate evidence base (Ganimian & Murnane, 2016). Educational systems were expected to introduce reforms and practices that will directly impact what is measured, that is, students' learning achievement. However, researchers argued that many educational

policies failed to have an impact where it matters most—the students' learning. For example, Ganimian and Murnane (2016) highlighted that system-wide reforms tend to improve school access and increase enrollment but rarely have a significant impact on student achievement. Glewwe and Muralidharan (2016) also underlined how increasing school input (e.g., substantial resources, pedagogical materials, and facilities, teacher quantity) would have a meaningful impact on student achievement only with their proper utilization within good teaching practices that affect the daily goings-on in classes. Addressing supply issues in education policies is not enough to effect change (Masino & Niño-Zarazúa, 2016).

Researchers agree that pedagogical improvement as a focus of policy and intervention would have higher achievement dividends and bigger investment returns (Ganimian & Murnane, 2016; Glewwe & Muralidharan, 2016). Yet, many educational policies do not pay attention to teaching and learning (Elliott, 2014; Schweisfurth, 2015). We addressed this critical gap in the literature by focusing on how teachers support their students' psychological needs and how this might lead to better achievement.

The Philippine Education System

Coming from a long history of foreign occupation beginning from the Spanish period up to the end of the Second World War, the Philippine education system had been an amalgam of different cultural and socio-political forces (Reyes, 2010). Much of its present form has been influenced by the American education system intended to be characterized as free, secular, and compulsory. It also adopted English as its primary medium of instruction (Adarlo & Jackson, 2016; Tanodra, 2003). Various socioeconomic and political contextual factors had left the Philippine education system with overwhelming challenges and limitations, which have had a negative impact on student learning outcomes. These achievement gaps were evidenced by the discouraging results of the National Achievement

Tests and poor performance patterns in international standardized tests (Adarlo & Jackson, 2016; Bernardo et al., 2015).

Researchers underline socioeconomic inequality as a critical factor in the achievement gaps among Filipino students. This inequality is reflected in the way school systems operate in the Philippines. There is a stark contrast between public and private schools, and between rural and urban schools (Bernardo et al., 2015; Bernardo & Garcia, 2006; Lockheed & Zhao, 1993). In general, private and urban schools perform better than their public and rural counterparts (Bernardo et al., 2015).

Public and Private Schools. A prominent part of Philippine education, which predates the public school system's establishment, is the private sector's involvement in delivering the state-mandated curriculum through the private schools (Jimenez & Sawada, 2001). The Philippine Statistics Authority (2018) reported that 2.7 million students (or 12%) of the total 23.4 million K-12 students enrolled in the academic year 2016-2017 were from private schools. The private sector provided 5,935 schools (42%) of the 14,217 secondary schools in the Philippines in the same academic year (Philippine Statistics Authority, 2018).

Private and public schools operate differently in the Philippines. Public schools are governed and funded by the national government and its agencies (e.g., DepEd or Department of Science and Technology) or by the local government. In contrast, private schools are usually run either by religious institutions or an independently incorporated organization's board of trustees. Private schools can charge students matriculation and other fees and have access to other sources of funds such as trust funds and donations (Bernardo et al., 2015; Jimenez & Sawada, 2001). On the other hand, public schools rely on the government's limited budget allocation.

The difference in the sources of funds of the private and public schools generally predicts a stark disparity in the availability of learning resources, the quality of the delivery of

education, and the kind of students attracted by these schools (Bernardo et al., 2015). For example, many public schools in the Philippines, despite recent policy improvements, are still hampered by a lack of resources that limit access to quality educational facilities and resources (Adarlo & Jackson, 2016; McDoom et al., 2019; Yamauchi & Parandekar, 2013). Since public schools are free, many of their enrollees come from disadvantaged families who also have no access to learning facilities at home (Bernardo & Garcia, 2006). In contrast, private schools tend to attract students with medium to high family SES, which in turn, have access to better learning resources at home (Lockheed & Zhao, 1993). Their ability to charge fees on students give private schools the capacity to provide better learning facilities.

Rural and Urban Schools. Disparities within and between public and private schools are also confounded with geographic location due to socioeconomic inequalities among urban and rural areas (McDoom et al., 2019). For instance, elite private schools that cater to students from high family SES are mostly located in highly urbanized areas. They co-exist with public schools, usually supported by the urban sector by supplementing their school facilities such as buildings, classrooms, and other facilities. On the other hand, schools in rural areas are smaller and cater to students with lower socioeconomic backgrounds (Jimenez et al., 1991; Lockheed & Zhao, 1993). Expectedly, the urban vs. rural and private vs. public inequalities were among the main factors in achievement gaps identified by many researchers. Urban schools outperform rural schools, and private schools outperform public schools in national and international assessments (Bernardo et al., 2015; McDoom et al., 2019; OECD, 2019a).

School SES. The disparities in achievement mentioned above underscore that socioeconomic inequalities generally explain the achievement gap within and between schools in the Philippine context. This situation is consistent with research showing that individual-level socioeconomic status is one of the influential factors in student achievement

(Sirin, 2005). Furthermore, the Philippine context also reflects the strong influence of the school-level SES on students' academic performance, as reported by various studies (Perry & McConney, 2010; Sirin, 2005; World Bank Group, 2020; Xue et al., 2020). For example, the World Bank Group (2020) described a "social segregation" in Philippine schools. "A typical disadvantaged student has about a one-in-seven chance of attending the same school as high-achieving peers" (p. 70). Students from the bottom SES quartile are enrolled in schools with a "disproportionately higher" concentration of low-performing students (World Bank Group, 2020, p. 28).

Philippine PISA Results

For the first time, the Philippines participated in PISA 2018 to use international benchmarks in evaluating the country's education system, especially with its current shift to K-12 mandatory education. The results came out in 2019, with the Philippines ranking lowest in reading and second-lowest in mathematics and science—second only to the Dominican Republic. Within the Philippines, students from private schools had higher reading proficiency levels than those from public schools. More specifically, about 85% of students from public schools did not meet the minimum proficiency level. Similarly, fewer students from rural schools had obtained at least the minimum proficiency level in reading literacy than those from urban schools (Department of Education, 2019). One alarming finding was that even though the highest scores came from private and urban schools, they still fell below the OECD average. Therefore, students from both public and private schools, urban and rural schools, did not meet the OECD average (Department of Education, 2019; World Bank Group, 2020).

Additionally, a World Bank (2020) report on Philippine PISA 2018 indicated a positive and significant association of the school's average SES with the students' mean reading scores. Independent private school students have significantly higher reading scores

than students coming from private schools that receive government subsidies. In turn, the average reading scores of students from less advantaged private schools are still significantly higher than those from schools that fall under the lower average SES quartile. Generally, the Philippines performance in PISA 2018 depicted OECD's (2009a) assessment on the impact of the school's average SES on the school-level and individual-level assessment performance across the globe.

The Philippines' dismal performance created a media sensation about the state of the country's education system. The Department of Education (DepEd) sees the PISA 2018 as a baseline data and an opportunity to move forward, highlighting "the urgency of improving the quality of basic education in the Philippines." DepEd committed itself to "aggressively" raise the quality of education and identified four critical areas of improvement such as (1) evaluation and updating of its current curricular reform, (2) improvement of the learning environment, (3) teacher skills training and development, and (4) collaborating with its various stakeholders (Department of Education, 2019). However, the DepEd report did not provide details of how and when these strategic interventions would happen. There was also no reference to empirical studies that would support the implementation of these strategies.

The lack of reference to empirical research is understandable since it is the Philippines' initial participation in the assessment. Studies that examine the Philippines' PISA data to inform policymakers are in their infancy. As of the current writing, there are only three published studies on the Philippine PISA data (Cordon & Polong, 2020; Trinidad, 2020; World Bank Group, 2020).

Self Determination Theory and Need-Supportive Teaching

Self-determination theory (Ryan & Deci, 2000, 2017, 2020) is a theory of human development that investigates the person's natural propensity for growth. It further looks at how the contextual environment supports this growth. SDT asserts that for humans to

flourish, their basic psychological needs of autonomy, competence, and relatedness have to be satisfied. *Autonomy* refers to a person's sense of volition and ownership of his or her action. *Competence* is the person's sense of succeeding and growing in one's effort. *Relatedness* is the person's feeling of being connected. These psychological needs are the basic elements for an intrinsic and autonomous motivation that leads to well-being and positive outcomes (Ryan & Deci, 2000). SDT's basic tenets have a wide range of empirical support from educational studies using different methodologies such as cross-sectional (e.g., Haerens et al., 2015; Hospel & Galand, 2016; Zhoc et al., 2019); longitudinal (e.g., Green et al., 2012; Nishimura & Sakurai, 2017; Y. Wang et al., 2019); experimental (e.g., Cheon et al., 2020; Leptokaridou et al., 2016); interventionist (e.g., Lazowski & Hulleman, 2016); and mixed-methods (Hornstra et al., 2015) approaches. These broad spectrum of research has situated SDT as one of the most empirically supported contemporary motivation theories in education (Ryan & Deci, 2020; van den Berghe, Vansteenkiste, et al., 2014).

SDT foregrounds the teacher's role in supporting or thwarting learners' psychological needs, which have downstream consequences on students' learning and well-being (Guay et al., 2008; Ryan & Deci, 2020). Teachers help support learner autonomy when they offer explanatory rationale, take the students' perspective, and welcome students' ideas to determine their learning. They support learner competence by providing structure such as setting clear expectations, giving constructive feedback, adjusting teaching strategies, and offering instrumental help. Finally, teachers support students' need for relatedness through involvement, that is, when teachers invest their time on students by showing affection, understanding, and enjoyment in interacting with them (Ahn et al., 2019; Skinner & Belmont, 1993).

Need-supportive teaching has been shown to have a powerful impact on student achievement (Diseth et al., 2012; Stroet et al., 2013; Y. Wang et al., 2019). Students become

more engaged (Jang et al., 2016; Zhou et al., 2019), resilient (Pitzer & Skinner, 2017), and consequently show positive learning outcomes (Taylor et al., 2014; Vansteenkiste et al., 2012) when their teachers support their basic psychological needs. Empirical studies have also shown that supporting basic psychological needs is universal and consistently has a significant impact on students across different cultural contexts (Chirkov, 2009; Reeve, Ryan, et al., 2018).

SDT researchers have also developed numerous professional development programs designed to improve need-supportive teaching (Aelterman et al., 2013; Cheon, Reeve, Lee, et al., 2018; Langdon et al., 2017; Reeve & Cheon, 2016; Su & Reeve, 2011). These studies have shown that teachers can engage in need-supportive teaching practices if they are taught the relevant pedagogical skills and if they are given the rationale for doing so. These teacher development programs have been shown to yield consistent dividends for students' motivation, engagement, and achievement (Guay et al., 2016; Reeve et al., 2004)

A key strength of SDT is the broad empirical support on the universality of the basic psychological need support and its positive outcomes. This universality pertains to the generalizability of SDT's framework regardless of "age, gender, language, socioeconomic status, nationality, culture, ability level, special needs status, or historical time period" (Reeve et al., 2018, p. 18). This applicability, "regardless" of socioeconomic status, is critical in addressing student achievement gaps influenced by socioeconomic inequality at the individual and school level (Berkowitz et al., 2017; Bernardo et al., 2015; King, 2016; Trinidad, 2020). One crucial implication is the possibility of increasing student achievement beyond what is predicted by the student's family and school SES, as typically shown in the past PISA results (OECD, 2016a, 2019a) For example, Berkowitz et al.'s (2017) meta-analytic synthesis demonstrated that a positive classroom climate, which involves need-

supportive practices, mitigates the impact of low socioeconomic background on students' academic achievement.

However, studies that examine need-supportive practices, and their associated outcomes across different socioeconomic strata are rare (Rodríguez-Meirinhos et al., 2020). There is also a dearth of research on studies in medium and low-income countries, such as the Philippines.

The Present Study

This study aimed to investigate how need-supportive teaching was associated with students' reading achievement using the PISA 2018 Philippine data. Given the vast differences in resources and achievement across different school types and socioeconomic contexts in the Philippine context, we also tested whether these results generalized to students from different school types (public vs. private; urban vs. rural) and socioeconomic contexts (i.e., students with varying family SES levels, schools from different SES quartiles).

Method

Data and Participants

The study used data from the 2018 Programme for International Student Assessment (PISA; OECD, 2021), which tested more than six hundred thousand 15-year-olds across 79 countries and regions in reading, science, and math. PISA 2018's primary focus was reading, while math and science were its secondary assessment domain. Participants from the Philippines consisted of 7,233 students. We limited our sample to 7,050 students (53.66% females) with complete data. These students were from 187 schools that provided a nationally representative sample of 15-year-old students in the country.

Measures

Aside from the standardized test component for students, PISA included a questionnaire component designed to measure various contextual factors, many of which

have potential associations with the students' performance in the primary assessment domain. Hence, the questionnaire measures allow the study to make a meaningful investigation of the association of the need-supportive practices of the students' language teacher with the students' reading test scores in PISA. For this research, we had data on students' reading test scores, demographic details (i.e., socioeconomic background, school type, community), and need-supportive teaching measures (i.e., of the test language teacher).

Key Independent Variable. *Need-supportive teaching* (NST) is measured as the average of three items that approximate how supportive the student's language teacher was. The composite variable had a Cronbach's alpha of 0.84, which denoted high internal consistency between the constituent items. The composite variable had a minimum value of 1 and a maximum value of 4, with 4 indicating the highest rating of need-supportive teaching.

These three items were: (1) "The teacher made me feel confident in my ability to do well in the course," (2) "The teacher listened to my view on how to do things," and (3) "I felt that my teacher understood me." These items were introduced in PISA 2018 and closely mirror SDT questionnaires that measure competence support, autonomy support, and relatedness support (Ahn et al., 2019; Skinner & Belmont, 1993; Stroet et al., 2013). All items were rated on a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

Dependent Variable. Given that the independent variable rated the language teacher's need-supportive teaching, we used the students' reading test scores rather than their mathematics and science scores. *Reading achievement* was scaled using the Rasch method to have a mean of 500 and a standard deviation of 100 for the sample from the 79 countries and regions. The average reading test score for OECD countries was 487 points (OECD, 2019a), compared to the average reading test score for Filipino students of 340 points with a standard deviation of 78.51 points.

Covariates. We included control variables that accounted for demographics and school types to control potential confounders that may explain the reading test score. First, we added a measure that controls for the students' socioeconomic status. PISA has a variable that measures the students' socioeconomic background. It indexes the student's *economic, social, and cultural status* (ESCS) through their answers on their family's possessions, parents' education and occupation, and home educational resources (OECD, 2019b). PISA's analytical framework has used ESCS as one of the critical predictors of achievement, making it a crucial variable of interest among empirical studies in analyzing student achievement using the PISA data (Ding & Homer, 2020; Govorova et al., 2020). For the Philippine sample, this variable has a mean value of -1.43, with a standard deviation of 1.11. The full sample is standardized with a mean of 0 and a standard deviation of 1.

We computed and controlled for a school-level variable of socioeconomic status (i.e., the average of the students' ESCS scores in a school) since one's education and achievement may be affected by the school's level of advantage (Perry & McConney, 2010; Sirin, 2005; Xue et al., 2020). We also controlled for gender, given that girls in the Philippines, on average, had higher academic performance than boys (Trinidad, 2020). We coded the gender variable as 1 for females and 0 for males.

To see if there was a differential impact between school types, we also created categorical variables for public and private schools, determined by whether students paid tuition fees to an institution. We also categorized schools according to urbanicity following PISA's definition. The PISA school questionnaire asked the Principals to describe the community in which their schools were located. A sample description is "a village, hamlet, or rural area (fewer than 3000 people)." Schools in a city or a large city (a community of more than 100,000 people) were classified as urban schools, whereas those located in communities

with less than 100,00 people were considered rural schools (OECD, 2016b). Lastly, we created quartiles for family socioeconomic status (SES) and school SES.

Analytic strategy

Hierarchical linear models were estimated to answer whether need-supportive teaching influences reading test scores of students. By nesting students within schools, these models can account for variations in the school-level and the individual-level (Raudenbush & Bryk, 2002). The estimation strategy is formally expressed with the equation below:

$$Y_{ij} = \beta_{0j} + \beta_{1j}\,(NST) + \beta_{2j}\,(Female) + \beta_{3j}\,(SES) + e_{ij}; \quad (1)$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\,(School\ SES) + u_{0j}\,, \quad (2)$$

where Y_{ij} is the reading test score of individual i in school j, and *NST* is the student's rating of need-supportive teaching. Level 1 or the student-level covariates were a dichotomous variable for gender and a continuous variable that provided an index of the family's socioeconomic level. For Level 2 (i.e., school-level), we included an additional covariate for school-level socioeconomic status, denoted by *School SES*. The notation e_{ij} is the Level 1 residual, and u_{0j} is the Level 2 residual.

Next, we tested whether the results would generalize across students and schools from different socioeconomic strata in two ways. First, we tested the model across different family and school socioeconomic quartiles to determine the impact of need-supportive teaching across different socioeconomic strata. Second, we tested the interaction of school types and SES levels with need-supportive teaching to determine whether the type of school or levels of SES had a significant impact on need-supportive teaching.

Results

Preliminary Analyses

Table 3.1 presents both the descriptive statistics of the measures for need-supportive teaching and the student level bivariate correlations. Need-supportive teaching was positively

correlated with reading scores. At a more granular level, the items that approximate competence-support, autonomy-support, and relatedness-support were significantly and positively correlated with the standardized reading test score. Consistent with the global PISA findings, the family's socioeconomic status and being female were both significantly and positively correlated with reading achievement.

Primary Analyses

Table 3.2 shows the Hierarchical Linear Model depicting the relationship between need-supportive teaching and standardized reading test scores. In Model 1, we tested the full model. The full model's inter-class correlation coefficient (ICC) was 0.34, with gender and SES as Level 1 covariates and School Mean SES as Level 2 covariates. The model explained 34% of the variance is between schools (Level 2), and 66% was between students (Level 1). Need-supportive teaching positively predicted reading achievement (β = 18.2, SE = 1.06, $p < 0.001$).

In Model 2, we added interaction effects. Results showed that need-supportive teaching was not significantly moderated by school type, location, the individual-level SES, and school mean SES. This provides evidence that need-supportive teaching is associated with adaptive achievement outcomes regardless of school type and socioeconomic strata. This result converged with the results of our supplementary analysis (See Appendix B Table B1).

Table 3.1

Descriptive Statistics and Bivariate Correlations Between Need-Supportive Teaching and Reading Achievement With Disaggregated Components

		Mean/ %	SD	1	2	3	4	5	6	7
Individual Level Variables										
1	Reading Achievement	340.06	78.51	1.00						
2	Need-supportive teaching	2.92	0.69	0.22***	1.00					
3	Competence-support	2.97	0.82	0.20***	0.87***	1.00				
4	Autonomy-support	2.89	0.77	0.19***	0.87***	0.64***	1.00			
5	Relatedness-support	2.90	0.79	0.17***	0.87***	0.62***	0.64***	1.00		
6	Female			0.16***	0.06***	0.05***	0.06***	0.04**	1.00	
7	Family socioeconomic status	-1.43	1.11	0.42***	0.07***	0.08***	0.07***	0.05**	-0.05***	1.00
Percentage Female		53.66								
Percentage Public schools		81.82								
Percentage Private schools		18.18								
Percentage Rural schools		54.55								
Percentage Urban schools		45.45								

Note: The measures represent the mean, standard deviation of the items; percentage belonging to a gender or school category. The coefficients show the correlations between the different individual-level variables. ** $p < .01$, *** $p < .001$

Table 3.2

Hierarchical Linear Models of Need-supportive Teaching's Influence on Reading Achievement

	Model 1	Model 2
Key variable		
Need-supportive teaching (NST)	18.20*** (1.06)	13.03** (4.39)
Covariate at the student level		
Female	24.61*** (1.46)	24.39*** (1.46)
SES	13.96*** (0.80)	14.98*** (3.35)
Covariate at the school level		
School Mean SES	46.03*** (2.53)	60.56*** (8.42)
Private School	---	-3.10(12.52)
Urban School	---	8.31(7.77)
Interactions		
NST * SES	---	-0.34(1.12)
NST * Private	---	-1.78(3.75)
NST * Urban	---	-2.19(2.31)
NST * School Mean SES	---	-4.14(2.59)
Intercept	360.02*** (5.36)	379.51***(14.60)
Intraclass correlation coefficient	0.34	0.13
Level 1 Variance	3,621.63	3,614.41
Level 2 Variance	490.18	489.29
% variance explained at Level 1	11.58	11.76
% variance explained at Level 2	77.23	77.27
Number of students	7,050	7,050
Number of schools	187	187

*Note: Standard errors are in close parentheses. **p < .01, *** p < .001*

Supplementary Analyses

We also conducted a series of supplementary analyses to test the robustness of our results. Due to space constraints, these analyses are not included here but can be found in the supplementary materials (see Table B1). First, we tested whether need-supportive teaching would predict reading achievement across different school types (private vs public, rural vs. urban). Results showed that need-supportive teaching positively predicted reading achievement across students from different types of schools such as public (β = 19.24, SE =

1.14, $p < 0.001$), private ($\beta = 13.08$, SE = 2.83, $p < 0.001$), rural ($\beta = 20.11$, SE = 1.37, $p < 0.001$), and urban ($\beta = 15.98$, SE = 1.63, $p < 0.001$).

Next, we tested the model across individual SES and school SES quartiles. Results showed that need-supportive teaching consistently predicted reading achievement across students and schools of varying socioeconomic backgrounds (see Appendix B Table B2).

Then, we examined the mean levels of need-supportive teaching across different school types (private vs. public; rural vs. urban). Supplementary analyses indicated that private schools had higher mean need-supportive teaching than public schools. Urban schools had higher mean need-supportive teaching than rural schools, and more affluent schools have higher mean need-supportive teaching than lower SES schools (see Appendix B Table B3).

Next, we examined whether the three types of need support would function similarly (see Appendix B Table B4). Note that our measure of need-supportive teaching aggregated items that approximated teachers' support for autonomy, competence, and relatedness. We examined whether each type of basic need support was associated with reading achievement. Findings showed that autonomy, competence, and relatedness were all positively associated with reading achievement showing that they were all significant predictors of student achievement.

Discussion

The study aimed to examine whether need-supportive teaching was associated with reading achievement across different socioeconomic strata. We tested our hypothesis by examining the overall sample and samples disaggregated by family SES quartiles, school types, and school-level SES. Our results showed that need-supportive teaching significantly predicted reading achievement. These results held despite accounting for several alternative explanations (gender, individual SES, school-level SES). Our results corroborated past SDT research, which had shown that the satisfaction of students' basic psychological needs

predicted better engagement and other positive motivational outcomes, leading to better academic performance (Pitzer & Skinner, 2017; Rodríguez-Meirinhos et al., 2020; Ryan & Deci, 2017; Taylor et al., 2014). Given that many of these studies were conducted among Western and developed countries, our findings support the cross-cultural universality of SDT's theoretical assumptions in the context of a developing economy such as the Philippines. More specifically, our study demonstrated that need-supportive teaching was generalizable across school types and socioeconomic strata, providing more robust support for the universality of SDT's core tenets.

Consistent with SDT's universality, our results further demonstrated that need-supportive teaching appeared to have no significant interaction with school type, school community type, or individual and school-level socioeconomic strata. These results resonate with previous research that found school-level and individual-level socioeconomic background had no moderating effect on positive school and classroom environment (Berkowitz, 2020; Berkowitz et al., 2017). Our findings showed that schools and teachers could leverage daily classroom practices in improving their students' academic achievement given the right perspective. The study opens the possibility that fostering a need-supportive environment can lead to positive learning outcomes and mitigate the predicted impact of an individual's or school's socioeconomic status on student achievement. Our study demonstrated that need-supportive teaching's positive impact on students' reading achievement was applicable to the Philippine context regardless of school type and socioeconomic background of the students and school community. These findings indicate the practicability and potential benefits of improving need-supportive teaching among Philippine schools.

Informed by self-determination theory, our study has several implications for policy formulation in the Philippines. It encourages policymakers to pay attention to policies that

introduce interventions at the school and individual levels. A systematic impact evaluation of education policies showed that increasing or improving school resources would only result in positive learning outcomes if they directly impacted the students' day to day school experiences (Ganimian & Murnane, 2016). Increasing and improving school input (e.g., school buildings and learning materials) are important steps toward students' improvement. However, policymakers may need to pay more attention to how teachers teach as a crucial lever to improve student achievement.

Studies have shown that the Philippine education system is still teacher-centered in delivering learning content (de Mesa & de Guzman, 2006). Much of what happens in the classroom is controlled by the teachers. Some studies show that teachers adopt external rewards and punishment in their classes, which negatively impacts student achievement (Banzon-Librojo et al., 2017; Bernardo et al., 2008). Implementing need-supportive school and classroom practices require supporting teachers' retooling and professional development.

The World Bank Group (2016) study reported that teachers' professional development in the Philippines was less than the average of most countries. Furthermore, these professional development programs were focused on helping them attain pedagogical and content knowledge skills and relatively less attention was devoted to how they should teach (Bernardo & Garcia, 2006; World Bank Group, 2016). To complement these existing professional development programs, perhaps teachers could also be trained to be more need-supportive in their teaching which could potentially facilitate better learning outcomes.

Our present study suggested how pedagogical quality was a critical factor in improving students' learning as measured by their standardized reading test scores. Specifically, our study indicated that need-supportive teaching, an approach based on the SDT framework, had a positive and significant impact on students' reading achievement regardless of school type and individual and school socioeconomic strata. The present study,

to our knowledge, is one of the first empirical studies that drew on the Philippine PISA 2018 data. Our results put forward SDT as a robust theoretical framework and provide compelling empirical evidence about the adaptiveness of need-supportive teaching. This could provide data for policymakers in crafting data-driven, evidence-based, and impactful educational policies and practices.

Limitations and Directions for Future Research

Some existing limitations need to be articulated for possible improvement and future study. First, our data was based on a cross-sectional survey, which prevents us from drawing causal conclusions. Future researchers may need to conduct longitudinal and experimental investigations to establish causal relationships among the variables. Second, we only focused on the direct associations between need-supportive teaching and achievement. Future research could flesh out the theoretical mechanisms by examining potential mediators and other potential moderators. Another limitation is that teachers' support was measured using students' self-reports; this can be complemented by behavioral observations or teacher reports to reduce self-report bias. Lastly, the PISA 2018 contextual survey measures have limited our study to investigate only the Filipino students' reading achievement. It did not allow us to examine need-supportive teaching's potential impact on math and science achievement. Such investigation could have also provided possible insights to policymakers. PISA changes the main focus of assessment triennially; hence, future researchers are encouraged to explore the relationship of need-supportive teaching with the other subject areas in the succeeding PISA assessment domain.

Conclusion

The Philippines' participation and dismal ranking in PISA 2018 opened an avenue for reviewing its quality of education. The Philippine government has initiated a spate of reforms to improve educational outcomes. However, these strategies require massive economic

investment. In developing countries such as the Philippines, financial resources are limited, and policymakers face the question of where to invest the limited resources to impact student learning. Informed by self-determination theory, this research brought to fore need-supportive teaching's potential role in optimizing student achievement and learning. Amid the growing pressure of educational accountability, coupled with scarce economic resources, developing countries might need to prioritize improving student outcomes through need-supportive teaching.

Chapter 4: Need-Supportive Leadership, Need-Supportive Teaching, and Student Engagement: A Self-Determination Perspective

[Joseph Y. Haw and Ronnel B. King]

Abstract

Self-determination theory (SDT) foregrounds need-supportive teaching as a critical ingredient in facilitating student motivation and engagement. Much of the research on need-supportive teaching, however, focuses on its effects on students. An equally important but less explored topic is what facilitates teachers' propensity to engage in need-supportive teaching. This study examined how leadership practices facilitate need-supportive teaching and how need-supportive teaching, in turn, is associated with student engagement. The participants were 581 teachers and 2,283 students from 14 high schools in the Philippines. Study 1 examined need-supportive school leadership practices as predictors of need-supportive teaching. We found that need-supportive school leadership positively predicted need-supportive teaching via autonomous motivation. Study 2 examined whether need-supportive teaching was associated with student engagement. We found that need-supportive teaching positively predicted student engagement via autonomous motivation. Theoretical and practical implications are discussed.

Keywords: need-supportive teaching, need-supportive leadership, autonomous motivation, self-determination theory, Philippines

Self-determination theory (SDT; Ryan & Deci, 2020) underscores the importance of supportive social contexts in facilitating motivation and growth. According to SDT, supportive social contexts spur a motivational dynamic. Supportive social contexts lead to the

satisfaction of basic psychological needs (i.e., autonomy, competence, and relatedness). When these needs are satisfied, individuals become more autonomously motivated, leading to various adaptive outcomes such as optimal engagement (Ryan & Deci, 2017). Hence, in the educational context, SDT research foregrounds the teachers' role in creating need-supportive contexts, which are crucial to facilitating students' autonomous motivation and engagement (Ryan & Deci, 2017).

Consequently, much of the research in SDT has focused on the positive influence of need-supportive teaching practices on students' autonomous motivation and student learning outcomes (Bureau et al., 2022; Froiland et al., 2016; Stroet et al., 2013, 2015). However, research has not paid sufficient attention to need-supportive contexts for teachers that could enable them to be need-supportive teachers to students (Pelletier & Rocchi, 2016; Ryan & Deci, 2020; Stroet et al., 2015). Specifically, studies that examine the relationship between need-supportive school leadership practices and need-supportive teaching are "almost non-existent" (Adams, 2021). This lack has critical implications for the teaching and learning process as prior studies suggest the potential downstream consequences of leadership practices on teachers' practices down to students learning (Ahn et al., 2021; Bardach & Klassen, 2021; Collie & Martin, 2017a; Marshik et al., 2017; Roth, 2014). The ways teachers are "supported and motivated 'from above' affects their capacities to support and optimally motivate the students…below them" (Ryan & Deci, 2020, p. 7). This gap leaves a missed opportunity to maximize a "doubly motivating" dynamic as a great resource in teaching and learning (Bardach & Klassen, 2021).

The stark gap is even more pronounced among developing countries and regions. A majority of SDT research is drawn from samples in Western and affluent economies. Studies based on Eastern samples tend to focus on Confucian countries that are also have relatively well-developed economies (e.g., Howard et al., 2021; Jiang et al., 2021). Despite the well-

documented research on SDT's cross-cultural applicability, not much is known about SDT's core tenets in Southeast Asian and developing countries' contexts. Hence, studies based on these underrepresented contexts would extend SDT's evidence base that reflects the "complexities of learning environments around the globe" (Ryan & Deci, 2020, p. 8)

This study aimed to address the gaps mentioned above by investigating need-supportive teaching from two angles: its antecedents and its outcomes. First, we examined need-supportive school leadership practices (subsequently referred to as need-supportive leadership) as factors "from above" and their relationship with teacher autonomous motivation and need-supportive teaching. Second, we examined need-supportive teaching practices (subsequently referred to as need-supportive teaching) and their association with students' learning outcomes (i.e., motivation and engagement). We contextualized our study in the Philippines, considered one of the developing countries in the Southeast Asian region. The following research questions guided our investigation.

(1) Does need-supportive school leadership predict teachers' autonomous motivation and need-supportive teaching? Does autonomous motivation mediate the relationship between need-supportive school leadership practices and need-supportive teaching?

(2) Does need-supportive teaching predict students' learning engagement? Does autonomous motivation mediate the relationship between need-supportive teaching and student engagement?

Theoretical Background

Need-Supportive School Leadership

According to SDT, all human beings have three basic psychological needs—autonomy, competence, and relatedness (Ryan & Deci, 2000). *Autonomy* refers to the person's sense of volition and the desire to be a causal agent in one's life (Stroet et al., 2015). *Competence* is the feeling of being able to meet and master a challenge effectively.

Relatedness involves the feeling of being significant and connected to others (Vansteenkiste et al., 2020). These needs are necessary nutrients that need to be satisfied for optimal functioning and development. The satisfaction of these basic psychological needs depends on the person's social contextual environment that could either support or thwart these needs. SDT has established extensive empirical evidence showing that need-supportive social environments foster adaptive outcomes, whereas need-thwarting social environments often lead to damaging outcomes (Ryan & Deci, 2017, 2020).

In the educational context, school leaders can create environments that would support teachers' basic psychological needs, positively impacting their teaching behaviors and practices (Liebowitz & Porter, 2019; Maas et al., 2021). School leaders demonstrate *autonomy support* when they give their teachers a voice on matters of work and when they provide clear rationale when assigning a task (Aelterman et al., 2019). School leaders show *competence support* through constructive feedback and recognizing their teachers' talents and skills (Adams, 2021). Lastly, they express *relatedness support* by building trustworthy and reliable relationships with their teachers (Rothmann & Fouché, 2018).

Past research has linked need-supportive school leadership with teachers' behavior in the classroom (e.g., Escriva-Boulley et al., 2021; Liebowitz & Porter, 2019; Pelletier et al., 2002; Soenens et al., 2012). For example, Pelletier and colleagues' (2002) seminal work first suggested that demands from school leaders can be considered as "pressure from above" that affect the quality of teachers' behavior in the classroom. In the same way, scholars have empirically demonstrated that need-supportive school leadership spurs positive outcomes such as better engagement at work (Hakanen et al., 2006), adaptability (Collie & Martin, 2017a), self-efficacy (Y. Liu et al., 2020), and the motivation to be supportive to their students (Eyal & Roth, 2010; Ham & Kim, 2015; Roth et al., 2007). Moreover, need-supportive school leadership significantly affects teachers' capacity to build a need-

supportive learning climate (Adams, 2021; Liebowitz & Porter, 2019). Given the empirical support for need-supportive leadership's positive outcomes, we posit that:

H1a: Need-supportive school leadership practices will positively predict need-supportive teaching practices.

Teacher Autonomous Motivation

One of SDT's core assertions is that motivation can be viewed as a continuum. On the one hand, there are types of motivation that are *controlled*. These types of motivation are either prompted by external (e.g., promised reward or threat of punishment) or even internalized pressure (e.g., guilt and shame). On the other hand, there are types of motivation that are *autonomous*. Autonomous motivation pertains to wanting to engage in the task for its own sake or when the task has been internalized as part of one's identity. Autonomous motivation is one of the significant outcomes of basic psychological needs satisfaction. Hence, given the critical role of need-supportive social contexts in basic psychological needs satisfaction previously mentioned, SDT theorizes that the relationship between supportive social contexts and positive outcomes is mediated by autonomous motivation (Ryan & Deci, 2017).

Such motivational dynamics have been found in the workplace, including school contexts (Collie et al., 2015; Gagné et al., 2016; Roth, 2014; Rothmann & Fouché, 2018; Slemp et al., 2018). In schools, need-supportive school leadership practices foster teachers' autonomous motivation and influence their teaching behaviors (Marshik et al., 2017; Slemp et al., 2018, 2020). Autonomously motivated teachers have been found to be more inspiring (Fernet et al., 2016), innovative (Gorozidis & Papaioannou, 2014), and committed (Kõiv et al., 2019; Rothmann & Fouché, 2018). Recent research has also shown autonomous motivation as a mechanism that underpins the school leadership's need-supportive practices' positive influence on teachers' ability to foster a need-supportive social environment for their

students (Adams, 2021; Marshik et al., 2017; Slemp et al., 2020; van den Berghe, Soenens, et al., 2014). Hence, we hypothesized that:

H1b: Autonomous motivation will partially mediate the association between need-supportive leadership practices and need-supportive teaching.

Need-Supportive Teaching

Prior studies have shown that the ways teachers are "supported and motivated 'from above' affects their capacities to support and optimally motivate the students…below them" (Ryan & Deci, 2020, p. 7). For example, past research has highlighted the association of administrative pressure with teachers' controlling (i.e., need-thwarting) teaching style (Pelletier et al., 2002; Pelletier & Rocchi, 2016; Pelletier & Sharp, 2009). Scholars have also demonstrated that autonomously motivated teachers are perceived to exhibit need-supportive practices (Roth, 2014; Roth et al., 2007). As the teachers are an important part of students' social context in school, SDT underscores the central role of need-supportive teaching practices in facilitating student motivation, engagement, and achievement (Niemiec & Ryan, 2009; Reeve, 2016).

Teachers provide *autonomy support* when they offer explanatory rationale, take the students' perspective, and welcome students' ideas to determine their learning (Reeve, 2016; Ryan & Deci, 2017). They offer *competence support* or *structure* by setting clear expectations, giving constructive feedback, adjusting teaching strategies, and offering instrumental help (Ahn et al., 2019; Skinner & Belmont, 1993). Finally, teachers show *relatedness support* or *involvement*, by investing their time with students by showing affection, understanding, and enjoyment in interacting with them (Ahn et al., 2019; Niemiec & Ryan, 2009; Ryan & Deci, 2017).

There is a wealth of empirical evidence supporting the positive impact of need-supportive teaching on students' academic and well-being outcomes (Lauermann & Berger,

2021; Stroet et al., 2013; Y. H. Wang et al., 2019). For example, need-supportive teaching has been positively associated with student academic achievement (Goodman et al., 2021; Haw et al., 2021; Kaplan, 2018; Y. H. Wang et al., 2019) and well-being (Diseth & Samdal, 2014; Y. Wang et al., 2021). Prior studies have also found positive associations between need-supportive teaching with "non-graded" student academic outcomes such as skills improvement (Cheon et al., 2020), doing homework (Katz et al., 2009), resilience (Pitzer & Skinner, 2017), and engagement (Jang et al., 2016; Zhou et al., 2019).

Research had emphasized student engagement as an essential outcome of need-supportive teaching (Quin et al., 2017; Stroet et al., 2013). Student engagement reflects the students' investment and effort to be involved in the learning process (Olivier et al., 2021; Quin et al., 2017). It shows the quality of teacher-student interaction in the classroom and is indicative of "quality of teaching" (Quin et al., 2017). Moreover, student engagement is a critical school outcome that indicates persistence in learning and acquiring new knowledge (Stroet et al., 2013). Extant SDT literature has provided extensive empirical evidence that need-supportive teaching is a significant predictor of student engagement (Kurdi et al., 2018; Olivier et al., 2021; Stroet et al., 2013). Given the evidence from prior research, we hypothesized that:

H2a: Need-supportive teaching will be positively associated with student engagement.

Student Autonomous Motivation

Consistent with SDT's core theoretical assumptions, researchers found various positive implications of autonomous motivation among students (Howard et al., 2021; Ryan & Deci, 2017, 2020). For example, Howard et al.'s (2021) recent meta-analytic study found that autonomous motivation was positively associated with students' self-efficacy, mastery goal orientation, well-being, effort, engagement, and student achievement. Reeve (2013)

showed student engagement as multifaceted and suggested that autonomous motivation tapped different levels of student engagement: emotional, behavioral, social, and psychological. He further demonstrated that autonomous motivation facilitated students' agency in creating a motivationally supportive learning climate.

Several studies have highlighted that autonomous motivation could account for the relationship between need-supportive teaching and student engagement (for a meta-analytic study, see Stroet et al., 2013). Furthermore, recent research has demonstrated the global effect of need-supportive practices, indicating the joint contribution of each dimension (i.e., autonomy-support, structure, and involvement) on classroom engagement. Other scholars also extended prior findings by linking need-supportive teaching with autonomous motivation and student achievement (Ahn et al., 2019, 2021). Hence, we posited that:

H2b: Students' autonomous motivation will partially mediate the association between need-supportive teaching and student engagement.

Motivational Sequence

The associations and processes found in prior research reveal a sequential motivational dynamics between the antecedents of need-supportive teaching practices and their consequences on student learning: *need-supportive leadership → autonomously motivated teachers → need-supportive teaching → autonomously motivated students → engaged students.* Several studies have documented this potential sequential relationship (Pelletier & Sharp, 2009; Roth et al., 2007; van den Berghe, Vansteenkiste, et al., 2014). For example, Pelletier et al.'s (2002) landmark study found that "pressure from above" was associated with need-supportive teaching. Roth et al. (2007) later found that the teachers' autonomous motivation could facilitate the students' autonomous motivation for learning. Among the extant literature, it was probably Van den Berghe et al.'s (2014) meta-analytic study that first outlined a complete sequence of motivational dynamics from teacher

antecedents to student outcomes in Physical Education. However, the meta-analysis only documented studies that focused on "sections" of the sequence (e.g., some studies focused on antecedents only, some on outcomes only).

More recently, researchers have found empirical evidence linking teacher motivation and need-supportive practices with student motivation and learning outcomes (Ahn et al., 2021; Bardach & Klassen, 2021; Marshik et al., 2017). For instance, Ahn et al. (2021) found positive and significant associations among teacher autonomous motivation, need-supportive teaching, student autonomous motivation, and students' academic achievement. However, the antecedents for teachers' motivation and their teaching outcomes are still relatively underexplored. Specifically, studies that examine school leadership practices in relation to need-supportive teaching are "almost non-existent" (Adams, 2021). We aimed to address this gap by examining need-supportive leadership as an antecedent of need-supportive teaching and, in turn, the potential outcomes of need-supportive teaching on student engagement.

The Philippine Context

In the Philippines, prior research suggests encouraging advances in need-supportive teaching, such as giving students greater freedom to voice their opinion (de Mesa & de Guzman, 2006). However, scholars argue that teaching and learning in the Philippines still leaned towards the traditional approach (de Mesa & de Guzman, 2006; Haw et al., 2021; Trinidad, 2020). In a traditional approach, teachers tend to control and undermine autonomy in teaching (de Mesa & de Guzman, 2006; Stroet et al., 2015). This holds despite the emerging evidence that basic psychological need satisfaction and need-supportive teaching are linked to positive student outcomes in the Philippines (Alfonso et al., 2019; Church et al., 2013; Haw et al., 2021; Mendoza & Yan, 2021). This tendency has various contributing factors, such as lack of support from school leaders, which "exacerbates teacher stress and punitiveness which affect student behaviors and the school climate" (Banzon-Librojo et al.,

2017, p. 21). An empirical study on the antecedents and consequences of need-supportive teaching may provide critical information for school leaders and teachers in fostering a more positive learning climate which could lead to more gains for Filipino students. However, to our knowledge, there has been no study that has systematically examined need-supportive leadership as an antecedent of need-supportive teaching in the Philippines. Moreover, research on the potential contribution of need-supportive teaching to students' engagement is also quite rare. We aim to address this gap by situating our investigation in the Philippine context.

Covariates

Research suggests that demographic background variables could impinge on various teacher and student outcomes. Teacher characteristics such as gender and teaching experience have influenced their beliefs, perceptions, and behavior (Berkovich & Gueta, 2020; Rubie-Davies et al., 2012). For example, Klassen and Chiu (2010) found an increase in teacher-efficacy factors following early to mid-career teachers but declines for those with more extended experience. Moreover, Berkovich and Gueta (2020) found gender's moderating role in teachers' basic psychological need satisfaction and exercise of leadership among their students.

Among students, research finds gender differences in the strength of association between students' perceived teacher support and engagement (Bru et al., 2021; Katz, 2017; King, 2016). For example, King's (2016) study of Philippine students found that female students have more adaptive academic motivation and engagement profiles. Research also suggests that students' motivation generally declines throughout adolescence and as they progress in high school (Gnambs & Hanfstingl, 2016). Furthermore, prior research suggests that the students' perceived or subjective social status (SSS) also potentially influences students' beliefs, aspirations, motivation, and behavior in school (Destin et al., 2012;

Sweeting et al., 2011). Anticipating the influence of teacher and student background, we added them as covariates in our investigation to control their confounding effects and ensure more robust results.

The Current Study

This study examines need-supportive teaching from two angles: its antecedents and consequences. We situate this study in the Philippine context, considered one of the developing countries in Southeast Asia. We first investigate the relationships among the teachers' perception of need-supportive school leadership, teachers' autonomous motivation, and need-supportive teaching (Study 1). Then we examined the association of need-supportive teaching with students' autonomous motivation and student engagement (Study 2). Figures 4.1 and 4.2 below show the conceptual framework of the two-pronged study.

Figure 4.1

Relationship Between Need-Supportive Leadership and Need-Supportive Teaching via Autonomous Motivation

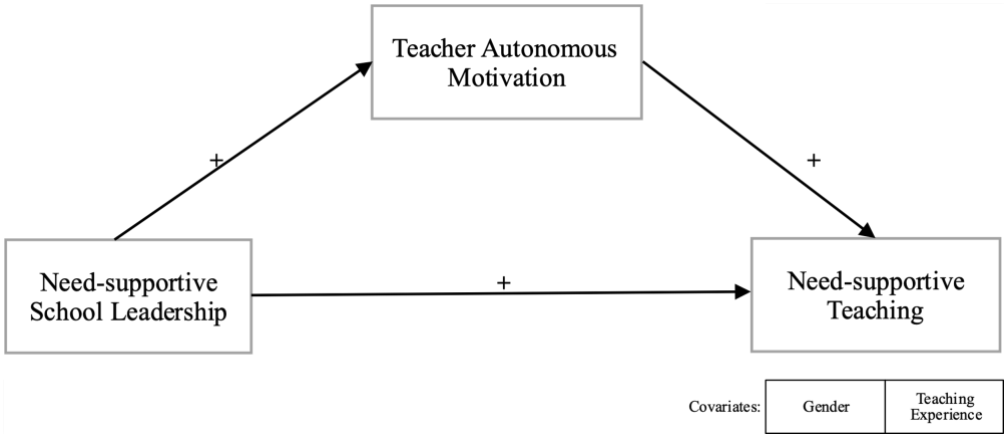
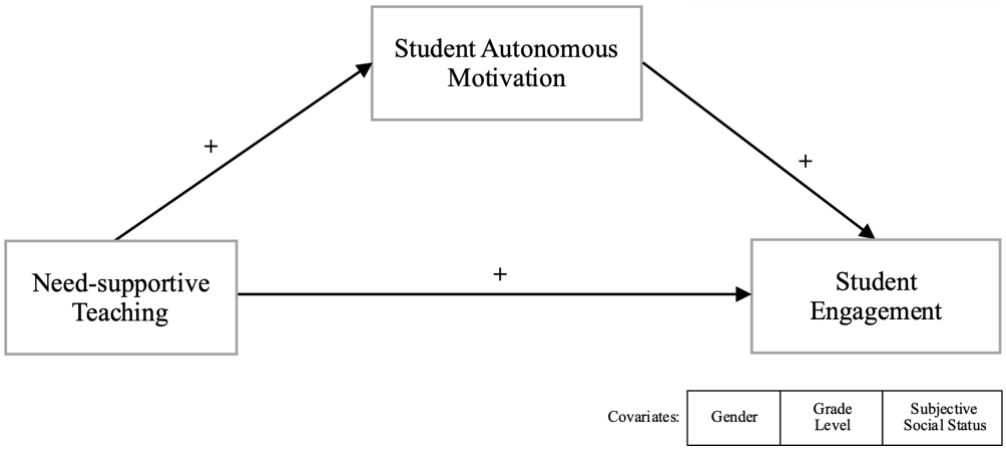


Figure 4.2

Relationship Between Students' Perceived Need-Supportive Teaching and Need-Supportive Teaching Practices via Autonomous Motivation



Study 1: Antecedents of Need-Supportive Teaching

This study explored need-supportive school leadership as a predictor of teachers' autonomous motivation and need-supportive teaching. We hypothesized that autonomous motivation would partially mediate the association between need-supportive school leadership and need-supportive teaching.

Method

Participants and Procedures. The participants were 581 (Females = 59%) teachers from different Junior (Grade 7 = 18%; Grade 8 = 14%; Grade 9 = 15%; Grade 10 = 19%) and Senior (Grade 11 = 16%; Grade 12 = 18%) High Schools, nested in 14 Catholic Private Schools across the Philippines. Their average age was 33.90 years (SD = 10.23). About 47% of the teachers were in their early career (between 0 and 5 years). The 14 schools shared a common educational philosophy and pedagogy since they were run by the same Religious Order.

Before data collection, the first author obtained ethics approval from the institutional research ethics committee (see Appendix G). The goals and ethical conduct of the study were presented to the participating schools, with administration and teacher representatives

present. These schools and teacher representatives consented to participate but recommended de-linking the teacher data from students and individual school leaders. Specifically for students, de-linking meant that the student surveys pertained to their perceptions of their teachers in general rather than referring to a specific subject teacher (e.g., a specific English or Math teacher). Teachers were wary of being identified in the surveys if the data were not de-linked.

Similarly, in surveying the teachers' perception of school leadership, questions were anchored on the leadership team in general rather than pertaining to one specific principal or reporting officer. The arrangement was proposed to add a layer of assurance, on top of the anonymous and non-evaluative nature of the survey, to encourage maximum student teacher participation. The arrangement was also proposed to avoid making the data overly sensitive to the individual principal's leadership style since each school has only one principal. These arrangements meant that we could not tightly link the teachers' data to a specific principal, nor could we link students' data to specific teachers. However, this was an acceptable compromise given the sensitive nature of this study.

We conducted our survey using an online platform. The school leaders of the participating schools facilitated the recruitment by sending the primary author's letter to the teachers specifying the link of the online survey. The online survey included an information sheet and a consent form (see Appendix E). Only the first author had access to the data gathered from those who consented to answer the online survey.

Measures. We used questionnaires validated by prior studies as measures of our study variables: need-supportive leadership (independent variable), teacher autonomous motivation (mediator), and need-supportive teaching (dependent variable). Internal reliability coefficients are found in Table 1. All the items used in the measure for this study are found in Appendix E.

Need-supportive Leadership. We adapted the School Principal Behavior Scale (SPBS; Rothmann & Fouché, 2018) to measure the teacher's perceived need-supportive leadership. We modified the questionnaire to refer to a group rather than an individual, changing the stem from "my Principal" to "my School Leaders" to refer to the teachers' various school leaders (i.e., Principal, Vice-Principal, and other supervisors) who have different instructional and oversight leadership roles. This practice is consistent with several studies that measured teachers' perception of school leadership and practices (e.g., Chen, 2016; Joo, 2018; Leithwood & Jantzi, 2006; Lu et al., 2015; Place, 2019; Suprunowicz, 2021). The questionnaire has three self-report subscales that indicate the school leaders' support for autonomy (five items: e.g., "My school leaders encourage me to participate in important decisions."), competence (six items: e.g., "My school leaders take the time to learn about my career goals and aspirations), and relatedness (with six items: e.g., "My school leaders are accessible"). The teachers rated the items using a 5-point Likert scale (1- *strongly disagree*; 5 - *strongly agree*).

Teacher Autonomous Motivation. We used items from the Multidimensional Work Motivation Scale (MWMS: Gagné et al., 2015) to operationalize teacher autonomous motivation. The stem question was, "Why do you or would you put efforts into your current job?" MWMS has two subscales that pertain to autonomous motivation: identified (three items, e.g., "Because I have fun doing my job.") and intrinsic (three items, e.g., "Because I personally consider it important to put efforts in this job."). The teachers rated the answers using a 7-point Likert scale (1-*strongly disagree*; 7-*strongly agree*).

Need-Supportive Teaching. We used 12 items from the teacher version of the Teacher as a Social Context Questionnaire to measure the teacher's need-supportive practices (Iglesias-García et al., 2020). The questionnaire is composed of three subscales: autonomy-support (four items; e.g., "I try to give my students a lot of choices about classroom

assignments."), structure (four items; e.g., "I try to be clear with the students about what I expect of them in class."), and involvement (four items; e.g., "The students can count on me to be there for them."). The items were rated using a 5-point Likert scale (1- *strongly disagree*; 5 - *strongly agree*).

Covariates. Our online survey included gender and teaching experience as basic personal background. The participants gave their teaching experience using a 6-point scale. Each scale represented a five-year range of teaching experience (e.g., 1- *less than a year* and 6 – *above 20 years*). Gender was coded 1 for females and 0 for males.

Analysis. We expected very low cluster dependence since these schools followed a homogenous educational philosophy and pedagogy. However, research suggests that even models with very low ICC are still susceptible to Type I error (e.g., C. Huang, 2012; McNeish, 2017). Hence, we considered the clustering of data in our analytic strategy. Given the limited cluster, we followed F. Huang's (2016) recommendation to analyze a 1-1-1 fixed effect model since we were only interested in the individual-level effects. In the fixed-effect model, we conducted a single level structural equation model. We controlled Level 2 effects by creating dummy variables for the 14 schools and used them as covariates.

We employed a two-step structural equation modelling approach (Anderson & Gerbing, 1988). We first conducted a confirmatory factor analysis (CFA) to evaluate the measurement model's data fit. Since the sample was large enough to be rejected by a chi-square test, we used alternative criteria as suggested in Hu and Bentler (1995): CFI $\geq$ 0.90, TLI $\geq$ 0.90, RMSEA $\leq$ 0.05, and SRMR $\leq$ 0.05. We measured need-supportive school leadership practices as a second-order latent variable consisting of three first-order latent variables: autonomy support, competence support, and relatedness support. This was consistent with Rothmann et al.'s (2018) precedent. Also consistent with prior research, we subsumed the two subscales into one autonomous motivation measurement (e.g., Abós et al.,

2018; Ahn et al., 2021). We used a single factor measurement for need-supportive teaching practices as a general outcome based on Escriva-Boulley et al.'s (2021) study.

After ascertaining the model fit, we added the complete structural equation and used maximum likelihood estimation. We used the bootstrapping method with 5000 samples to evaluate the mediation effect's significance. Specifically, we infered a significant mediation when the 95% confidence interval do not contain zero. We first examined a model with only the study variables and then added the covariates to explore whether the results held after accounting for alternative explanations.

Results

Preliminary Analysis. Table 4.1 shows the summary statistics, intra-class correlation, and bivariate correlations. Correlation results echo the positive relationship expected by SDT among teachers' perceived need-supportive leadership, autonomous motivation, and need-supportive teaching. The correlations among the study variables have significance and range from typical to large effect sizes (Bosco et al., 2015; Funder & Ozer, 2019; Gignac & Szodorai, 2016).

Primary Analysis. The first step in our primary analysis was to do a CFA. We first tested a measurement model where the dependent variable was measured as a one-factor need-supportive teaching outcome following Escriva-Boulley's et al.'s (2021) measurement. The one-factor model did not show a good fit: $\chi^2(df) = 1773.03(489)$, $p < 0.001$; CFI = 0.89; TLI = 0.88; RMSEA = 0.07 (90% CI = 0.06, 0.07); SRMR = 0.05. However, we found a very good fit when we represented the items into three respective first-order latent variables (e.g., autonomy, structure, and involvement) and loaded them into a second-order latent variable: $\chi^2(df) = 1317.08$ (486), $p < 0.001$; CFI = 0.93; TLI = 0.92; RMSEA = 0.05(90% CI = 0.05, 0.06); SRMR = 0.05.

Table 4.1

Summary Statistics and Bivariate Correlations Between Need-Supportive Leadership, Autonomous Motivation, and Need-Supportive Teaching

Variables	1	2	3	4
1. Need-supportive Leadership				
2. Autonomous Motivation	0.31***			
3. Need-supportive Teaching	0.23***	0.51***		
4. Gender	-0.08	0.00	-0.01	
5. Teaching Experience	-0.07	0.11**	0.10*	0.07
Mean (*SD*)	3.93 (0.69)	4.39 (0.50)	4.30 (0.43)	
Skewness	-0.89	-0.64	-0.07	
Kurtosis	1.19	0.13	-0.68	
Cronbach's Alpha	0.96	0.86	0.90	
Type I Intra-class Correlation Coefficient (ICC1)	0.04	0.02	0.03	

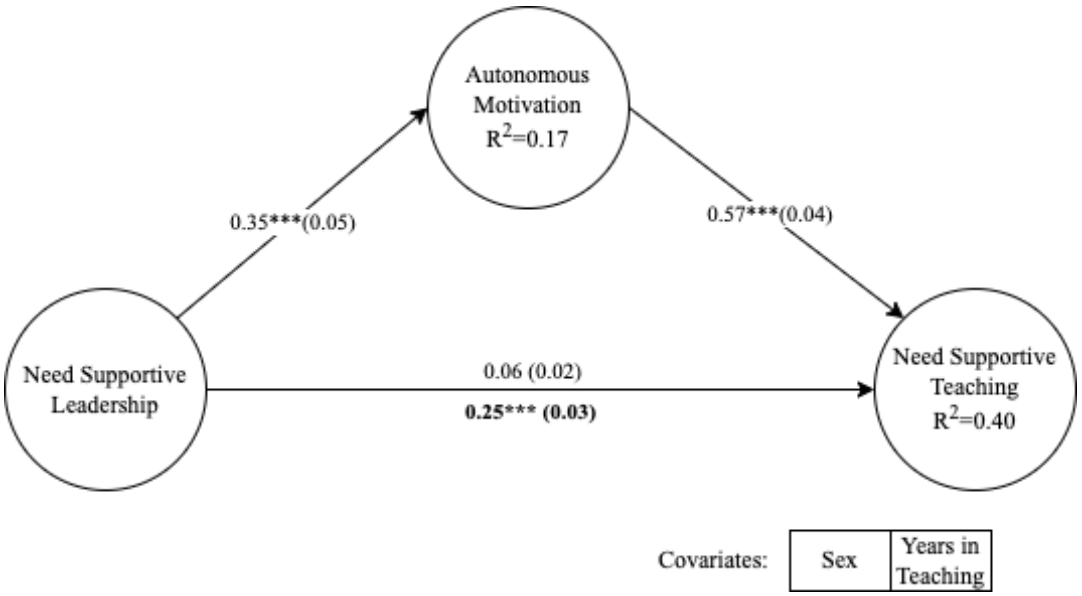
Note: ***$p < 0.001$ ** $p < 0.01$ * $p < 0.05$; ICC1 is the measure of variance due to clustering.

The second step involved testing the SEM model. We first tested a model with the study variables only, then another model where we added the covariates. We did not present the full results here for brevity but provided them as supplementary material (see Tables C1 and C2 in Appendix C). The model maintained a good data fit after adding the covariates: $\chi^2(df) = 2091.23(951)$, $p < 0.001$; CFI = 0.91; TLI = 0.90; RMSEA = 0.05 (90% CI = 0.04, 0.05); SRMR=0.05.

The path estimates with covariates were summarized in Figure 4.3. Results show a positive and significant association between need-supportive leadership and autonomous motivation. We also found a positive and significant association between autonomous motivation and need-supportive teaching. Results further show a significant relationship between need-supportive leadership and need-supportive teaching via autonomous motivation even when covariates were added (B = 0.10, SE = 0.02, 95% bias-corrected and accelerated (BCA) CI [0.07, 0.13]; $\beta = 0.20$, $p < 0.001$). However, the results did not show a statistically significant association between need-supportive leadership and need-supportive teaching.

Figure 4.3

Individual Level Mediation Model of Association Between Need-Supportive Leadership and Need-Supportive Teaching Practices via Autonomous Motivation.



Note: For clarity of presentation, covariate estimates have not been shown. Please see Table C2 in Appendix C for details. Estimate in bold typeface indicates the total effect.

***p < 0.001 **p < 0.01 *p < 0.05

Brief Discussion

Higher need-supportive school leadership was associated with higher autonomous motivation, which in turn, was associated with higher need support for students. However, contrary to what we expected, we did not find a significant positive association between need-supportive school leadership and need-supportive teaching (H1a). Consequently, the results suggested that autonomous motivation fully mediated the effects of need-supportive leadership on need-supportive teaching, which was contrary to our expected partial mediation (H1b).

Study 2: Consequences of Need-Supportive Teaching

This second study examined whether the need-supportive teaching would positively relate to students' outcomes (i.e., autonomous motivation and engagement) as predicted in

SDT literature. We hypothesized that need-supportive teaching would positively predict higher student autonomous motivation, which, in turn, would predict higher student engagement.

Method

Participants and Procedures. The participants consisted of 2,283 high school students (51% females) from different Junior (17% Grade 7; 16% Grade 8; 21% Grade 9; 15% Grade 10) and Senior (15% Grade 11; 16% Grade 12) High School levels nested in 14 schools across the Philippines. The mean age of these students was 15.23 years, with a 1.83 standard deviation. The participants in this study were students of the teachers surveyed in Study 1.

The first author's institutional ethical standards committee approved the study's ethical procedures concerning human subjects together with Study 1. Consent from schools was obtained together with the consent obtained from Study 1. As in Study 1, the school administrators and teacher representatives recommended de-linking the student survey from individual teachers. This involved anchoring the survey question on students' perception of need-support from their teachers in their year level instead of a teacher or teachers in their class.

After the participating schools gave their informed consent, general passive informed consent was obtained from parents of students whose ages were lower than 16. The participating schools coordinated the recruitment of students and data collection from students via an online survey after the period for parents' response to opt-out had elapsed. The online questionnaire informed the students of the study's purpose and the questionnaire's voluntary and anonymous nature. The students were also informed that their participation would not affect their grades (see Appendix F). The online survey was administered five weeks after the teacher survey in Study 1. The first author's letter specifying the objective of

the study and the link to the online survey was emailed to the students by their respective class advisers. Only the first author had access to the online survey's database. The data were collected only from students who gave their informed consent.

Measures. We adapted validated measurement instruments from prior research to measure students' perception of need-supportive teaching (independent variable), students' autonomous motivation (mediator), and student engagement (dependent variable). The scales were revised to control for common method bias (Podsakoff et al., 2012). Table 2 shows the internal reliability coefficients of the items. All the items used in the survey are found in Appendix F.

Need-Supportive Teaching. We used a short form of the Teachers as a Social Context Questionnaire (TASCQ; Ahn et al., 2019). The original items referred to the student's perception of individual teachers' supportive practices. In conformity with the participating schools' recommended procedures, we adapted the questionnaire to disassociate the students from individual teachers. Hence, we changed the wording of the items from "my teacher" to "my teachers". The questionnaire consisted of 12 items, having four items each referring to autonomy support (e.g., "My teachers give me a lot of choices about how I do my schoolwork"), structure (e.g., "My teachers make sure I understand before they go on with the lesson"), and involvement (e.g., "My teachers really care about me"). Each item was rated using a 7-point Likert scale (i.e., *1- strongly disagree to 7- strongly agree*). Following Ahn et al.'s (2019) study and the lack of consensus in research on how students perceive need-supportive teaching is measured (Ahn et al., 2021), we operationalized need-supportive teaching as a single factor.

***Student Autonomous Motivation*.** We utilized two subscales from the Academic Self-Regulation (Vansteenkiste et al., 2009): identified (three items, e.g., "Because it is personally important to me") and intrinsic (three items, e.g., "Because I enjoy doing it") to measure

autonomous motivation. The question stem was "Why are you studying in general?" and the students were asked to rate the given possible answers from 1 (*strongly disagree*) to 5 (*strongly agree*).

Student Engagement. Jang et al.'s (2016) student engagement subscales were utilized to measure student engagement. The subscales consisted of a total of 14 items that referred to cognitive (e.g., "When learning about a new topic in my subjects, I usually try to summarize it in my own words."), emotional (e.g., "I enjoy learning new things in my classes"), and behavioral engagement (e.g., "I listen very carefully in my classes"). Items were rated from 1 (*strongly disagree*) to 6 (*strongly agree*). The items were rated from 1 (*strongly disagree)* to 6 (*strongly agree*).

Covariates. We used an item in the youth version of the MacArthur Scale of Subjective Social Status (E. Goodman et al., 2001). The item depicts the society as a ladder with ten rungs (1- *the worst of;* 10- *the best of*). Students were asked to locate where they perceive their family is placed on the ladder. A higher number indicates a perceived higher level in society. Students were also asked about their grade levels, ranging from 1 (Grade 7) to 6 (Grade 12). A higher number indicates a higher grade level. Gender was coded 1 for females and 0 for males.

Analysis. We employed a two-step structural equation modelling approach (Anderson & Gerbing, 1988). A confirmatory factor analysis (CFA) was first conducted to examine the model-data fit. Due to the chi-square test's sensitivity to large samples, we utilized other fit indices in evaluating the measurement model: CFI $\geq$ 0.90, TLI $\geq$ 0.90, RMSEA $\leq$ 0.05, and SRMR $\leq$ 0.05 (Hu & Bentler, 1995). The structural equation is added and evaluated in the same manner. We examined a fixed-effects model wherein we controlled Level 2 effects by creating dummy variables for the 14 schools and used them as covariates (F. Huang, 2016). Then we proceeded with a single level structural equation modelling. We used maximum

likelihood in estimating the path coefficients. We used the bootstrapping method with 5000 samples to evaluate the mediation effect's significance. Significant mediation exists when zero is not within the 95% confidence interval. We examined a model with only the study variables and then added the covariates to explore whether the results held after accounting for alternative explanations.

Results

Preliminary Analysis. Table 4.2 gives the summary statistics and correlations of the study variables. The correlation of study variables was consistent with prior SDT research. Need-supportive teaching was positively correlated with autonomous motivation and student engagement with a typically large effect size (Bosco et al., 2015; Gignac & Szodorai, 2016). Autonomous motivation was likewise positively correlated with engagement with a large effect size.

Table 4.2

Summary Statistics and Bivariate Correlations Between Need-Supportive Teaching, Autonomous Motivation, and Student Engagement

	1	2	3	4	5
Need-supportive Teaching					
Autonomous Motivation	0.54***				
Student Engagement	0.62***	0.74***			
Grade Level	-0.06**	0.06**	0.02		
Gender	0.01	0.06**	-0.01	-0.01	
Subjective Social Status	0.08***	0.02	0.07***	-0.03	-0.10***
Mean (SD)	5.21 (0.92)	3.66 (0.71)	4.38 (0.72)		
Skewness	-0.75	-0.55	-0.45		
Kurtosis	1.39	0.61	0.89		
Cronbach's Alpha	0.92	0.81	0.91		
ICC1	0.03	0.04	0.05		

Note: ICC1 is the measure of variance due to clustering. ***p<.001 **p<.01 *p<.05.

Primary Analysis. We conducted CFA as the first step of our preliminary analysis. As measured in prior empirical studies, we measured need-supportive teaching as a single

factor underpinned by autonomy-support, structure, and involvement (Ahn et al., 2019, 2021). Autonomous motivation was represented as a second-order latent variable with two first-order variables for identified and intrinsic motivation. This is consistent with Vansteenkiste et al.'s (2009) analysis that subsumes intrinsic and identified regulation under autonomous motivation. We represented student engagement as a one-factor latent variable that subsumes the behavioral, cognitive, and emotional engagement items following precedent modelling from prior studies (Fatou & Kubiszewski, 2018; Leo et al., 2022; Skinner & Belmont, 1993). CFA results showed a good measurement model to data fit after two sets of engagement items were allowed to covary (see details Appendix C's Tables C3 and C4): $\chi^2(df)$ = 3960.60 (519), $p < 0.001$; CFI = 0.92; TLI = 0.91; RMSEA = 0.06 (90% CI = 0.05, 0.06); SRMR = 0.04.

We then added the structural equation as our second step. We tested first a model with only the study variables and another model where we added the covariates. For brevity, we have presented here only a summary of the model with covariates and provided the full details of the models in Appendix C (see Tables C3 and C4). Results showed that the model maintained a good data fit after adding the covariates: $\chi^2(df)$= 5563.01 (1032), $p < 0.001$; CFI = 0.90; TLI = 0.90; RMSEA = 0.04 (90% CI = 0.04, 0.05); SRMR = 0.04.

Figure 4.4 below summarized the key results. The SEM model showed a positive and significant association between need-supportive teaching and student engagement via autonomous motivation even with covariates (B = 0.40, *SE* = 0.02, 95% BCA CI = 0.35, 0.44; β=0.55, $p < .001$). Results also revealed a positive and statistically significant direct effect of need-supportive teaching on student engagement (B = 0.08, *SE* = 0.02, 95% BCA CI = 0.04, 0.11; β = 0.11, $p < .001$), indicating a partial mediation effect. The findings support the hypothesized mediation model (H2a and H2b). Higher need support from teachers

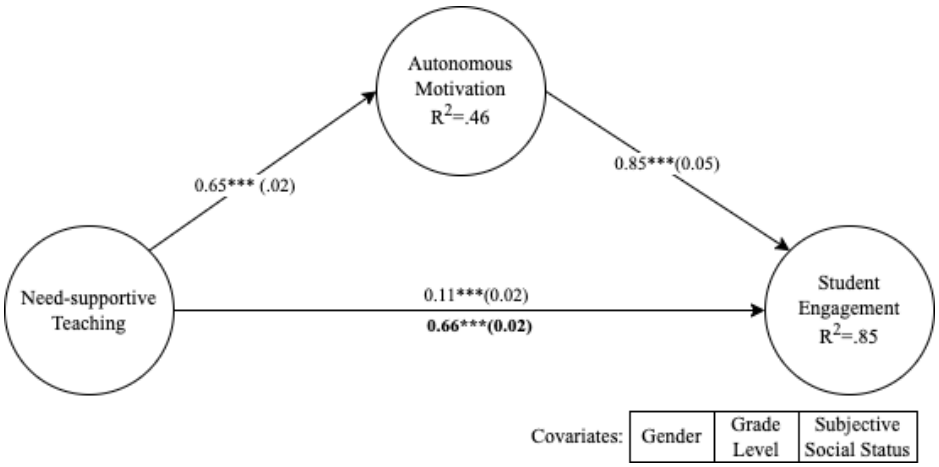
predicted higher student autonomous motivation. Higher student autonomous motivation, in turn, predicted student engagement.

Brief Discussion

Our findings find congruence in prior SDT studies that suggest the positive influence of need-supportive teaching on student engagement (Jang et al., 2010; Reeve et al., 2004; Stroet et al., 2013). Furthermore, consistent with past research, our findings further provide empirical evidence on the mediating role of autonomous motivation as a mechanism that underpins the relationship between need-supportive teaching and student engagement (Howard et al., 2021; Jang et al., 2012).

Figure 4.4

Individual Level Mediation Model of Association Between Need-Supportive Teaching and Student Engagement via Autonomous Motivation



Note: For clarity of presentation, first-order latent variables and covariate estimates were not shown here. Please see Table C4 in Appendix C for details. The estimate in bold typeface indicates the total effect. ***p < 0.001 **p < 0.01 *p < 0.05

General Discussion

Our study aimed to investigate whether the ways school leaders supported and motivated their teachers affected the way these teachers optimally supported and motivated their students. We examined need-supportive teaching from two angles using data from

Philippine schools. We first investigated what conditions foster teachers' need-supportive behaviors (Study 1). Second, we investigated the potential implications of need-supportive teaching on student engagement (Study 2). We found evidence that supported our hypothesized models even when known covariates were added.

Study 1 posited that need-supportive school leadership would positively predict need-supportive teaching mediated by autonomous motivation (H1a and H1b). We found teacher autonomous motivation to fully mediate the positive associations between school leadership practices and need-supportive teaching. The results somewhat deviated from our hypothesized model, which posited partial mediation. Further analysis suggested that a high correlation among the study variables suppressed the potential direct effect of need-supportive school leadership practices. A separate analysis focusing on individual variables suggested that H1a and H1b were supported. Taken all together, these findings were congruent with prevailing SDT empirical evidence.

Study 2 posited the same motivational dynamics among students: need-supportive teaching will predict autonomous motivation, and autonomous motivation will predict student engagement (H2a and H2b). We found empirical evidence that supported the hypothesized mediated relations. The results were congruent with studies that showed autonomously motivated teachers tend to adopt need-supportive practices to a greater extent (Katz & Shahar, 2015; Slemp et al., 2020). Our findings suggested that teachers who perceive their school leaders as need-supportive feel more autonomously motivated and more likely to engage in need-supportive teaching practices.

A central feature of our two-pronged study is that our sample population come from the same network of schools. The teachers who reported their experience of need-supportive school leadership practices, autonomous motivation, and need-supportive teaching practices are the teachers of students who reported their experience of need-supportive teaching,

autonomous motivation, and engagement. Hence, the convergence of the findings in the two studies surfaces a sequence of motivational dynamics generally supported in SDT literature (Ahn et al., 2021). A key assertion that can be inferred from our findings is that supporting the teachers' basic psychological needs facilitates an autonomous type of motivation that is mirrored in students' experiences (Bardach & Klassen, 2021). Our findings suggest a "doubly motivational" dynamics, that is, that need-supportive school leadership fosters autonomously motivated teachers who, through their need-supportive teaching, foster students' autonomous motivation and learning engagement (Adams, 2021; Bardach & Klassen, 2021; Ryan & Deci, 2020).

It is also noteworthy that the findings were drawn from a developing and Southeast Asian population sample which is rarely explored in SDT research, thereby extending SDT's evidence base. Despite well-documented research on its cross-cultural applicability, not much is known about SDT core tenets in Southeast Asian and developing countries' contexts, such as the Philippines. Our study is one of the few, if not first, that systematically and integrally investigated the antecedents and consequences of need-supportive teaching in the Philippine context.

Our study provides empirical evidence of the potential benefits of fostering autonomy-support, structure, and involvement in the classroom that has practical implications for school leaders and teachers. School leaders (e.g., Principals, Instructional Supervisors, and Administrative Teams) are concerned about improving teachers' practices that facilitate a positive motivational climate conducive to student engagement and learning. The primary strategy often explored is teacher beliefs and practices intervention. Indeed, interventions improve teachers' capacity to foster classroom motivational climate (e.g., Cheon et al., 2020; Rubie-Davies & Rosenthal, 2016). However, it may not be sufficient if teachers remain controlled and demotivated (e.g., Slemp et al., 2020). A crucial finding was that

autonomously motivated teachers have a higher chance of teaching in a need-supportive way (Adams, 2021; Roth et al., 2007; Slemp et al., 2020). Our findings showed that teachers' autonomous motivation would most likely increase when they perceived their school leaders to be need-supportive (Eyal & Roth, 2010; A. Lee et al., 2020; Roth, 2014). Hence, school leaders may help teachers create a motivating learning environment if they complement professional development by fostering need support such as giving teachers a voice in their work (autonomy-support), providing constructive feedback, recognizing and enhancing talents and skills (competence-support), and building a trustworthy relationship with their teachers (relatedness-support).

Teachers are likewise concerned about having motivated and engaged students. However, lessons may not simply evoke interest requiring teachers to explore various teaching strategies to motivate their students towards engagement. Our findings echo prior research that teachers may reap positive outcomes from these strategies if done in a need-supportive way (Jang et al., 2010; Reeve et al., 2004). For example, teachers may do well in tapping the students' inner resources by explaining the rationale of the lesson, allowing the students to have a say in the learning activities, and acknowledging their feelings toward the activities (autonomy-support). Students become more engaged when they have a sense of meeting a challenge. Hence, teachers could support students by setting clear expectations, providing optimally challenging activities, and showing them ways to solve these challenges (competence-support or structure). Lastly, students may become more motivated and engaged if teachers show interest and concern in their growth and learning through (relatedness-support or involvement).

Limitations and Future Research Directions

We acknowledge several limitations in this study that open various avenues for improvement in future research. First, our teacher and student data were based on a cross-

sectional survey. Hence, no causal conclusions can be drawn. Even when we use the terms "antecedents" and "consequences" in the paper, we acknowledge these to be theoretical propositions and is in line with how prior SDT researchers have discussed these variables. However, we cannot empirically test the temporal ordering among the variables. We encourage future researchers to conduct longitudinal and experimental investigations to test causal claims.

Second, we measured our study variables by relying on self-reports which are susceptible to measurement bias. Although using self-reports to measure need-supportive practices is the norm in SDT research (Bardach & Klassen, 2021; Stroet et al., 2013), we encourage future researchers to complement these reports with observational data and situational judgement tests (e.g., vignettes) to reduce self-report bias (Bardach et al., 2020).

Third, our study focused only on need-supportive practices. We are aware that need-thwarting and need-frustration also influence both teacher and student autonomous motivation and their corresponding outcomes (e.g., Sarmah et al., 2022; Slemp et al., 2020; Stroet et al., 2015). However, we did not add these constructs into the survey to avoid respondent fatigue as having too many survey items might reduce participation. Future research could investigate these practices and provide richer insights on the role of need-thwarting and need-frustrating practices in the school motivational dynamics.

Lastly, we were not able to tightly link the teacher and student data. Ideally, the best test of the motivational sequalae from need-supportive leadership to teachers' need-supportive teaching to students' engagement would be possible only if all the teacher and student data were linked together. However, due to data sensitivity and to encourage maximum participation among teachers, participating schools explicitly requested that data be de-linked out of the concern that this study might be used as a tool to identify "good" and "bad" teachers and school leaders. Hence, we modified the student survey so that the students

referred to need-supportive teaching in a general way and their answers did not pertain to specific teachers. In the same way, the teacher survey referred to school leaders in general and did not refer to specific principals nor to a specific class of students they were teaching. These modifications did not allow us to tightly link individual teachers to a class, preventing us from conducting a more robust investigation of the motivational sequence from need-supportive leadership to student engagement. We encourage future researchers to collect data that would allow them to link school leaders', teachers', and students' data in one study and at the same time cater to schools' privacy and ethical concerns.

Conclusion

What motivates teachers to engage in need-supportive teaching practices is a crucial educational question given the centrality of teachers' role in facilitating students' learning motivation and engagement. Our findings suggest a potential motivational dynamic facilitated by a supportive climate from the school leaders to the teachers and, in turn, from teachers to students. Need-supportive school leaders help build need-supportive teachers by facilitating autonomous motivation. Need-supportive teachers help build autonomously motivated and engaged learners. Indeed, the quality of need-supportive leadership practices "from above" experienced by the teachers may have a significant connection with the quality of need-supportive teaching practices they show to the students "below" them.

Chapter 5: Need-Supportive School Leadership Optimizes Teacher Well-Being: Variable and Person-Centered Approaches

[Joseph Y. Haw, Ma. Jenina N. Nalipay, and Ronnel B. King]

Abstract

This study investigated how teachers' perceptions of school leaders' need-supportive practices were associated with teacher well-being using variable- and person-centered approaches. Self-determination theory was used as the theoretical lens. A sample of 611 high school teachers (58% females) nested in 15 schools participated in this study. Study 1 used a variable-centered approach to test whether school leaders' need-supportive leadership practices predicted teacher well-being via autonomous motivation. Results revealed that need-supportive leadership positively predicted well-being and negatively predicted ill-being via autonomous motivation. Study 2 applied a person-centered approach to identify subgroups of teachers based on their perceptions of school leaders' need supportive practices. Results indicated two distinct profiles: high need support and low need support. High need-support teachers, who felt more supported by their school leaders, reported significantly higher autonomous motivation and well-being, and lower ill-being. In contrast, low need-support teachers, who felt less supported by their school leaders, reported lower autonomous motivation and well-being, and higher ill-being. Overall, results demonstrated the importance of school leaders' need-supportive practices in promoting teachers' well-being.

Keywords: self-determination theory, need-supportive school leadership, variable and person-centered approach, autonomous motivation, well-being, ill-being

Teacher well-being contributes to teachers' quality of teaching, motivation, and commitment, and subsequently connects with the quality of student learning in the classroom (Collie et al., 2015). Hence, it has been one of the critical concerns in education in the recent decades (Hascher & Waber, 2021). Consequently, a key educational research question focuses on what factors influence teacher well-being. Several studies attest to the complexity of teacher well-being and how it is influenced by a confluence of contextual factors such as personal, social, school, and culture, among others (Hascher & Waber, 2021; Simmons et al., 2019; Slemp et al., 2020).

Self-determination theory (SDT; Ryan & Deci, 2000, 2017) is a contemporary theory of motivation and wellness that underscores school leaders' practices as a critical predictor of teacher well-being. SDT asserts that school leaders' support for teachers' basic psychological needs (i.e., autonomy, competence, and relatedness) is crucial to facilitating autonomous motivation that leads to flourishing and well-being. A wide array of empirical studies has provided evidence that supports the association between teachers' basic psychological need satisfaction and optimal motivation and well-being (e.g., Collie & Martin, 2017; Ebersold et al., 2019; Slemp et al., 2020). However, SDT studies that systematically examine need-supportive school leadership practices as predictors of teacher motivation and well-being are still quite rare (Ryan & Deci, 2020). Moreover, a majority of SDT literature had relied on a variable-centered approach that generalizes empirical insights from averaged patterns. There is an expressed need for other approaches that could draw more nuanced insights from about perceived need support, motivation, and well-being in the varied conditions of teachers (Ryan & Deci, 2020).

We aimed to address the abovementioned gaps on two fronts. First, we used a variable-centered approach to examine need-supportive school leadership practices—as underpinned by autonomy, competence, and relatedness support— and their potential

associations with teachers' autonomous motivation and well-being (Study 1). The study covers both the negative and positive spectrum of well-being. Second, we employed a person-centered approach to identify specific subsets of teachers in the sample based on their perceptions of need support and investigated whether their profiles aligned with SDT's predicted well-being outcomes (Study 2).

Theoretical Background

Need-Supportive School Leadership Practices

According to SDT, there are three basic psychological needs that must be satisfied as a necessary condition for optimal well-being and functioning: autonomy, competence, and relatedness. *Autonomy* is the feeling of volition or self-endorsement of value or behavior. *Competence* is the feeling of efficacy or meeting an optimal challenge. *Relatedness* is the feeling of being connected and valued by an individual or group. The satisfaction of these needs depends much on the individual's quality of social context support (Ryan & Deci, 2017). In the educational context, school leaders could either support or thwart the satisfaction of these basic psychological needs. School leaders support teachers' need for autonomy by giving them a voice on matters that pertain to their work. They foster competence by giving teachers constructive feedback and recognizing their talents and skills. Finally, school leaders support relatedness by building trustworthy and reliable relationships (Rothmann & Fouché, 2018).

Prior research has revealed that school leaders' need-supportive practices significantly contribute to teacher well-being (Collie et al., 2018; Ebersold et al., 2019; Slemp et al., 2020). Hence, it is not surprising that scholars opine that need-supportive school leadership practices can provide teachers with the inner resources that could help them face challenges in the workplace (e.g., Collie, 2021; Herman et al., 2021). For example, Collie et al.'s (2018) study suggested that teachers who perceive autonomy-supportive principals tend to have lower

emotional exhaustion and disengagement. Moreover, Ebersold et al. (2019) showed that autonomy support was positively associated with positive emotion and life satisfaction. However, many of these studies only examined autonomy support, leaving the contribution of competence and relatedness support relatively unknown. There are only a few studies that have systematically investigated the three dimensions of need-supportive leadership practices and their implications on teacher well-being.

Autonomous Motivation

SDT asserts that basic psychological need support triggers a sequential motivational process that leads to positive well-being outcomes (Ryan & Deci, 2017, 2020). Specifically, need support contributes to the satisfaction of basic psychological needs which facilitates autonomous motivation. *Autonomous motivation* is a type of motivation wherein an individual engages in an action because of intrinsic love for the task or for self-endorsed reasons (Ryan & Deci, 2020). For example, the recent COVID-19 pandemic had forced teachers to adapt to new modes of instruction, such as online classes, which rendered teaching more taxing and rather unenjoyable. An autonomously motivated teacher takes the challenge of online teaching due to sheer love of teaching. In contrast, teachers with a controlled motivation engage in an action because of external (e.g., performance evaluation) or internal pressures (e.g., feeling guilty if one does not do the work well).

Research has provided comprehensive empirical evidence on the positive benefits of autonomous motivation among teachers (Collie et al., 2018; Roth, 2014; Slemp et al., 2020). Slemp et al.'s (2020) meta-analytic study found that autonomous motivation leads to various adaptive behavior and positive experiences that acted as internal protective resources for teachers amidst job demands. Their findings suggested that autonomous motivation was positively associated with teacher well-being and typically negatively associated with ill-

being (e.g., anxiety and depression). Indeed, fostering autonomous motivation plays a key role in teacher well-being.

The strong association of autonomy-supportive school leadership practices with teacher autonomous motivation has been well documented (Slemp et al., 2020). However, this is not the case for competence and relatedness support, or the combination of the three basic psychological need support practices. To our limited knowledge, there has been no study yet that has systematically examined the contribution of these need-supportive practices together with autonomy support. Hence, not much is known about how support for competence and relatedness could facilitate autonomous motivation. Such a gap limits the breadth of practices that school leaders can tap to support their teachers. We aimed to bridge this gap by examining these components together and their contribution in facilitating autonomy support.

Well-Being

The natural consequence of supporting and satisfying the basic psychological need satisfaction is well-being (Martela & Sheldon, 2019; Ryan & Deci, 2017, 2020). Well-being could be construed as having both a positive and a negative spectrum (Franken et al., 2018). However, many SDT studies have been centered on the negative spectrum of teacher well-being (e.g., Cann et al., 2021; Collie, 2021). In this study, we aimed at examining the potential association of need-supportive school leadership practices and autonomous motivation on both the positive and negative spectrum of well-being.

For the positive spectrum, we use Keyes' (2008) model of well-being which recognizes three different components of well-being including emotional, social, and psychological dimensions. *Emotional well-being* refers to the of presence of positive emotions and satisfaction with one's life (this is also called subjective well-being). *Social well-being* is about whether individuals perceive themselves to function well in society (e.g.,

social acceptance), whereas *psychological well-being* refers to the individuals' assessment of their unique talents amidst challenges (e.g., self-acceptance and having purpose in life).

For the negative spectrum, we focus on anxiety and depression which are the most common mental health problems among teachers and the general population (Ozamiz-Etxebarria et al., 2021; Staples et al., 2019).

Variable-Centered and Person-Centered Approach

Most of the empirical studies cited above relied on a *variable-centered approach,* which involves examining the associations among the variables with the assumption that the parameter estimates are homogenous across the population (Hofmans et al., 2020). Though good for describing the average pattern, variable-centred approaches do not capture naturally occurring subgroups within the population. Consequently, these approaches overlook the nuances of subgroups in the population such as patterns of similarities or differences based on the study variables (Abós et al., 2018; Collie et al., 2020). Scholars suggest that a person-centered approach is better suited in examining such patterns (Collie et al., 2020).

A *person-centered approach* examines the relationship of variables "among people". It investigates specific subgroups in the population (Hofmans et al., 2020). There has been a growing interest in examining teacher profiles with regard to their experiences of teacher motivation and well-being (Collie et al., 2020). However, there seems to be a lack of person-centered evidence on teacher profiles based on their experience of need-supportive school leadership. SDT scholars underscore this gap and have called for a more nuanced types of methodology such as person-centered approach (Ryan & Deci, 2020). The current study aims to address this gap by employing both variable-centered and person-centered approach as the analytical strategy.

The Current Study

The following research questions guided the course of the study.

(3) What is the relationship between school leaders' need-supportive practices, teacher autonomous motivation, and teacher well-being (Study 1)?

(4) What are the profiles of teachers in terms of need support from their school leaders? Do these profiles of teachers significantly differ in well-being (Study 2)?

(5) In addressing these research questions, we also included gender and teaching experience as covariates, as they have been shown to be closely associated with teacher well-being (Collie et al., 2015).

Study 1: Variable-Centered Approach

We examined a mediation model wherein need-supportive school leadership practices predict teacher autonomous motivation, which in turn predicts teacher well-being. We posited the following hypotheses:

(6) H1a: Need-supportive leadership practices will be positively associated with teachers' well-being.

(7) H1b: Need-supportive leadership practices will be negatively associated with teachers' ill-being

(8) H2a: Autonomous motivation will partially mediate the associations between need-supportive leadership and well-being.

(9) H2b: Autonomous motivation will partially mediate the associations between need-supportive leadership and ill-being.

Method

Procedures and Participants. There were 611 (58% Female) participating teachers from Philippine Private schools, with an average age of 33.90 (SD=10.23) and with varying teaching experience (5% in induction program, 41% between 1 – 5 years, 29% between 6 – 15 years, 25% in later career). They teach different grade levels of Junior (Grade 7 = 103,

Grade 8 = 83, Grade 9 = 92, and Grade 10 = 108) and Senior High School (Grade 11 = 105, Grade 12=121). This study obtained institutional ethics approval (see Appendix G).

The study was conducted during the second year of COVID-19 pandemic. Philippine schools had begun using different learning modes to adapt to the COVID-19 pandemic. Due to the COVID-19 situation, we deemed it more feasible to gather data via an on-line survey using convenience sampling. The first author invited 15 Private Schools, being run by a Religious Order, that had adopted either full online or hybrid (online with asynchronous mode) instruction and had accessible internet connection. The 15 schools gave their consent to participate and helped in coordinating the data collection via an online questionnaire. The schools' respective administrators sent the first author's letter to the teachers, explaining the study's objectives and the specific link of the online survey. The online survey included information on the voluntary and anonymous nature of the study and a consent form. Only the first author had access to the online survey's database and data were collected only from teachers who gave their informed consent.

Measures.

Need-supportive School Leadership Practices (NSL). We adapted the School Principal Behavior Scale (SPBS; Rothmann & Fouché, 2018) to measure the teacher's perceived need-supportive leadership practices as our key independent variable. We changed the stem from "my Principal" to "my School Leaders" to refer to the teachers' various school leaders (i.e., Principal, Vice-Principal, and other supervisors). The questionnaire had three self-report subscales: autonomy support (five items; $\alpha = 0.91$; e.g., "My school leaders encourage me to participate in important decisions."), competence support (six items; $\alpha = 0.91$; e.g., "My school leaders take the time to learn about my career goals and aspirations), and relatedness support (with six items; $\alpha = 0.92$; e.g., "My school leaders are accessible"). The items were rated using a 5-point Likert scale (1-*strongly disagree*; 5-

strongly agree). We followed the precedent of Rothmann et al. (2018) that showed NSL as second-order latent variable (with the three subscales as first-order latent variables) having the best data fit among other models.

***Teacher Autonomous Motivation*.** We used six items from the Multidimensional Work Motivation Scale (MWMS: Gagné et al., 2015) to operationalize teacher autonomous motivation as our mediator variable (α=0.86). The stem question was, "Why do you or would you put efforts into your current job?" A sample item was "Because I have fun doing my job." The teachers rated the answers using a 7-point Likert scale (1-*strongly disagree*; 7-*strongly agree*).

Teacher Well-being. The Mental Health Continuum – Short Form (MHC-SF; Keyes et al., 2008) is a 14-item questionnaire that measures subjective well-being. The stem question of the questionnaire was "In the past month, how often did you feel…" followed by items rated using a 6-point Likert Scale (0 - *never*; 5 - *every day*). It had three subscales which measured emotional (three items; α = 0.88; e.g., "Satisfied"), social (five items; α = 0.90; e.g., "That you had something important to contribute to society"), and psychological (six items; α = 0.88; e.g., "That you liked most parts of your personality") well-being. The item scores were summed up, with a maximum score of 70 for the whole questionnaire or 15, 25, and 30 for each respective subscale. A higher score indicated a higher level of flourishing.

Teacher Ill-Being. We measured teacher ill-being using the Patient Health Questionnaire, an ultra-brief questionnaire for screening anxiety and depression (PHQ-4; Kroenke et al., 2009). The stem was "Over the last two weeks, how often have you been bothered by the following problems?" followed by answers rated from 0 ("not at all") to 3 ("nearly every day"). The questionnaire has two subscales, each consisting of two core criteria for screening depression (α = 0.80; e.g., "Feeling down, depressed, or hopeless") and anxiety (α=0.87; e.g., "Feeling nervous, anxious, or on edge") disorders. Prior studies have

found each subscale to have a good psychometric property and valid screeners for anxiety and depression disorders (e.g., Plummer et al., 2016; Staples et al., 2019). Scores for each subscale are summed up. Higher scores indicate higher levels of anxiety and depression.

Analysis. We utilized Anderson and Gerbing's (1988) two-step approach to structural equation modelling. We first conducted a confirmatory factor analysis (CFA) to evaluate the measurement model's data fit using Hu and Bentler's suggested criteria: CFI ≥ 0.90, TLI ≥ 0.90, RMSEA≤ 0.05, and (SRMR≤ 0.05. Then we tested the complete structural equation via maximum likelihood estimation. To infer the significance of mediation effects, we used the bias-corrected accelerated bootstrapping method (5000 samples) and evaluated whether zero is not within the 95% confidence interval. We analyzed a 1-1-1 fixed effect model where the 15 schools were represented as dummy variables to account for the nesting of data (F. Huang, 2016). We first examined a model with only the study variables and then added the gender and teaching experience as covariates to explore whether the results held after accounting for alternative explanations. We also conducted ancillary analyses that examine the individual dimensions of need-supportive leadership practices on teacher well-being and ill-being.

Results

Preliminary Analysis. Table 4.1 shows the summary statistics and bivariate correlations. Measurement items showed excellent internal reliability coefficients. Results indicated correlations consistent with SDT theorizing showing need-supportive leadership practices' positive associations with teachers' autonomous motivation and well-being and negative association with teacher ill-being. Moreover, autonomous motivation is positively correlated with well-being and negatively correlated with ill-being. Results showed typical to large effect sizes for well-being and smaller effect sizes for ill-being (Gignac & Szodorai, 2016).

Table 5.1

Summary Statistics and Bivariate Correlation Between Need-Supportive Leadership, Autonomous Motivation, Well-being, and Ill-being

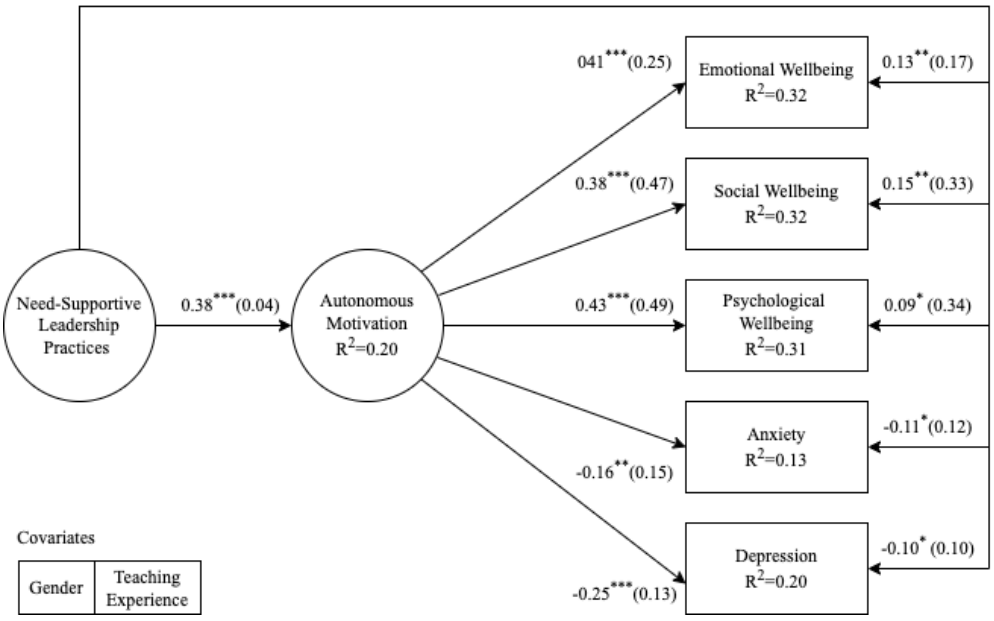
Variables	1	2	3	4	5	6	7	8
1. Need-Supportive Leadership Practices								
2. Teacher Autonomous Motivation	0.33***							
3. Emotional Well-being	0.27***	0.42***						
4. Psychological Well-being	0.23***	0.43***	0.72***					
5. Social Well-being	0.28***	0.40***	0.76***	0.77***				
6. Anxiety	-0.16***	-0.18***	-0.42***	-0.37***	-0.36***			
7. Depression	-0.18***	-0.27***	-0.52***	-0.49***	-0.45***	0.69***		
8. Gender	-0.08*	-0.01	0.02	0.03	-0.01	0.07	0.01	
9. Teaching Experience	-0.06	0.11**	0.23***	0.21***	0.15***	-0.22***	-0.27***	0.06
Mean (SD)	3.93 (0.69)	4.38 (0.51)	10.94 (2.78)	22.23 (5.39)	16.60 (5.34)	2.51 (1.72)	1.86 (1.50)	
Skewness	-0.89	-0.64	-0.81	-0.74	-0.42	0.62	0.81	
Kurtosis	1.19	0.09	0.50	0.23	-0.57	-0.32	0.47	
Interclass Correlation Coefficient (ICC Type 1)	0.04	0.02	0.05	0.04	0.08	0.02	0.05	

*Note: ***p<.001 **p<.01 *p<.05*

CFA and SEM analysis. Results of the confirmatory factor analysis showed a perfect model fit: (χ^2(df) = 628.22(224), p<.001; CFI = 0.96;TLI = 0.95; RMSEA[95%CI]=0.05 [0.05,0.06]; SRMR= 0.03). Hence, we proceeded in evaluating the full structural model. We first evaluated a model consisting of only the study variables (Model 1) and then added the covariates (Model 2). Model 1 results are found in Appendix D (see Table D1). Model 2 results showed a very good structural model to data fit: χ^2(df)= 1356.09(681), p < 0.001; CFI = 0.95; TLI = 0.93; RMSEA[95% CI] = 0.04 [0.04, 0.04]; and SRMR = 0.04. Results are summarized in Figure 5.1.

Figure 5.1

Associations Among Need-Supportive Leadership, Autonomous Motivation, Well-Being, and Ill-Being



Note: Covariate estimates, manifest items, and error terms were not presented for clarity of presentation. Please refer to Appendix D Table D2 for the full SEM details.

Table 5.2 summarizes the path estimates of the associations among the study variables and covariates (Model 2). SEM results revealed that autonomous motivation mediated the relationship of need-supportive leadership practices with emotional, social, and psychological well-being. Moreover, autonomous motivation significantly mediated the negative association of need-supportive leadership practices with anxiety and depression. Bias corrected bootstrapping method with 5000 samples did not show zero to be within the confidence intervals indicating significant mediation effects.

Table 5.2

SEM Path Estimates Between Need-Supportive Leadership, Autonomous Motivation, Well-Being, and Ill-Being With Covariates (Model 2)

Path Estimates	β	Covariates	
		Gender	Teaching Experience
A. Direct Effects			
NSL → Autonomous Motivation	0.38***	-0.01	0.14**
Autonomous Motivation→ Emotional Well-being	0.41***	0.00	0.18***
NSL→ Emotional Well-being	0.13**		
Autonomous Motivation → Social Well-being	0.38***	-0.03	0.10**
NSL→ Social Well-being	0.15***		
Autonomous Motivation → Psychological Well-being	0.43***	0.02	0.14***
NSL→ Psychological Well-being	0.09*		
Autonomous Motivation→ Anxiety	-0.16**	0.08*	-0.19***
NSL→ Anxiety	-0.11*		
Autonomous Motivation → Depression	-0.25***	0.00	-0.20***
NSL → Depression	-0.10*		
B. Indirect Effects			
NSL→ Autonomous Motivation→ Emotional Well-being	0.16***		
NSL → Autonomous Motivation→ Social Well-being	0.15***		
NSL → Autonomous Motivation→ Psychological Well-being	0.16***		
NSL → Autonomous Motivation→ Anxiety	-0.06**		
NSL → Autonomous Motivation→ Depression	-0.10***		
Total Effects		Variance Explained	
Emotional Well-being	0.28***	0.32	
Social Well-being	0.30***	0.32	
Psychological Well-being	0.26***	0.31	
Anxiety	-0.17***	0.13	
Depression	-0.19***	0.20	
Autonomous Motivation	-	0.20	

Note: Covariate estimates are standardized. Since we were only interested on the fixed effects, we no longer showed here the regression coefficients of the 15 schools (F. Huang, 2016). ***p< .001 **p<.01 *p<.05

Supplementary Analyses. We conducted supplementary analyses and examined whether individual dimensions of need-supportive leadership practices (i.e., autonomy, competence, and relatedness) would be associated with the well-being outcomes in a similar way. Results revealed that each dimension (i.e., support for autonomy, competence, and relatedness) exhibited the same pattern of significant associations among the study variables (see Tables D2 – D4 in Appendix D).

Brief Discussion

Results indicated evidence supporting our hypotheses. Need-supportive leadership practices had significant positive associations with well-being (except psychological well-being) and significant negative associations with ill-being. Our results partially supported H1a and fully supported H1b. Significant indirect effects of need-supportive leadership on well-being and ill-being variables supported partial mediation hypothesized in H2a and H2b. Even after controlling for potential confounding effects of known covariates, the results remained consistent.

Study 2: Person-Centered Approach

We used a person-centered approach to identify teacher subgroups within the sample that may have identical profiles based on perceived need support. Given the lack of prior work using person-centered approaches, we did not posit any specific hypothesis as to the number of profiles that would be generated.

Method

Data and Measures. We used the data and measures following from Study 1. Since we were interested in examining the profile of teachers about their perceived need support from school leaders, we used their answers from the need-supportive leadership practices question items as our variable of analysis. We used the well-being and ill-being variables as

outcome variables. We scaled all the variables for standardized estimates and more meaningful comparisons of the substantive constructs.

Primary Analysis. We employed latent profile analysis (LPA) using *tidyLPA* package in R (Rosenberg & van Lissa, 2021). Teachers were profiled based on their perceptions of need-supportive leadership practices. A step-up approach was utilized to determine the profile solutions that would best describe the sample. We assumed that the sample would have at least two profiles (*k = 2)* and then successively added profiles at each step. Then, at each step, we evaluated the profile solutions using various fit criteria used in prior research (for details of each criterion, please see Spurk et al., 2020).: Bayesian Information Criterion (BIC), Sample Size-adjusted BIC (SABIC), Bootstrapped Likelihood Ratio Test (BLRT), and entropy values.

To determine the optimal profile solution, we compared the fit criteria between *k* and *k*+1. Lower BIC and SABIC indicate a better fit, while a BLRT *p*-value greater than 0.05 for the model with a *k*+1 profile suggests that it is not better than the model with a *k* profile. The entropy value is an index (with 1 as the highest value) that indicates the model's ability to separate the observations into distinct profiles. An entropy value closest to 1 is a better fit.

We also examined whether the number of profiles selected would be meaningful and congruent to SDT theorizing. Then, we extracted the profiles and added autonomous motivation, well-being, and ill-being indicators to examine whether they were significantly different using one-way analysis of variance (ANOVA).

Supplementary analysis. We conducted an automatic two-step agglomerative hierarchical clustering and *k*-nearest neighbor cluster analysis using SPSS 27 (IBM Corp., 2020) to check the robustness of our two-profile solution. We no longer presented the full results here for brevity but have provided them as supplementary material in Appendix D (see Tables D6a – D6c and Figure D1).

Results

LPA. We first compared a three-profile solution (*k*+1) with a two-profile-solution (*k*) as default. The comparative fit indices are found in Appendix D (see Table D5). Results showed that the three-profile solution had lower BIC and SABIC, indicating a better fit than the two-profile solution. However, the three-profile solution showed a non-significant BLRT indicating it was not better than *k*. Consequently, we no longer added other solutions. The two-profile solution had significant BLRT and indicated a better entropy value. Hence, we retained the two-profile solution. The first profile of teachers showed "high need-support" (n = 393, M = 0.21, SD = 0.92) or those who had reported high level of need support from their school leaders. The second profile indicated "low need-support" (n = 218, M = - 0.38, SD=1.03) or those teachers who had reported low level of basic psychological need support from their school leaders. Results further indicated significantly more high need-support teachers than low need-support teachers (B = 4.04, $p < 0.05$) indicating somewhat positive experience from more teachers in the sample.

ANOVA. Results showed that the two profiles were significantly different from each other (F = 49.43, $p < 0.001$). We then added the other study variables for comparison. Figure 5.2 below shows the latent profiles with the study variables. Following the empirical insights from Study 1, we tested whether high need-support teachers (Profile 1) would exhibit higher well-being and lower ill-being than low need-support teachers (Profile 2). Results indicated that the high need-support group had significantly higher autonomous motivation, higher well-being, and lower levels of ill-being. Table 5.3 summarizes the mean comparison of autonomous motivation, well-being, and ill-being variables between the two profiles.

Supplementary Analysis. Results indicated the same number of teacher profiles found in our main LPA analyses.

Figure 5.2

Autonomous Motivation, Well-Being, and Ill-Being of Teachers According to Need-Support Profile

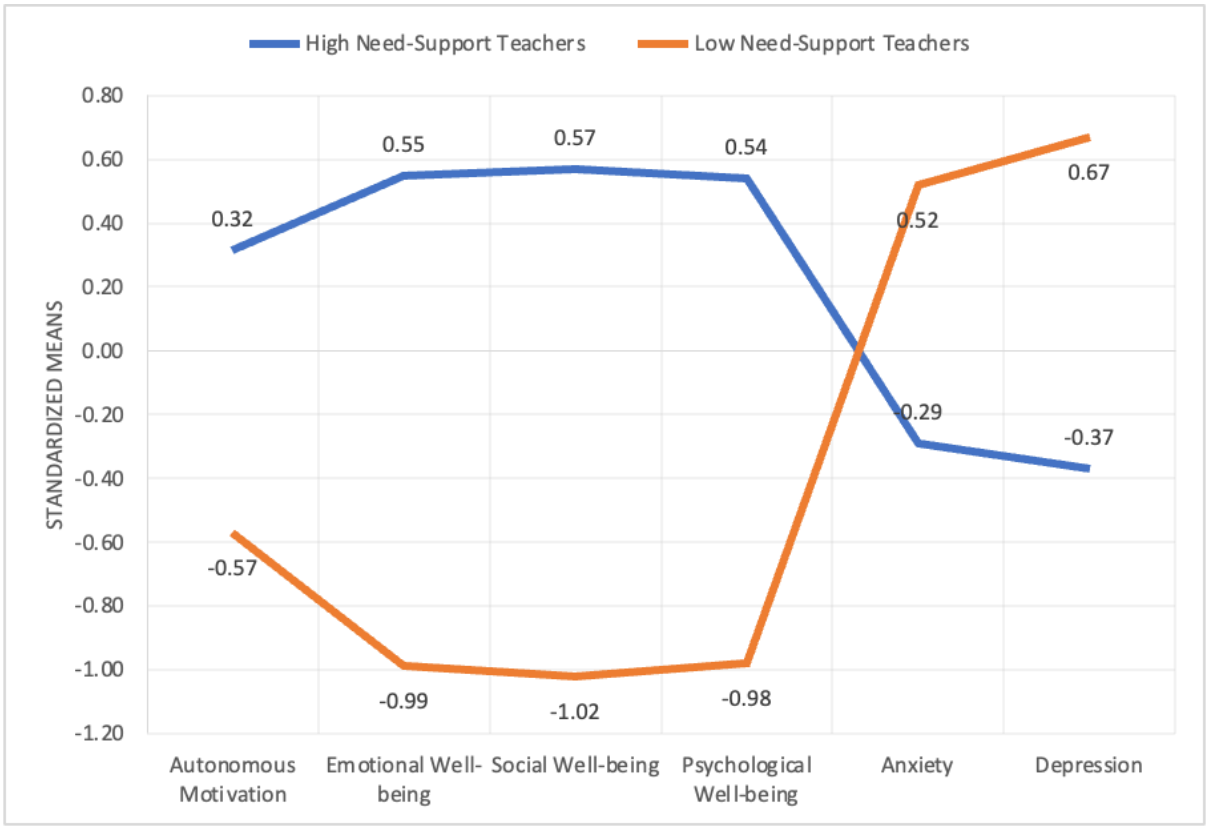


Table 5.3

Mean Comparisons of Autonomous Motivation, Well-Being and Ill-Being Between Teacher Profiles

Outcome Variables	Mean (*SD*)		Analysis of Variance	Effect Size
	High Need Support	Low Need Support	*F*	η^2
Autonomous Motivation	0.32 (0.84)	-0.57 (1.02)	120.98 ***	0.18
Emotional Well-Being	0.55 (0.56)	-0.99 (0.83)	599.66 ***	0.55
Social Well-Being	0.57 (0.65)	-1.02 (0.66)	821.98 ***	0.58
Psychological Well-Being	0.54 (0.58)	-0.98 (0.84)	563.81 ***	0.53
Anxiety	-0.29 (0.85)	0.52 (1.03)	97.05 ***	0.15
Depression	-0.37 (0.80)	0.67 (0.98)	183.54 ***	0.25

Note: Means were based on scaled scores. Homogeneity of variance not assumed, *F* is Welch Statistic. ***p<.001

Brief Discussion

Our results found two distinct teacher subgroups: high need support and low need support. Consistent with SDT theorizing, the high need-support teachers exhibited significantly higher autonomous motivation, well-being, and lower ill-being compared to low need-support teachers. These results were consistent with prior person-centered research that found the same number of profiles, with significantly different well-being outcomes, in terms of school leader support (Collie et al., 2020).

General Discussion

We investigated the potential implications of need-supportive school leadership practices in facilitating teacher well-being using variable-centered and person-centered approaches. Study 1 employed a variable-centered approach to examine the relationships among need-supportive school leadership practices, autonomous motivation, and teacher well-being. We hypothesized that autonomous motivation would partially mediate the relationship between need support and teacher well-being. The results supported the hypothesized model even after controlling for other known predictors. Our findings revealed associations among the study variables congruent with SDT's theoretical underpinnings. Study 2 employed a person-centered approach and explored subgroups within the sample that have similar profiles based on their perceived experience of need support. We found two teacher profiles congruent with prior research: those with high need-support and those with low need-support. A comparison of the two profiles revealed significant differences in quality of autonomous motivation and well-being.

Study 1 results were consistent with prior evidence that school leaders' supportive practices contributed to teachers' overall well-being and lower ill-being, partially mediated by autonomous motivation (Collie et al., 2018; Pauli et al., 2018; Slemp et al., 2020). The findings provided empirical evidence of need-supportive leadership practices as a potential

facilitator of teachers' well-being and "protective factor" in the additional pressure and demands of teaching brought about by the recent pandemic (Collie, 2021; Herman et al., 2021). It is noteworthy that need support and autonomous motivation were more strongly associated with an increase in well-being than a decrease in ill-being.

Teaching is a highly demanding profession where levels of stress and anxiety are often the norm (Harmsen et al., 2018; Herman et al., 2021). It is reasonably expected that the primary strategy is to implement interventions to lower teachers' stress and anxiety and decrease job demands. However, the importance of increased well-being as an internal protective resource for teachers when job demands are high and unavoidable is often overlooked. From the SDT perspective, this internal protective resource means satisfaction of their basic psychological needs for autonomy, competence, and relatedness. Our findings suggested that school leaders may have better gains in facilitating teacher well-being and flourishing in the ever-increasing and mostly unavoidable demands of teaching by supporting these psychological needs.

Study 2 uncovered two distinct subgroups of teachers based on their experience of need-supportive school leadership practices. Congruent with SDT theorizing, the findings suggested that "high need-support" teachers exhibited higher autonomous motivation and better well-being. In contrast, "low need-support" teachers reflected lower autonomous motivation and lower well-being. The findings from a person-centered approach made a more detailed description of the relationships of the study variables among these two groups. This could otherwise be overlooked and presented only as an average pattern in a variable-centered approach. The findings have practical implications for school leaders. First, they offer practical information that could be used for more targeted and profile-specific well-being intervention efforts (Collie et al., 2020). Second, and more importantly, they further highlight the central role of need-supportive leadership practices in fostering teachers'

motivational and well-being dynamics. Attention and support for teachers' basic psychological needs as a crucial ingredient of teacher well-being cannot be over-emphasized.

The study extends SDT literature on teacher well-being in several ways. First, we operationalized need support practices as a combination of support for autonomy, competence, and relatedness. Many of the extant SDT literature that explored teacher well-being focused only on autonomy support (e.g., Collie et al., 2018; Ebersold et al., 2019; Martela & Sheldon, 2019). Even though autonomy support has received more attention from SDT scholars, the literature has suggested the importance of taking into account other types of need-supportive practices, including those that support competence and relatedness. Our study filled the gap also expressed by prior SDT meta-analytic studies on well-being (Slemp et al., 2018). Second, we employed a person-centered approach (i.e., latent profiling), which is rarely explored in teaching and teacher studies using an SDT perspective. Insights from prior studies on teacher motivation and well-being are mainly drawn from variable-centered approaches which do not reflect differences among subgroupings in the sample population.

Limitations and Directions for Future Research

We acknowledge some limitations and directions for future research. First, our cross-sectional study prevents us from drawing causal conclusions. Our analysis may be well complemented by other methods such as longitudinal and experimental investigations to determine causal relationships. Second, we depended on self-report measures, which could be influenced by social desirability and common method bias (Podsakoff et al., 2012). Third, the Study 2 findings were based on a single-factor model of need-supportive leadership as a unit of analysis. Hence, it was not unexpected for the findings to have small number of clusters. We speculate that a three-factor model would be able to detect more groupings in the sample with more nuanced profile of autonomous motivation and well-being. However, such analysis

goes beyond the scope of our study. We encourage future researchers to investigate whether the three-factor model could potentially extend the insights drawn from the current findings.

Lastly, our sample came only from the Philippine context. Furthermore, our sample was drawn only from the private school sector of the Philippine's education system. Future research could extend the study to other school types in the Philippines and other cultural contexts to maximize generalizability. Despite these limitations, the study was able to provide evidence on the importance of need-supportive leadership on teacher well-being using both variable- and person-centered approaches.

Conclusion

The educational landscape is always changing, and it brings new challenges and demands that could take a toll on teachers and teaching. These challenges had been exacerbated by the current worldwide challenge on education posed by the COVID-19 pandemic. Schools had to adapt and had employed different learning platforms, such as online instruction, to ensure teaching and learning will continue to happen. This added even more pressure to an already stressful profession (Pressley, 2021). More than ever, promoting teacher well-being is crucial. School leaders might be able to cultivate their teachers' well-being by giving them voice (autonomy), providing clear support (structure), and showing care (relatedness).

Chapter 6: Discussion and Conclusion

This doctoral thesis examined the role of need-supportive social contexts and autonomous motivation in fostering optimal teaching and learning. It examined the relationships between need-supportive teaching, student autonomous motivation, and student achievement across different cultural and socioeconomic settings. Moreover, it investigated the relationships between need-supportive leadership, teacher autonomous motivation, and need-supportive practices. It further explored the potential associations of these relationships with student motivation and learning engagement. Lastly, it examined teacher well-being as a specific outcome of need-supportive leadership and autonomous motivation. The thesis was conducted as a folio work consisting of four independent but inter-related studies and presented here as individual chapters.

To reiterate briefly, Study 1, presented in Chapter 2, investigated whether need-supportive teaching predicted students' academic achievement via intrinsic motivation and would generalize across eight cultural groups. The study found that need-supportive teaching had a mediated effect on achievement via intrinsic motivation across eight cultural groups based on Schwartz's (2009) cultural value orientation grouping. The study suggested broad support for SDT's universality claim (Haw & King, 2022b). Study 2, presented in Chapter 3, investigated the generalizability of need-supportive teaching's association with academic achievement across socioeconomic classes in the Philippine setting. The study found that neither socioeconomic status, school type, nor school location significantly interacted with the hypothesized association (Haw et al., 2021).

Chapter 4 presented Study 3's two-part investigation of SDT's motivation mediation model in two contexts: teachers and students. The first part examined whether need-supportive leadership predicted need-supportive teaching. The study found evidence that supported the hypothesized mediation model. Need-supportive leadership significantly and

positively predicted need-supportive teaching via autonomous motivation. The second part of the study reiterated the test of SDT's motivation mediation on student engagement and found results consistent with prior research. Need-supportive teaching predicted student engagement via autonomous motivation. A critical feature of the study was that the teacher and student samples were broadly linked by their nesting in school (Haw & King, 2022a). This feature allowed for an argument regarding the potential associations of need-supportive practices from the school leaders to the teachers, and from teachers to the students (Haw & King, 2022a; Ryan & Deci, 2020).

Finally, Chapter 5 presented Study 4's two-pronged investigation of the associations among need-supportive leadership, autonomous motivation, and well-being (Haw et al., 2022). The study tested a mediation model of need-supportive teaching predicting teacher well-being via autonomous motivation. The findings were consistent with previous research linking higher need-support with higher well-being and lower ill-being among teachers. The study's latent profile analysis (LPA) further revealed two subgroups with significantly different well-being profiles based on their school leaders' need-supportive practices. The findings indicated that teachers with high need-support had significantly higher well-being and lower ill-being than those with low need-support.

Theoretical and Practical Implications

As presented in Chapter 1, each study aimed to provide empirical evidence that addressed a key research question arising from the gaps identified in SDT literature (see Table 1.2 in Chapter 1). Hence, the four independent but inter-related studies provided several empirical insights that have critical implications for SDT theorizing and its practical application, especially in developing countries such as the Philippines.

Theoretical Implications

In Chapters 2 and 3, the researchers argued that SDT's universality had been rarely investigated beyond East and West operationalization. They further argued that the extant literature had presented relatively little empirical evidence of the full breadth of need-supportive teaching and its potential "universal" applicability (Haw et al., 2021; Haw & King, 2022b). The current research addressed these gaps using a more nuanced operationalization of culture (Cohen & Varnum, 2016; King et al., 2018).

Chapter 2 was perhaps the first study to re-examine SDT's universality claim study using Schwartz's (2006, 2009) cultural groupings. Schwartz organized the world's cultures into eight major groups: Western Europe, Eastern Central Europe, Eastern Europe, Latin America, English speaking, Confucian, Southeast Asia, and Africa and the Middle East. The study provided a critical test of SDT's universality claim by using these more nuanced cultural groupings. The empirical findings suggested that regardless of cultural orientation, need-supportive teaching seemed to facilitate intrinsic motivation, leading to higher academic achievement levels (Haw & King, 2022b).

Cultural variations are within SDT's *moderate universality* claim (Reeve et al., 2018; Ryan & Deci, 2020) but seem to be rarely discussed in the empirical literature. Such lacuna could be partly attributed to the broad operationalization of cultural groupings used in prior research. For example, binary categories (e.g., East and West, Individualist and Collectivist) are broad constructs that have been previously used to sift cultural generalizability. However, these broad brushstrokes fail to detect cultural nuances. For example, South East Asian countries seem to have higher autonomy than Confucian countries—both of which are considered collectivist societies. Chapter 2's findings suggest that using more fine-grained cultural groupings could detect cultural nuances not typically found by broader categories, leading to the call for further critical investigation of SDT's universality claim.

Chapter 3 then tested the relationship of need-supportive teaching with academic achievement across socioeconomic strata. Prior research has suggested that SES influences student achievement since it directly correlates associations with schooling inputs (e.g., material resources) and personal motivational processes (e.g., Bernardo et al., 2015; Trinidad, 2020). A critical feature of the study was its counterintuitive findings relative to this wide array of empirical evidence, which highlighted the generalizability of the students' basic psychological needs and their perception of how teachers support these. The findings suggested that students seem to know and benefit from need-supportive teaching regardless of family and school socioeconomic status (Haw et al., 2021).

In Chapters 4 and 5, the studies echoed prior research's argument regarding the dearth of empirical evidence on teachers' quality of motivation and the supportive social contexts that facilitates it (Haw et al., 2022; Haw & King, 2022a). Such a gap has critical theoretical implications since what school leaders do affects what teachers do for students (Haw & King, 2022a; Ryan & Deci, 2020). The two studies addressed this gap by focusing on the potential associations of need-supportive leadership with need-supportive teaching.

Chapter 4 followed up on the motivational sequence from teacher to student established by prior research: teacher's basic psychological need satisfaction → teacher's autonomous motivation→need-supportive teaching→student's autonomous motivation→student's engagement and other outcomes (e.g., Ahn et al., 2021; Marshik et al., 2017; Roth et al., 2007). A crucial gap that the study tried to address was examining the role of school leaders in this motivational sequence. The study suggests that the sequence could be extended by looking at need-supportive leadership as an antecedent of the teachers' motivation and may also have associations with the students' motivation via need-supportive teaching. Ethical concerns by participating schools prevented the linking of teachers' with students' data (see Chapter 4 for this limitation). Nevertheless, the results broadly suggested

that the way teachers were "supported and motivated 'from above' were significantly associated with their capacities to support and optimally motivate the students…below them" (Ryan & Deci, 2020, p. 7).

Chapter 5 reinforced the support for the significant implications of need-supportive leadership on teachers' motivation and various positive outcomes (Haw et al., 2022). A noteworthy feature of the study that suggested a new theoretical contribution to SDT literature was the use of a person-centered approach. The findings from such an approach nuanced the understanding of need-supportive teaching and its association with motivation and well-being outcomes as different groups experience them. It showed that teachers who experience better need support from school leaders had significantly higher autonomous motivation, higher well-being, and lower ill-being. The findings offered in the study add to the emerging empirical evidence from "more nuanced methods of assessing motivations and perceived need supports" that reflect the complex situations of teachers in a school setting (p. 8).

The four studies have operationalized need-supportive social contexts as need-supportive teaching and need-supportive leadership—both underpinned by combined autonomy-support, competence-support, and relatedness-support (Ahn et al., 2019; Rothmann & Fouché, 2018). Prior studies have operationalized need-supportive social contexts primarily through autonomy support (e.g., Patall et al., 2018; Reeve, 2016; Zhang et al., 2020; c.f. Adams & Khojasteh, 2018). This is quite understandable since autonomy and control play a central function in basic psychological needs satisfaction (Ryan & Deci, 2000).

However, some scholars have argued that such a single perspective covers only a limited spectrum of practices employed by teachers to motivate students toward learning engagement (Adams & Khojasteh, 2018). The findings presented in Chapter 2 elucidate the downside of focusing only on autonomy support. The results from 79 regions and eight

cultures revealed that need support was variably experienced. The variability became clearer when need-supportive practices were disaggregated into three separate components. The study found (see Appendix A) that for some cultures, autonomy-support alone may not significantly contribute to intrinsic motivation and achievement whereas for some cultures, relatedness-support might have the most significant contribution in facilitating motivation and achievement. The findings also held for school leaders. School leaders have to support teachers from various socio-cultural and socio-economic backgrounds, who present different avenues and degrees of basic psychological need satisfaction. Hence, focusing on autonomy-support alone does not provide the range of practices teachers and school leaders could tap into when fostering need-supportive social context.

The studies were supported by prior empirical evidence suggesting a larger magnitude of the combined effects of the three dimensions compared to their individual effects (Stroet et al., 2013). Moreover, recent research suggested that need-supportive practices' contribution is optimal when autonomy-, competence-, and relatedness-support are equally present in teaching (Olivier et al., 2021). The thesis was aligned with precedent research that supported the potential larger and wider contribution of these dimensions. Nevertheless, exploring more empirical evidence that will support it is undoubtedly a desirable direction in the future.

Finally, this doctoral thesis, in general, revealed SDT's integrative framework of facilitating an optimal teaching and learning process. It extended the emerging literature that connects the teacher and student motivational dynamic, providing evidence that supports SDT's generalizability across both teachers and students (see Reeve et al., 2018; Ryan & Deci, 2020). This thesis is perhaps one of the few studies in SDT literature that explored an integrative framework of SDTs motivational sequence, beginning with school leaders to the students. Need-supportive social contexts (i.e., school leaders and teachers) were shown to predict autonomous motivation, which in turn predicted positive consequences among

teachers and students. Future research may further extend this sequence by exploring the potential significance of the school leaders' motivational dynamic and the factors that facilitate it—a direction that has been articulated in prior studies (Ryan & Deci, 2020).

Practical Implications

The empirical findings of the four studies also had several practical implications for policymakers, school leaders, and teachers. First, the empirical evidence of SDT's universality across cultures and socioeconomic strata suggested the viability of need-supportive teaching in various contexts. Hence, SDT could be used broadly in various cultures and sectors from different socioeconomic strata to guide classroom strategies in enhancing students' learning experiences which, in the long run, could lead to improved learning outcomes (Haw et al., 2021; Haw & King, 2022b). However, there is still a need to explore nuances for application in specific groups to optimize learning outcomes and benefits (Haw & King, 2022b).

Second, literacy is often associated with socioeconomic status, as evidenced in the PISA 2018 results (OECD, 2019a; Perry & McConney, 2010). For example, the Philippine's dismal performance in PISA is associated with a lack of material resources in schools (Trinidad, 2020). Given limited resources, addressing the problem of material resources may be a challenge for developing countries such as the Philippines. Nevertheless, providing material resources may not necessarily translate to better learning outcomes. What teachers do and how they do them affect individual students' experiences and learning outcomes (Ganimian & Murnane, 2016; Glewwe & Muralidharan, 2016; Hattie, 2008; Schweisfurth, 2015). The findings suggested need-supportive teaching as a possible way of increasing the Filipino learners' intrinsic or autonomous motivation (e.g., enjoyment of reading), engagement, and the chance of better learning. Hence, education policymakers and school leaders may find more gains in considering investments in increasing the capacities of

teachers for supporting autonomy, creating structure, and showing involvement (Haw et al., 2021).

Lastly, the findings suggested that need-supportive teaching in schools may become more evident when the teachers themselves experience need support from their school leaders (Haw & King, 2022a). Teachers are empowered to be need-supportive to their students if they experience school leadership in a need-supportive way (Adams, 2021; Haw & King, 2022a; Kõiv et al., 2019; Lu et al., 2015). Furthermore, the results also showed that need-supportive school leadership influences teachers' well-being. Notably, teachers who experience low need support from their school leaders tend to have lower well-being and higher ill-being. Moreover, teachers with a high need support show significantly higher well-being (Haw et al., 2022). Such quality of well-being could determine various teacher outcomes such as organizational commitment (Ford et al., 2019), self-efficacy (Lambersky, 2016), adaptability (Collie & Martin, 2017a), and other adaptive behaviors (Collie & Martin, 2017b) which could affect their interaction with students (Collie & Martin, 2017a). Hence, school leaders may need to critically examine their leadership style or practices and what kind of school climate they foster.

However, need-supportive leadership is not a silver bullet that ensures need-supportive teaching. Teachers may not necessarily be aware of need-supportive teaching strategies. Moreover, external pressures (e.g., parents' demands) and some personal traits or beliefs may inhibit teachers' support of their students (see, for example, Reeve, Jang, et al., 2018). Hence, need-supportive leadership does not preclude building structures that could increase teacher awareness and capacity for need-supportive teaching. For example, school leaders could introduce need-supportive teaching practices and their benefits in teacher professional development programs. Several empirical studies have shown that teachers could learn and be willing to be need-supportive (e.g., Cheon, Reeve, Lee, et al., 2018),

especially when they believe in its benefits for students (Katz & Shahar, 2015). As need-supportive teaching has its emotional demands on teachers (Burić & Frenzel, 2021), school leaders might also find it worth exploring professional development programs that help teachers build their emotional capacities.

Lastly, the preceding discussion underlines the crucial importance of need-supportive school leadership practices in schools not only for teachers but also for students. Several studies have highlighted school leaders' contribution to teachers and students (Adams, 2021; Adams & Khojasteh, 2018; Blömeke & Klein, 2013; Leithwood et al., 2020; Robinson et al., 2008). Specifically, they suggested that the significant indirect contribution of school leadership to learning is “teacher motivation, ability, and working condition” (Leithwood et al., 2020, p. 10). Furthermore, scholars also found evidence that the school leaders’ interpersonal relationships with students could significantly contribute to student outcomes (for a meta-analysis, see Liebowitz & Porter, 2019). Therefore, need-supportive school leadership practices should not be limited to dealing with teachers and staff. They might find it rewarding when they extend their supportive practices among students and other key school stakeholders.

Limitations and Directions for Future Research

The four studies presented in this research share common methodological limitations that must be acknowledged. These limitations should be considered in interpreting the results and findings of this research. First, this research is based on a cross-sectional design which prevents causal conclusions. Aware of this limitation, the studies avoided using causal claims to refer to the relationships among the study variables whenever possible. Future researchers are encouraged to utilize quasi-experimental and longitudinal designs to establish the causal relations of the key variables investigated in the studies included in this research.

Second, the four studies mainly relied on typical quantitative methods (i.e., SEM and HLM), which only investigated the relationships of variables as provided by the quantitative data. Hence, most of these studies are not able to capture and present some potential nuances of these relationships as they occur in real-life situations. For example, Study 3 showed that need-supportive teaching was associated with autonomous motivation and engagement but was unable to present "why" need-supportive teaching mattered to the lived experience of students. This doctoral thesis attempted to go further in Study 4 (presented in Chapter 5) by considering the variable relationships within subgroups of teachers via Latent Profile Analysis, which provided richer insight into the potential contribution of need-supportive leadership. Future researchers who wish to build on the empirical findings in this thesis are encouraged to explore other methods (e.g., qualitative, mixed-methods, person-centered approaches) for a better appreciation of SDT's contribution to addressing the real-life issues and complexities of teaching and learning.

Third, all studies relied on self-reported measures. Self-reports are not exactly a limitation in SDT studies, as SDT puts a premium on experience and perception as a more precise indicator of what matters to students and teachers (Adams & Khojasteh, 2018; Bardach & Klassen, 2021; Ryan & Deci, 2020; Stroet et al., 2013). However, self-reports could also be susceptible to various measurement biases (e.g., social desirability and common source biases), which may have influenced the results of the study. Some precautions were made to mitigate these biases (e.g., reporting the measurement reliability and variations in point scales used), but these could not insulate the research from other potential biases (see, for example, how PISA controlled for bias in OECD, 2019b). Future researchers are encouraged to expand this study by supplementing it with observational and behavior-based data.

Lastly, the research design was entirely based on need-supportive practices without discounting the possibility of need-thwarting practices that may interact with the experiences of teachers and students simultaneously (see Aelterman et al., 2019). In the same way, the study only involved intrinsic and autonomous motivation as potential mediators. Other types of extrinsic motivation (e.g., external and introjected regulation) may be at play and were not captured by the study. Hence, future researchers could enrich the studies presented here by examining other models with different configurations of practices and types of motivations.

Aside from improving the methodological limitations of the works presented in this doctoral thesis, the research also opened several avenues for future investigation that could potentially have theoretical and practical contributions. First, Chapter 2 and Chapter 3 findings suggested that there was still much to explore about SDT's universality claim. As there seemed to be no other cross-cultural study on SDT conducted with an expansive cultural grouping, SDT may be best served by more studies that continue to take a critical look at SDT's universality from a culturally imaginative perspective (Cohen & Varnum, 2016; King et al., 2018; Schwartz, 2006, 2014). Future researchers could build on the current thesis by including as many countries (or regions) and models of cultural groups as possible in future research (for another complex cultural grouping, see Inglehart & Welzel, 2010) and testing need-supportive teaching across socio-economic strata in other developing economies. These studies could potentially extend the knowledge base on SDT's universality claim.

Subsequently, these studies could further support SDT's practical contribution to teaching and learning in specific cultural and socio-economic contexts. Considering these cross-cultural investigations' comprehensive and large-scale nature, using data from large-scale international assessments still seems the most viable and practical option for future researchers despite their inherent limitations. As more countries and regions have been

participating in PISA every cycle, future researchers may still find the PISA dataset a valuable resource for testing SDT's cross-cultural generalizability.

Second, Chapter 4 suggested a potential motivational sequence from need-supportive leadership to student motivation and engagement. As previously mentioned, this downstream sequence has empirical precedent from prior studies and meta-analyses of leadership literature (Adams, 2021; Adams & Khojasteh, 2018; Blömeke & Klein, 2013; Leithwood & Jantzi, 2006; Robinson et al., 2008). Future research may support the theoretical assertion by studies that tightly link teachers' and students' data. Such tight links would also allow future empirical investigations on the configurations of need-supportive practices in a full multi-level structure. Following the argument regarding the motivational sequence as underpinned by autonomous motivation, it may also be worthwhile to investigate what facilitates school leaders' need-supportive practices. Such a line of inquiry is consistent with Ryan and Deci's (2020) view that the leadership motivational dynamics should also be examined.

Lastly, Chapter 5 underscored the importance of teacher well-being and argued that it related to teachers' performance and the quality of teaching and learning. This argument opens an interesting question of whether teacher well-being has significant associations with their need-supportive practices and whether there are other roles teacher well-being may play in the models of motivation explored in this research. In this light, it might also be worth exploring the link between teacher well-being and their practices with student well-being. Student well-being, after all, is considered one of the current goals and expected outcomes of education (UNESCO, 2015, 2016).

Conclusion

The doctoral thesis examined the critical role of need-supportive social contexts and their downstream consequences on students and teachers using SDT as the central theoretical perspective. Using data from the 2018 PISA, Studies 1 and 2 focused on the role of need-

supportive teaching on students' motivation and achievement. These two studies found empirical evidence for SDT's generalizability across cultures and socioeconomic strata. Across the globe and in different social classes, need-supportive teaching was found to be crucial. Students who perceived their teachers to be need-supportive were more likely to be autonomously motivated to be engaged in their learning and have higher levels of achievement.

Need-supportive teaching does not exist in a vacuum (Niemiec & Ryan, 2009). Teachers thrive when their needs for autonomy, competence, and relatedness are satisfied. Studies 3 and 4 focused on teachers. Results of the study suggested that school leaders have a role in supporting their teachers' needs. Need-supportive school leadership is one essential factor that could spur teachers' autonomous motivation, facilitating better teacher well-being and the propensity to engage in need-supportive teaching. Teachers who perceived their school leaders to be need-supportive were autonomously motivated to be need supportive of their students. Furthermore, teachers who perceived higher need support were more autonomously motivated leading to higher well-being.

Taken altogether, these studies generally revealed the importance of need-supportive social contexts, both for teachers and students. This thesis provided school leaders and teachers alike a practical guide for continuously adapting teaching and learning in the volatile, uncertain, complex, and ambiguous educational context. What school leaders and teachers do matters. From an SDT perspective, it is even more important that school leaders and teachers do what they do in a need-supportive way.

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Appendix A: Supplementary Materials to Chapter 2

Table A1

Internal Reliability Coefficients (Cronbach's Alpha) of Measures Used Per Country

Country	Need-supportive Teaching	Reading Intrinsic Motivation
A. Western Europe		
Austria	0.84	0.87
Belgium	0.83	0.86
Denmark	0.85	0.84
Finland	0.90	0.87
France	0.86	0.84
Germany	0.83	0.87
Greece	0.80	0.77
Iceland	0.89	0.85
Italy	0.85	0.86
Luxembourg	0.85	0.84
Malta	0.89	0.85
Netherlands	0.85	0.86
Norway	0.89	0.85
Portugal	0.88	0.86
Spain	0.87	0.86
Sweden	0.89	0.85
Switzerland	0.84	0.87
B. East-Central Europe		
Albania	0.81	0.71
Croatia	0.82	0.84
Czech Republic	0.84	0.86
Estonia	0.88	0.82
Hungary	0.85	0.87
Kosovo	0.76	0.65
Latvia	0.86	0.80
Lithuania	0.88	0.78
Poland	0.83	0.85
Romania	0.82	0.83
Slovak Republic	0.84	0.84
Slovenia	0.88	0.83
C. Eastern Europe		
Baku (Azerbaijan)	0.91	0.63
Belarus	0.86	0.80
Bosnia and Herzegovina	0.84	0.79
Bulgaria	0.87	0.75
Georgia	0.87	0.70
Kazakhstan	0.89	0.68
Moldova	0.78	0.80
Montenegro	0.85	0.78
Moscow Region (RUS)	0.84	0.79
Russian Federation	0.85	0.78
Serbia	0.85	0.80
Tatarstan (RUS)	0.86	0.76
Ukraine	0.82	0.73
D. Latin America		
Argentina	0.83	0.81
Brazil	0.83	0.78

Country	Need-supportive Teaching	Reading Intrinsic Motivation
Chile	0.91	0.82
Colombia	0.87	0.78
Costa Rica	0.88	0.82
Dominican Republic	0.90	0.66
Mexico	0.89	0.78
Panama	0.85	0.74
Peru	0.85	0.75
Uruguay	0.87	0.82
E. English Speaking Countries		
Australia	0.90	0.87
Ireland	0.87	0.88
New Zealand	0.89	0.88
United Kingdom	0.89	0.87
United States	0.88	0.86
F. Confucian Countries		
B-S-J-Z (China)	0.89	0.81
Chinese Taipei	0.85	0.83
Hong Kong	0.90	0.81
Japan	0.86	0.83
Korea	0.93	0.82
Macao	0.83	0.83
G. Southeast Asia		
Brunei Darussalam	0.71	0.78
Indonesia	0.82	0.67
Malaysia	0.75	0.72
Philippines	0.84	0.61
Singapore	0.89	0.87
Thailand	0.86	0.70
Vietnam	0.73	0.72
H. African and Middle-Eastern		
Israel	0.88	0.81
Jordan	0.85	0.56
Morocco	0.75	0.57
Qatar	0.87	0.73
Saudi Arabia	0.80	0.64
Turkey	0.87	0.79
United Arab Emirates	0.88	0.72

Table A2

Descriptive Statistics and Bivariate Correlations of Need-Supportive Teaching, Intrinsic Motivation, and Reading Achievement Across 76 Countries and Regions.

		Means and Standard Deviation						Correlation with Reading Intrinsic Motivation				Correlation with Reading Achievement				
Country	**n**	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation	Reading Achievement	Structure	Autonomy	Involvement	NST	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation
A. West Europe																
Austria	6802	2.60 (1.00)	2.64 (0.98)	2.80 (0.99)	2.68 (0.86)	2.33 (0.92)	484.39 (99.38)	0.07	0.08	0.06	0.08	0.10	0.11	0.12	0.12	0.35
Belgium	8475	2.84 (0.82)	2.75 (0.82)	2.74 (0.85)	2.78 (0.72)	2.19 (0.85)	492.86 (102.58)	0.04	0.03	0.04	0.04	0.07	0.04	0.05	0.06	0.26
Denmark	7657	2.97 (0.78)	2.80 (0.80)	2.93 (0.81)	2.90 (0.70)	2.25 (0.78)	501.13 (92.10)	0.12	0.10	0.10	0.12	0.20	0.12	0.17	0.19	0.28
Finland	5649	2.80 (0.81)	2.72 (0.81)	2.81 (0.83)	2.78 (0.74)	2.33 (0.83)	520.08 (99.55)	0.17	0.15	0.14	0.17	0.17	0.11	0.13	0.15	0.42
France	6308	2.61 (0.92)	2.56 (0.92)	2.57 (0.94)	2.58 (0.82)	2.44 (0.87)	492.61 (101.18)	0.15	0.12	0.13	0.15	0.07	0.06	0.05	0.07	0.34
Germany	5451	2.66 (0.94)	2.66 (0.93)	2.82 (0.92)	2.71 (0.80)	2.37 (0.90)	498.28 (105.75)	0.09	0.09	0.10	0.11	0.04	0.07	0.12	0.09	0.27
Greece	6403	2.86 (0.80)	2.79 (0.83)	2.76 (0.87)	2.80 (0.70)	2.57 (0.67)	457.41 (97.42)	0.17	0.16	0.15	0.19	0.11	0.11	0.08	0.12	0.29
Iceland	3296	2.74 (0.96)	2.79 (0.9)	2.82 (0.93)	2.79 (0.84)	2.33 (0.79)	473.97 (104.73)	0.08	0.09	0.11	0.10	0.12	0.13	0.16	0.15	0.31
Italy	11785	2.84 (0.80)	2.69 (0.84)	2.74 (0.88)	2.76 (0.74)	2.60 (0.83)	476.28 (96.87)	0.10	0.06	0.07	0.09	0.10	**0.01**	0.06	0.07	0.23
Luxembourg	5230	2.71 (0.92)	2.67 (0.92)	2.77 (0.93)	2.72 (0.81)	2.33 (0.87)	469.99 (108.41)	0.13	0.12	0.08	0.12	0.11	0.11	0.12	0.13	0.32
Malta	3363	3.04 (0.88)	2.9 (0.84)	2.95 (0.86)	2.96 (0.78)	2.55 (0.81)	448.23 (112.83)	0.10	0.05	0.07	0.08	0.24	0.15	0.19	0.21	0.29
Netherlands	4765	2.82 (0.78)	2.69 (0.79)	2.82 (0.79)	2.78 (0.69)	2.10 (0.81)	484.78 (104.81)	0.10	0.10	0.10	0.12	0.15	0.11	0.15	0.15	0.31

		Means and Standard Deviation						Correlation with Reading Intrinsic Motivation				Correlation with Reading Achievement				
Country	**n**	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation	Reading Achievement	Structure	Autonomy	Involvement	NST	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation
Norway	5813	2.82 (0.88)	2.73 (0.86)	2.77 (0.87)	2.78 (0.79)	2.18 (0.82)	499.45 (105.67)	0.12	0.11	0.10	0.12	0.18	0.14	0.17	0.18	0.27
Portugal	5932	2.93 (0.81)	2.88 (0.79)	2.92 (0.8)	2.91 (0.72)	2.63 (0.77)	491.80 (96.09)	0.11	0.13	0.11	0.13	**0.02**	0.05	0.05	0.04	0.30
Spain	35943	2.83 (0.89)	2.70 (0.90)	2.71 (0.91)	2.75 (0.80)	2.56 (0.86)	476.54 (92.75)	0.10	0.09	0.08	0.10	0.14	0.11	0.11	0.13	0.30
Sweden	5504	2.80 (0.89)	2.84 (0.85)	2.89 (0.87)	2.84 (0.79)	2.29 (0.81)	505.79 (107.54)	0.13	0.10	0.11	0.13	0.15	0.14	0.17	0.17	0.25
Switzerland	5822	2.71 (0.91)	2.73 (0.92)	2.84 (0.92)	2.76 (0.79)	2.3 0 (0.89)	483.93 (102.71)	0.09	0.10	0.08	0.10	0.06	0.08	0.10	0.09	0.37
B. East Central Europe																
Albania	6359	3.31 (0.78)	3.12 (0.83)	3.20 (0.83)	3.21 (0.69)	2.97 (0.63)	405.43 (80.28)	0.18	0.13	0.15	0.18	0.11	0.08	0.10	0.11	0.23
Croatia	6609	2.63 (0.86)	2.52 (0.89)	2.70 (0.88)	2.62 (0.75)	2.28 (0.77)	478.99 (89.20)	0.08	0.11	0.09	0.11	0.05	0.05	0.06	0.06	0.26
Czech Republic	7019	2.51 (0.84)	2.47 (0.84)	2.57 (0.86)	2.52 (0.74)	2.43 (0.87)	490.22 (97.33)	0.08	0.07	0.08	0.09	0.06	0.06	0.09	0.08	0.35
Estonia	5316	2.65 (0.85)	2.63 (0.86)	2.75 (0.84)	2.68 0.76)	2.52 (0.77)	523.02 (93.21)	0.11	0.08	0.07	0.10	0.13	0.12	0.14	0.15	0.32
Hungary	5132	2.85 (0.82)	2.65 (0.87)	2.76 (0.87)	2.75 (0.75)	2.55 (0.83)	475.99 (97.58)	0.06	0.06	0.06	0.07	**0.02**	**0.01**	**0.03**	**0.02**	0.39
Kosovo	5058	3.06 (0.88)	2.79 (0.86)	2.91 (0.86)	2.92 (0.71)	2.92 (0.59)	353.07 (68.28)	0.16	0.09	0.11	0.15	0.08	**0.00**	**0.01**	**0.03**	0.26
Latvia	5303	2.66 (0.84)	2.67 (0.85)	2.71 (0.87)	2.68 (0.75)	2.53 (0.75)	478.70 (90.03)	0.08	0.05	0.07	0.08	0.10	0.10	0.14	0.13	0.34
Lithuania	6885	2.85 (0.94)	2.75 (0.97)	2.87 (0.95)	2.82 (0.86)	2.39 (0.80)	475.87 (94.30)	0.06	0.05	0.07	0.07	0.09	0.06	0.10	0.09	0.22
Poland	5625	2.75 (0.84)	2.58 (0.85)	2.74 (0.83)	2.69 (0.73)	2.64 (0.79)	511.86 (97.34)	0.10	0.08	0.07	0.10	0.12	0.07	0.10	0.11	0.39
Romania	5075	2.98 (0.84)	2.8 (0.81)	2.96 (0.82)	2.91 (0.70)	2.55 (0.73)	427.7 (98.38)	0.11	0.10	0.10	0.12	0.06	0.06	**0.04**	0.06	0.27

		Means and Standard Deviation						Correlation with Reading Intrinsic Motivation				Correlation with Reading Achievement				
Country	**n**	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation	Reading Achievement	Structure	Autonomy	Involvement	NST	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation
Slovak Republic	5965	2.62 (0.87)	2.55 (0.86)	2.63 (0.86)	2.60 (0.75)	2.57 (0.81)	457.98 (100.33)	0.08	0.09	0.09	0.10	0.05	0.06	0.07	0.07	0.32
Slovenia	6401	2.64 (0.84)	2.59 (0.86)	2.69 (0.84)	2.64 (0.76)	2.31 (0.81)	495.35 (93.61)	0.10	0.08	0.10	0.11	0.09	0.07	0.09	0.09	0.33
C. East Europe																
Baku (Azerbaijan)	6827	2.82 (1.05)	2.79 (1.00)	2.83 (1.02)	2.81 (0.94)	2.72 (0.64)	389.39 (74.05)	0.08	0.07	0.08	0.08	0.11	0.08	0.10	0.11	0.24
Bosnia and Herzegovina	6480	2.79 (0.89)	2.65 (0.88)	2.73 (0.91)	2.73 (0.78)	2.47 (0.76)	402.98 (79.33)	0.13	0.11	0.12	0.14	0.14	0.10	0.09	0.13	0.25
Bulgaria	5294	2.73 (0.99)	2.83 (0.93)	2.77 (0.96)	2.78 (0.85)	2.65 (0.72)	419.84 (101.42)	0.05	0.08	0.07	0.08	0.11	0.14	0.08	0.12	0.28
Belarus	5803	2.87 (0.78)	2.79 (0.78)	2.87 (0.80)	2.84 (0.69)	2.71 (0.63)	473.79 (89.41)	0.15	0.12	0.15	0.16	0.09	0.07	0.10	0.10	0.34
Georgia	5572	2.79 (0.92)	2.86 (0.9)	2.85 (0.94)	2.83 (0.82)	2.82 (0.65)	379.75 (84.31)	0.10	0.12	0.10	0.12	0.07	0.11	0.09	0.11	0.33
Kazakhstan	19507	2.95 (0.90)	2.87 (0.89)	2.96 (0.90)	2.93 (0.81)	2.97 (0.55)	386.91 (77.33)	0.20	0.19	0.20	0.22	0.03	**0.02**	**0.02**	0.03	0.13
Moldova	5367	2.86 (0.80)	2.93 (0.75)	3.02 (0.75)	2.94 (0.64)	2.69 (0.66)	423.99 (93.32)	0.13	0.12	0.12	0.15	0.10	0.10	0.06	0.10	0.30
Montenegro	6666	2.69 (0.91)	2.78 (0.89)	2.80 (0.92)	2.76 (0.80)	2.62 (0.75)	421.06 (86.02)	0.14	0.14	0.12	0.15	0.10	0.17	0.10	0.14	0.26
Russian Federation	7608	2.70 (0.87)	2.50 (0.88)	2.79 (0.91)	2.66 (0.78)	2.77 (0.67)	478.5 (92.90)	0.13	0.10	0.13	0.14	0.11	0.04	0.10	0.10	0.29
Serbia	6609	2.76 (0.89)	2.56 (0.91)	2.76 (0.90)	2.69 (0.79)	2.49 (0.77)	439.47 (96.42)	0.12	0.12	0.11	0.13	0.14	0.06	0.11	0.12	0.23
Ukraine	5998	2.79 (0.81)	2.75 (0.8)	2.88 (0.80)	2.81 (0.69)	2.79 (0.62)	465.95 (93.34)	0.12	0.12	0.12	0.14	0.10	0.04	0.08	0.09	0.30
Moscow Region (RUS)	2016	2.63 (0.90)	2.41 (0.90)	2.71 (0.94)	2.58 (0.79)	2.77 (0.67)	485.89 (91.63)	0.15	0.11	0.10	0.14	0.14	0.08	0.11	0.12	0.28

		Means and Standard Deviation						Correlation with Reading Intrinsic Motivation				Correlation with Reading Achievement				
Country	**n**	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation	Reading Achievement	Structure	Autonomy	Involvement	NST	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation
Tatarstan (RUS)	5816	2.73 (0.88)	2.56 (0.89)	2.79 (0.90)	2.69 (0.79)	2.79 (0.64)	462.53 (90.94)	0.13	0.09	0.13	0.13	0.16	0.08	0.14	0.14	0.28
C. Latin America																
Argentina	11975	2.87 (0.85)	2.77 (0.85)	2.86 (0.87)	2.83 (0.74)	2.47 (0.73)	401.5 (97.79)	0.08	0.09	0.05	0.08	0.10	0.06	0.05	0.08	0.22
Brazil	10691	2.78 (0.85)	2.71 (0.83)	2.75 (0.86)	2.74 (0.73)	2.83 (0.67)	412.87 (99.64)	0.13	0.09	0.11	0.13	0.10	0.06	0.06	0.09	0.23
Chile	7621	2.89 (0.94)	2.84 (0.94)	2.83 (0.96)	2.85 (0.87)	2.47 (0.77)	452.27 (92.02)	0.05	0.05	0.04	0.05	0.13	0.14	0.13	0.14	0.26
Colombia	7522	2.97 (0.86)	2.88 (0.85)	2.88 (0.86)	2.91 (0.76)	2.75 (0.65)	412.3 (88.67)	0.08	0.09	0.07	0.09	0.08	0.07	0.05	0.08	0.27
Costa Rica	7221	2.99 (0.91)	2.86 (0.89)	2.90 (0.90)	2.92 (0.81)	2.52 (0.77)	426.5 (81.34)	0.06	0.06	0.05	0.06	0.10	0.07	0.08	0.09	0.21
Dominican Republic	5674	2.83 (1.05)	2.78 (1.00)	2.83 (1.03)	2.81 (0.93)	2.73 (0.66)	341.63 (81.85)	0.08	0.09	0.07	0.09	0.15	0.11	0.09	0.13	0.17
Mexico	7299	2.91 (0.91)	2.84 (0.89)	2.81 (0.89)	2.85 (0.81)	2.72 (0.67)	420.47 (83.51)	0.06	0.05	0.05	0.06	0.10	0.05	0.06	0.08	0.22
Panama	6270	2.89 (0.96)	2.83 (0.93)	2.88 (0.93)	2.87 (0.83)	2.66 (0.69)	376.97 (87.79)	0.07	0.05	0.05	0.06	0.12	0.07	0.06	0.09	0.16
Peru	6086	2.99 (0.79)	2.96 (0.76)	2.97 (0.77)	2.98 (0.68)	2.79 (0.60)	400.51 (91.81)	0.11	0.12	0.12	0.13	0.09	0.10	0.05	0.09	0.15
Uruguay	5263	2.90 (0.89)	2.79 (0.87)	2.79 (0.88)	2.83 (0.78)	2.69 (0.77)	427.12 (95.92)	0.11	0.10	0.09	0.11	0.14	0.12	0.11	0.14	0.26
D. English Speaking Countries																
Australia	14273	2.91 (0.84)	2.82 (0.84)	2.85 (0.86)	2.86 (0.78)	2.42 (0.85)	502.63 (108.66)	0.10	0.08	0.08	0.10	0.13	0.10	0.12	0.13	0.32
Ireland	5577	2.94 (0.79)	2.8 (0.78)	2.88 (0.78)	2.87 (0.70)	2.43 (0.82)	518.08 (90.70)	0.12	0.10	0.08	0.11	0.11	0.07	0.08	0.10	0.45
New Zealand	6173	2.98 (0.80)	2.87 (0.8)	2.89 (0.84)	2.91 (0.74)	2.43 (0.83)	505.73 (106.30)	0.13	0.09	0.11	0.12	0.10	0.07	0.11	0.10	0.37

		Means and Standard Deviation						Correlation with Reading Intrinsic Motivation				Correlation with Reading Achievement				
Country	**n**	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation	Reading Achievement	Structure	Autonomy	Involvement	NST	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation
United Kingdom	13818	2.97 (0.82)	2.81 (0.83)	2.89 (0.84)	2.89 (0.75)	2.36 (0.82)	503.93 (100.21)	0.12	0.10	0.11	0.12	0.11	0.09	0.11	0.11	0.30
United States	4838	2.97 (0.82)	2.81 (0.84)	2.83 (0.86)	2.87 (0.76)	2.42 (0.8)	505.35 (107.89)	0.10	0.09	0.10	0.11	0.16	0.10	0.13	0.15	0.29
E. Confucian Countries																
B-S-J-Z (China)	12058	3.03 (0.76)	3.01 (0.78)	2.95 (0.82)	3.00 (0.71)	3.25 (0.58)	555.24 (87.23)	0.24	0.21	0.20	0.24	0.08	0.08	0.10	0.10	0.32
Chinese Taipei	7243	2.91 (0.73)	2.98 (0.73)	2.56 (0.82)	2.82 (0.67)	2.68 (0.69)	502.6 (101.73)	0.13	0.11	0.06	0.11	0.06	0.09	-0.05	0.04	0.40
Hong Kong	6037	2.75 (0.79)	2.76 (0.78)	2.70 (0.82)	2.74 (0.73)	2.67 (0.69)	524.28 (99.48)	0.09	0.07	0.06	0.08	0.04	0.05	0.05	0.05	0.29
Japan	6109	2.48 (0.81)	2.39 (0.85)	2.48 (0.83)	2.45 (0.73)	2.68 (0.83)	503.86 (97.12)	0.07	**0.02**	**0.02**	0.04	**0.01**	-0.03	**0.00**	**-0.01**	0.35
Korea	6650	2.88 (0.82)	2.92 (0.82)	2.92 (0.83)	2.91 (0.77)	2.60 (0.68)	514.05 (102.00)	0.11	0.10	0.09	0.11	0.05	0.05	0.07	0.06	0.29
Macao	3775	2.76 (0.72)	2.69 (0.73)	2.48 (0.8)	2.64 (0.65)	2.66 (0.68)	525.12 (92.12)	0.18	0.13	0.12	0.16	0.05	**-0.01**	**0.00**	**0.01**	0.33
F. Southeast Asia																
Brunei Darussalam	6828	3.03 (0.66)	2.85 (0.66)	2.81 (0.75)	2.90 (0.55)	2.63 (0.66)	408.07 (97.45)	0.10	0.09	0.10	0.12	0.13	0.07	0.08	0.12	0.32
Indonesia	12098	3.14 (0.76)	3.03 (0.71)	2.94 (0.74)	3.04 (0.63)	2.89 (0.52)	370.97 (75.12)	0.16	0.13	0.13	0.16	0.07	0.10	**0.01**	0.07	0.16
Malaysia	6111	3.13 (0.68)	2.94 (0.7)	2.85 (0.74)	2.97 (0.58)	2.86 (0.59)	414.98 (84.83)	0.19	0.18	0.19	0.23	0.10	0.14	0.05	0.12	0.26
Philippines	7233	2.96 (0.83)	2.88 (0.78)	2.89 (0.80)	2.91 (0.70)	2.69 (0.53)	339.69 (79.87)	0.11	0.10	0.07	0.11	0.20	0.19	0.17	0.22	0.32
Singapore	6676	2.92 (0.78)	2.89 (0.77)	2.85 (0.81)	2.88 (0.71)	2.62 (0.79)	549.46 (108.95)	0.08	0.08	0.08	0.09	**0.01**	0.04	0.05	0.04	0.36
Thailand	8633	2.93 (0.66)	2.99 (0.66)	2.9 (0.69)	2.94 (0.59)	2.64 (0.51)	392.89 (78.92)	0.11	0.10	0.12	0.12	**0.03**	0.08	**0.03**	0.05	0.21

		Means and Standard Deviation						Correlation with Reading Intrinsic Motivation				Correlation with Reading Achievement				
Country	**n**	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation	Reading Achievement	Structure	Autonomy	Involvement	NST	Structure	Autonomy	Involvement	NST	Reading Intrinsic Motivation
Vietnam	5377	2.92 (0.69)	3.02 (0.69)	2.76 (0.74)	2.90 (0.57)	2.91 (0.51)	504.51 (73.58)	0.15	0.14	0.14	0.17	-0.05	**-0.01**	-0.06	-0.05	0.18
F. Africa and Middle East																
Israel	6623	2.83 (0.93)	2.74 (0.94)	2.77 (0.95)	2.78 (0.84)	2.57 (0.8)	470.42 (124.46)	0.06	0.08	0.07	0.08	0.06	-0.03	**0.00**	**0.01**	0.16
Jordan	8963	2.93 (0.95)	2.97 (0.88)	2.97 (0.94)	2.96 (0.81)	2.93 (0.59)	419.06 (87.34)	0.12	0.11	0.09	0.12	0.15	0.18	0.11	0.17	0.24
Morocco	6814	2.87 (0.87)	2.80 (0.88)	2.85 (0.90)	2.84 (0.72)	2.82 (0.59)	359.39 (74.62)	0.12	0.11	0.11	0.14	**0.00**	**0.02**	**-0.01**	**0.00**	0.12
Qatar	13828	2.79 (0.96)	2.73 (0.92)	2.73 (0.97)	2.75 (0.85)	2.66 (0.70)	407.09 (109.62)	0.09	0.08	0.07	0.09	0.20	0.14	0.13	0.18	0.25
Saudi Arabia	6136	2.89 (0.89)	2.85 (0.89)	2.82 (0.94)	2.85 (0.76)	2.74 (0.63)	399.15 (84.38)	0.06	0.07	0.05	0.07	0.11	0.13	0.06	0.12	0.25
Turkey	6890	2.67 (0.93)	2.64 (0.91)	2.65 (0.96)	2.65 (0.83)	3.02 (0.69)	465.63 (87.66)	0.13	0.11	0.10	0.13	**0.02**	0.06	0.04	0.04	0.25
United Arab Emirates	19277	2.95 (0.93)	2.91 (0.9)	2.87 (0.94)	2.91 (0.83)	2.73 (0.72)	431.78 (113.32)	0.12	0.12	0.09	0.12	0.19	0.15	0.13	0.17	0.27

Note: Canada, Lebanon, and North Macedonia were excluded because they have 100% missing data either on need-supportive teaching or intrinsic motivation for reading, or both. Countries are grouped following Schwartz' (2009) cultural value orientation grouping. Standard deviation values are enclosed in parentheses. B-S-J-Z stands for Beijing, Shanghai, Shenzhen, and Zhejiang from which the Chinese samples were drawn. Correlation coefficients in bold typeface are statistically non-significant. Correlation coefficients in regular typeface are statistically significant with at least $p<.05$.

Table A3

Multi-group Confirmatory Factor Analysis

	χ^2	df	CFI	TLI	RMSEA	SRMR	ΔCFI	ΔRMSEA
A. Western Europe								
Configural Invariance	5317.83	323	0.99	0.99	0.04	0.03		
Metric Invariance	7717.49	419	0.99	0.98	0.05	0.04	0.00	-0.01
Full Scalar Invariance	10652.47	515	0.98	0.98	0.05	0.04	0.01	0.00
B. East Central Europe								
Configural Invariance	6053.45	228	0.97	0.96	0.07	0.05		
Metric Invariance	7231.09	294	0.97	0.96	0.06	0.05	0.00	0.01
Full Scalar Invariance	11774.11	360	0.95	0.95	0.07	0.06	0.02	-0.01
Partial Scalar Invariance	8542.19	316	0.96	0.96	0.07	0.05	0.01	-0.01
C. Eastern Europe								
Configural Invariance	11576.05	247	0.95	0.92	0.08	0.06		
Metric Invariance	12791.35	319	0.94	0.93	0.08	0.06	0.01	0.00
Full Scalar Invariance	17743.12	391	0.92	0.92	0.08	0.07	0.02	0.00
Partial Scalar Invariance	13961.3	343	0.93	0.93	0.08	0.06	0.01	0.00
D. Latin America								
Configural Invariance	7186.61	190	0.96	0.95	0.07	0.05		
Metric Invariance	7483.8	244	0.96	0.96	0.06	0.05	0.00	0.01
Full Scalar Invariance	10524.91	298	0.95	0.95	0.07	0.06	0.01	-0.01
E. English Speaking								
Configural Invariance	1598.79	95	0.99	0.99	0.04	0.03		
Metric Invariance	1651.81	119	0.99	0.99	0.04	0.03	0.00	0.00
Full Scalar Invariance	1899.63	143	0.99	0.99	0.04	0.03	0.00	0.00
F. Confucian								
Configural Invariance	3263.16	114	0.97	0.96	0.06	0.05		
Metric Invariance	4138.38	144	0.97	0.96	0.06	0.05	0.00	0.00
Full Scalar Invariance	8494.03	174	0.93	0.93	0.08	0.07	0.04	-0.02

Partial Scalar Invariance	5134.2	154	0.96	0.95	0.07	0.06	0.01	-0.01
G. South East Asia								
Configural Invariance	5647.8	133	0.94	0.92	0.07	0.05		
Metric Invariance	7134.27	169	0.93	0.92	0.07	0.06	0.01	0.00
Full Scalar Invariance	13653.66	205	0.86	0.87	0.09	0.08	0.07	-0.02
Partial Scalar Invariance	7656.52	181	0.92	0.92	0.07	0.06	0.01	0.00
H. Africa and Middle-East								
Configural Invariance	13354.85	133	0.91	0.87	0.1	0.07		
Metric Invariance	14642.31	169	0.9	0.89	0.09	0.07	0.01	0.01
Full Scalar Invariance	18093.63	205	0.88	0.89	0.09	0.08	0.02	0.00
Partial Scalar Invariance	14757.23	181	0.9	0.9	0.09	0.07	0.00	0.00
Between individual regions (Over-all sample)								
Configural Invariance	53998.56	1463	0.97	0.95	0.07	0.05		
Metric Invariance	68656.36	1919	0.96	0.96	0.07	0.05	0.01	0.00
Full Scalar Invariance	133012.1	2375	0.92	0.93	0.09	0.07	0.04	-0.02
Partial Scalar Invariance	75064.3	2071	0.96	0.96	0.07	0.06	0.00	0.00

Table A4

SEM of Relationships Among Need-Supportive Teaching, Intrinsic Motivation, and Reading Achievement by Cultural Group With No Covariates

	West Europe	East Central Europe	East Europe	Latin America	English Speaking	Confucian Countries	South Asia	Africa and Middle East
A. Structural Equation Model Fit Indices								
$\chi^2(df = 17, p < .001)$	741.87	734.53	676.57	1116.35	218.30	684.60	769.75	786.91
Scaling Correction Factor	4.07	3.19	5.57	2.83	7.17	2.37	4.52	3.13
Robust CLI	0.99	0.99	0.98	0.98	0.99	0.99	0.96	0.98
Robust TLI	0.99	0.98	0.97	0.97	0.98	0.98	0.94	0.97
Robust RMSEA (CI)	0.04 (0.03, 0.04)	0.04 (0.04, 0.05)	0.05 (0.05, 0.05)	0.05 (0.05, 0.05)	0.04 (.04, .05)	.05 (.04, .05)	0.06 (0.06, 0.07)	.05 (.04, .05)
SRMR	0.02	0.03	0.03	0.03	0.02	0.03	0.05	0.04
B. Standardized Path Estimates								
Need Supportive Teaching → Intrinsic Motivation	0.13*** (0.04)	0.15*** (0.04)	0.20*** (0.04)	0.11*** (0.04)	0.12*** (0.16)	0.20*** (0.05)	0.18*** (0.05)	0.11*** (0.04)
Intrinsic Motivation→ Reading Achievement	0.31*** (0.68)	0.34*** (1.25)	0.32*** (1.64)	0.29*** (1.21)	0.32*** (1.59)	0.43*** (1.26)	0.35*** (2.68)	0.35*** (2.04)
Need Supportive Teaching → Reading Achievement	0.06*** (0.99)	-0.03** (1.29)	0.00 (1.14)	0.06*** (1.07)	0.11*** (1.96)	0.02* (1.25)	0.01 (1.61)	-0.03** (1.23)
Indirect Effect	0.04*** (0.36)	0.05*** (0.48)	0.06*** (0.51)	0.03*** (0.42)	0.04*** (0.78)	0.09*** (0.73)	0.06*** (0.93)	0.04*** (0.54)
Total Effect	0.10*** (0.94)	0.02* (1.35)	0.06*** (1.18)	0.09*** (1.07)	0.15*** (2.10)	0.11*** (1.33)	0.07*** (1.40)	0.01 (1.23)
Reading Achievement R^2	0.10	0.11	0.10	0.08	0.12	0.19	0.12	0.12
Intrinsic Motivation R^2	0.02	0.02	0.04	0.01	0.02	0.04	0.03	0.01

Note: For brevity, the measurement model fit indices were no longer included. The large sample rejected all chi-square statistics.

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

Table A5

Multigroup Invariance Test of Path Coefficients

Model		χ^2	df	CLI	TLI	RMSEA	SRMR	$\Delta\chi^2$ (Δdf) (vs. Model 1)
1-	Measurement constrained	53527.81	346.00	0.97	0.97	0.05	0.04	
2-	β NST→INT constrained	54028.94	353.00	0.97	0.97	0.05	0.04	104.22 (7) ***
3-	β INT→ ACH constrained	55175.51	353.00	0.97	0.97	0.05	0.04	352.36 (7)***
4-	β NST→ACH constrained	54171.06	353.00	0.97	0.97	0.05	0.04	119.59 (7) ***
5-	All βs constrained	56356.04	353.00	0.97	0.97	0.05	0.04	571.2 (21) ***

Note: This is the result of a multi-group SEM with a sequential imposition of constraints across eight groups (Bollen, 1989; Deci et al., 2001; Sass & Schmitt, 2013). We used an SEM model having a measurement equality constraints, but no constraints on the regression paths, as our baseline model (Deci et al, 2001; Sass & Schmitt, 2013). Then, we sequentially imposed equality constraints on each path and compared it with the baseline model using the $\Delta\chi^2$. A significant $\Delta\chi^2$ indicates significant difference in the magnitude of path coefficients across the cultural groups compared (Bollen, 1989; Deci et al., 2001; Sass & Schmitt, 2013). The $\Delta\chi^2$ of all constrained models were significant suggesting non-invariance in magnitude of path coefficients between variables across the eight cultural groups. *** $p< 0.001$

Table A6a

Need-Supportive Teaching to Intrinsic Motivation Regression Invariance Test by Cultural Group ($\Delta\chi^2$)

Cultural Group	Western Europe	East Central Europe	East Europe	Latin America	English Speaking	Confucian Countries	South Asia
Western Europe							
East Central Europe	**3.35**						
East Europe	**0.13**	4.06*					
Latin America	23.38***	10.00**	22.29***				
English Speaking	**0.47**	**0.11**	**0.86**	4.45*			
Confucian Countries	11.10***	22.83***	7.78**	51.14***	8.33**		
South Asia	**0.22**	**3.41**	**0.00**	17.40***	**0.94**	4.83*	
Africa & Middle East	47.51***	29.50***	43.44***	4.90*	11.85***	75.78***	34.64***

Note: Values in bold typeface indicate that path coefficients between two cultural groups are statistically the same. Significant values (*** $p < 0.001$ ** $p < 0.01$ *$p < 0.05$) indicate statistical difference in the magnitude of path coefficients between the two groups. For example, the effect size of the relationship between need-supportive teaching and intrinsic motivation are the same among European and English-speaking countries. Note that these groups are conventionally categorized as "Western Culture." These cultural significantly differ with Latin American, Confucian, African, and Middle Eastern countries in need support to intrinsic motivation effect size.

Table A6b

Intrinsic Motivation to Achievement Regression Invariance Test by Cultural Group ($\Delta\chi^2$)

Cultural Group	Western Europe	East Central Europe	East Europe	Latin America	English Speaking	Confucian Countries	South Asia
Western Europe							
East Central Europe	6.43*						
East Europe	12.51***	**1.92**					
Latin America	32.80***	7.26**	**0.64**				
English Speaking	6.95**	**0.86**	**0.05**	**0.90**			
Confucian Countries	495.3***	274***	144.61***	179.66***	148.52***		
South Asia	67.32***	41.46***	25.18***	23.00***	25.45***	7.63**	
Africa & Middle East	74.42***	42.70***	23.44***	21.56***	23.36***	18.92***	**0.46**

Note: Values in bold typeface indicate that path coefficients between two cultural groups are statistically the same. Significant values (*** p<.001 **p<.01 *p<.05) indicate statistical difference in the magnitude of path coefficients between the two groups. This table shows that English speaking culture has the same magnitude as East Central Europe, East Europe and Latin American countries. East Europe has an equal magnitude as English Speaking and Latin American culture. South Asian and African/Middle Eastern cultures have statistically similar effect size.

Table A6c

Need-Supportive Teaching to Achievement Regression Invariance Test by Cultural Group ($\Delta\chi^2$)

Cultural Group	Western Europe	East Central Europe	East Europe	Latin America	English Speaking	Confucian Countries	South Asia
Western Europe							
East Central Europe	28.00***						
East Europe	6.21*	7.33**					
Latin America	**0.01**	28.29***	6.80**				
English Speaking	5.61*	32.17***	14.80***	5.04*			
Confucian Countries	**3.19**	11.20***	**0.36**	**3.65**	11.59***		
South Asia	5.35*	**2.94**	**0.11**	5.85*	14.14***	**0.77**	
Africa & Middle East	63.79***	4.67*	26.18***	62.32***	53.35***	33.35***	11.47***

Note: Values in bold typeface indicate that path coefficients between two cultural groups are statistically the same. Significant values (*** p<.001 **p<.01 *p<.05) indicate statistical difference in the magnitude of path coefficients between the two groups. This table shows that the magnitude of relationship between need-supportive teaching and achievement in Confucian countries is statistically similar with Western Europe, Eastern Europe, Latin America, and South Asia. The similarities in effect size can also be found between South Asia and East Central Europe, East Europe, and as mentioned earlier Confucian countries.

Table A7

Structural Equation Model Analysis by Region

	Model-fit Indices					Path Coefficients			Indirect Effect	Total Effect
	χ^2 (df=38, p<.001)	CFI	TLI	RM SEA	SR MR	Need Supportive Teaching → Intrinsic Motivation	Intrinsic Motivation→ Reading Achievement	Need Supportive Teaching→ Reading Achievement		
A. Western Europe										
Austria	251.71	.99	.98	.03	.02	.08***	.31***	.10***	.02***	.12***
Belgium	362.11	.99	.98	.04	.02	.02	.24***	.05***	.01	.05***
Denmark	449.37	.98	.97	.05	.03	.12***	.27***	.15***	.03***	.18***
Finland	328.66	.99	.98	.04	.03	.16***	.37***	.07***	.06***	.13***
France	276.33	.99	.98	.03	.02	.16***	.31***	.02	.05***	.07***
Germany	231.37	.99	.98	.04	.02	.09***	.26***	.07**	.02***	.09***
Greece	553.71	.96	.95	.05	.04	.22***	.27***	.06***	.06***	.12***
Iceland	331.36	.98	.97	.05	.03	.10***	.30***	.12***	.03***	.15***
Italy	344.07	.98	.97	.04	.02	.09***	.23***	.05**	.02***	.07***
Luxembourg	285.90	.99	.98	.04	.03	.12***	.26***	.08***	.03***	.11***
Malta	237.96	.99	.98	.04	.03	.07**	.27***	.18***	.02**	.20***
Netherlands	331.45	.98	.97	.04	.03	.10***	.32***	.10***	.03***	.13***
Norway	254.98	.99	.99	.04	.02	.11***	.25***	.14***	.03***	.17***
Portugal	289.18	.99	.98	.04	.02	.13***	.30***	.01	.04***	.05*
Spain	852.68	.99	.98	.04	.02	.09***	.30***	.10***	.03***	.13***
Sweden	277.62	.99	.98	.04	.02	.12***	.24***	.13***	.03***	.16***
Switzerland	210.75	.99	.99	.03	.02	.10***	.31***	.08***	.03***	.11***
B. East Central Europe										
Albania	477.30	.96	.95	.05	.05	.13***	.22***	.08***	.03***	.11***
Czech Republic	301.07	.98	.98	.04	.03	.09***	.29***	.05**	.03***	.08***
Croatia	423.14	.98	.97	.04	.02	.12***	.23***	.05**	.03***	.07***
Estonia	433.46	.98	.97	.05	.03	.10***	.34***	.11**	.03***	.15***
Hungary	200.31	.99	.99	.03	.02	.07***	.35***	-.001	.03***	.03
Kosovo	507.75	.94	.91	.06	.05	.11***	.32***	-.003	.04***	.03
Latvia	418.09	.97	.96	.05	.03	.05**	.34***	.11***	.02**	.12***
Lithuania	662.11	.97	.95	.06	.04	.04*	.16***	.08***	.01**	.09***
Poland	378.81	.98	.97	.05	.03	.08***	.36***	.09***	.03***	.12***
Romania	342.89	.98	.97	.05	.04	.09***	.20***	.03	.02***	.04*
Slovak Republic	246.34	.99	.98	.04	.03	.07***	.29***	.04**	.02***	.06***
Slovenia	276.24	.99	.98	.04	.02	.10***	.28***	.04**	.03***	.07***
C. East Europe										
Baku (Azerbaijan)	811.96	.96	.94	.06	.07	-.04*	.20***	.11***	-.01*	.10***
Belarus	515.62	.97	.96	.05	.04	.13***	.26***	.05**	.03***	.08***
Bosnia and Herzegovina	352.65	.98	.97	.04	.03	.14***	.21***	.09***	.03***	.12***
Bulgaria	513.06	.97	.96	.05	.04	.02	.21***	.12***	.01	.13***
Georgia	443.63	.97	.95	.05	.04	.12***	.34***	.06***	.04***	.10***

	Model-fit Indices					Path Coefficients			Indirect Effect	Total Effect
	χ^2 (df=38, p<.001)	CFI	TLI	RM SEA	SR MR	Need Supportive Teaching → Intrinsic Motivation	Intrinsic Motivation→ Reading Achievement	Need Supportive Teaching→ Reading Achievement		
Kazakhstan	961.38	.97	.95	.05	.04	.23***	.13***	-.01	.03***	.02
Moldova	308.44	.98	.97	.04	.03	.14***	.22***	.05**	.03***	.08***
Montenegro	563.10	.97	.96	.05	.04	.14***	.24***	.11***	.03***	.15***
Moscow Region (RUS)	159.75	.97	.96	.05	.03	.15***	.27***	.09**	.04***	.13***
Russian Federation	438.99	.98	.97	.04	.03	.15***	.30***	.07***	.05***	.12***
Serbia	456.67	.98	.97	.05	.03	.11***	.20***	.10***	.02***	.12***
Tatarstan (RUS)	531.77	.97	.95	.05	.04	.13***	.28***	.12***	.04***	.16***
Ukraine	411.33	.97	.95	.05	.04	.14***	.28***	.03*	.04***	.07***
C. Latin America										
Argentina	493.60	.97	.96	.05	.04	.04*	.23***	.06**	.01*	.07***
Brazil	679.12	.97	.96	.05	.03	.13***	.23***	.06***	.03***	.09***
Chile	507.30	.98	.97	.05	.03	.04**	.26***	.12***	.01**	.13***
Colombia	394.82	.98	.97	.05	.04	.06**	.30***	.06***	.02**	.08***
Costa Rica	333.02	.99	.98	.04	.03	.06**	.21***	.09***	.01**	.10***
Dominican Republic	478.64	.97	.96	.05	.05	.02	.17***	.12***	.003	.12***
Mexico	252.08	.99	.98	.04	.03	.04*	.28***	.08***	.01*	.09***
Panama	288.48	.98	.97	.04	.03	.04*	.20***	.11***	.01*	.11***
Peru	277.00	.98	.98	.04	.03	.16***	.17***	.07***	.03***	.09***
Uruguay	324.30	.98	.97	.04	.03	.09***	.30***	.10***	.03***	.12***
D. English Speaking Countries										
Australia	601.71	.99	.98	.04	.03	.09***	.32***	.08***	.03***	.11***
Ireland	441.22	.98	.98	.05	.03	.09***	.42***	.04**	.04***	.08***
New Zealand	353.43	.99	.99	.04	.03	.10***	.35***	.04**	.04***	.08***
United Kingdom	305.90	.99	.99	.04	.02	.12***	.30***	.08***	.04***	.11***
United States	328.04	.98	.98	.04	.03	.09***	.27***	.10***	.03***	.12***
E. Confucian Countries										
B-S-J-Z (China)	346.71	.99	.98	.04	.04	.23***	.33***	-.01	.08***	.07***
Chinese Taipei	722.58	.97	.96	.05	.04	.08***	.38***	.01	.03***	.04**
Hong Kong	323.42	.99	.98	.04	.03	.05**	.30***	.03*	.02**	.05***
Japan	470.24	.98	.97	.05	.03	.03	.37***	-.02	.01	-.01
Korea	812.81	.97	.95	.06	.04	.10***	.27***	.04*	.03***	.06***
Macao	253.65	.98	.97	.04	.03	.17***	.37***	-.07***	.06***	-.01
F. South Asia										
Brunei Darussalam	761.59	.95	.93	.06	.03	.13***	.30***	.06***	.04***	.10***
Indonesia	399.46	.95	.93	.05	.05	.11***	.21***	.07***	.02***	.10***

	Model-fit Indices					Path Coefficients			Indirect Effect	Total Effect
	χ^2 (df=38, p<.001)	CFI	TLI	RM SEA	SR MR	Need Supportive Teaching → Intrinsic Motivation	Intrinsic Motivation→ Reading Achievement	Need Supportive Teaching→ Reading Achievement		
Malaysia	688.34	.93	.90	.06	.04	.26***	.27***	.05**	.07***	.12***
Philippines	1062.44	.92	.90	.07	.07	.04	.38***	.17***	.02	.19***
Singapore	291.40	.99	.99	.03	.02	.10***	.34***	.001	.03***	.03**
Thailand	612.35	.96	.94	.06	.05	.07***	.19***	.05**	.01**	.06***
Vietnam	267.11	.97	.96	.04	.03	.24***	.18***	-.08***	.04***	-.04*
F. Africa and Middle East										
Israel	466.25	.98	.97	.05	.03	.06***	.16***	-.004	.01**	.006
Jordan	425.82	.97	.95	.05	.05	.06**	.25***	.14***	.02**	.15***
Morocco	551.90	.94	.92	.05	.04	.14***	.21***	-.03	.03***	.001
Qatar	1388.36	.96	.95	.06	.05	.05***	.25***	.14***	.01***	.16***
Saudi Arabia	657.61	.94	.91	.06	.05	-.02	.27***	.11***	-.01	.10***
Turkey	500.30	.98	.97	.05	.04	.10***	.25***	.01	.03***	.03*
United Arab Emirates	1122.15	.97	.96	.05	.05	.05***	.28***	.13***	.02***	.15***

Note: The structural model analysis followed Anderson and Gerbing's (1988) two-step approach. The CFA fit indices were not included in here for conciseness of presentation.

****p*<.001 ***p*<.01 **p*<.05

Appendix B: Supplementary Material to Chapter 3

Table B1

Hierarchical Linear Models of Need-supportive Teaching's Influence on Reading Achievement by School Type and School Location

	Public Schools	Private Schools	Rural Schools	Urban Schools
Key variable				
Need supportive teaching	19.24***	13.08***	20.11***	15.98***
	(1.14)	(2.83)	(1.37)	(1.63)
Covariates at the student level				
Female	24.16***	26.55***	26.22***	22.33***
	(1.57)	(3.81)	(1.88)	(2.26)
SES	14.59***	9.83***	12.79***	15.67***
	(0.84)	(2.37)	(1.01)	(1.28)
Covariate at the school level				
School SES	44.03***	64.35***	36.57***	52.41***
	(3.95)	(7.46)	(4.39)	(3.84)
Intercept	356.04***	377.53***	335.19***	378.65***
	(7.38)	(10.67)	(8.49)	(7.07)
Intraclass correlations coefficient	0.24	0.43	0.26	0.37
Level 1 Variance	3,545.01	3,987.92	3,331.60	3,965.22
Level 2 Variance	435.97	633.53	520.75	382.59
% Variance explained at Level 1	12.58	7.30	13.22	10.06
% Variance explained at Level 2	66.77	81.12	62.53	85.20
Number of students	5,905	1,145	3,879	3,171
Number of schools	153	34	102	85

Note: The table presents regression coefficients from hierarchical linear models regressing reading test score on need-supportive teaching, with individual-level and school-level demographic predictors, disaggregated by the school type or school location. Standard errors are written in parentheses. *** $p < .001$

Table B2

Hierarchical Linear Models of Need-supportive Teaching's Influence on Reading Achievement by Individual and School Level SES Quartiles

	Full	Family SES Q1	Family SES Q2	Family SES Q3	Family SES Q4	School SES Q1	School SES Q2	School SES Q3	School SES Q4
Key variable									
Need supportive teaching	18.20***	20.33***	19.45***	21.50***	13.04***	22.05***	20.64***	14.40***	16.25***
	(1.06)	(1.87)	(2.16)	(2.12)	(2.37)	(1.89)	(2.11)	(2.05)	(2.45)
Covariates at the student level									
Female	24.61***	21.26***	16.94***	23.87***	32.42***	25.28***	30.16***	20.22***	21.94***
	(1.46)	(2.48)	(2.83)	(3.07)	(3.34)	(2.58)	(2.76)	(3.06)	(3.19)
SES Index	13.96***					12.11***	16.13***	15.12***	15.14***
	(0.80)					(1.27)	(1.48)	(1.76)	(1.87)
Covariate at the school level									
School Mean SES Index	46.03***	22.89***	41.52***	53.02***	50.68***				
	(2.53)	(3.99)	(3.92)	(4.09)	(4.70)				
Intercept	360.02***	274.92***	329.68***	340.11***	375.46***	254.75***	274.44***	303.52***	345.56***
	(5.36)	(9.13)	(9.21)	(8.99)	(9.92)	(6.79)	(7.17)	(7.18)	(10.28)
Intraclass correlations coefficient	0.34	0.10	0.15	0.22	0.33	0.11	0.06	0.05	0.38
Level 1 Variance	3,621.63	2,508.01	3,337.37	3,938.82	4,573.82	2,774.13	3,223.97	4,166.70	4,265.40
Level 2 Variance	490.18	227.71	256.32	420.66	1,064.06	333.43	207.94	231.34	2,125.21
% Variance explained at Level 1	11.58	11.52	7.73	10.69	5.99	16.44	16.26	8.74	7.94
% Variance explained at Level 2	77.23	28.37	59.41	66.43	55.97	22.41	10.12	5.66	24.63
Number of students	7,050	1,751	1,761	1,760	1,778	1,755	1,738	1,806	1,751
Number of schools	187	166	178	185	183	46	46	47	48

Note: The table presents regression coefficients from hierarchical linear models regressing reading test score on need-supportive teaching, with individual-level and school-level demographic predictors, disaggregated by the socioeconomic quartile of either the family or the school. Standard errors are written in parentheses. *** $p < .001$

Table B3

Need-Supportive Teaching Disaggregated by School Type

By school type	All schools	Public schools	Private schools	Public vs. Private (*p*-value)	Rural schools	Urban schools	Rural vs. Urban (*p*-value)
Competence support	2.97 (0.82)	2.97 (0.82)	3.01 (0.79)	0.123	2.95 (0.82)	2.99 (0.82)	0.079
Autonomy support	2.89 (0.77)	2.88 (0.78)	2.94 (0.74)	0.035	2.88 (0.77)	2.91 (0.77)	0.070
Relatedness support	2.90 (0.79)	2.89 (0.80)	2.97 (0.76)	0.002	2.88 (0.80)	2.93 (0.78)	0.005
Need supportive teaching	2.92 (0.69)	2.91 (0.69)	2.97 (0.68)	0.007	2.90 (0.69)	2.94 (0.69)	0.015
By school SES quartile	All schools	School SES Q1	School SES Q2	School SES Q3	School SES Q4	ANOVA *p*-value	
Competence support	2.97 (0.82)	2.89 (0.83)	2.96 (0.78)	3.00 (0.88)	3.03 (0.76)	<0.001	
Autonomy support	2.89 (0.77)	2.81 (0.78)	2.86 (0.75)	2.94 (0.81)	2.95 (0.72)	<0.001	
Relatedness support	2.90 (0.79)	2.84 (0.80)	2.88 (0.78)	2.92 (0.84)	2.97 (0.74)	<0.001	
Need supportive teaching	2.92 (0.69)	2.85 (0.68)	2.90 (0.66)	2.95 (0.75)	2.99 (0.66)	<0.001	

Note: The measures represent the need supportive teaching average scores (out of four) for students who belong to the particular school type (i.e., all schools, public schools, private schools, etc.). One-way analyses of variance (ANOVA) were conducted and *p*-values are shown.

Table B4

Individual Need-supportive Teaching Aspect's Influence on Reading Achievement

	Competence-support	Autonomy-support	Relatedness
Key variable			
Need supportive teaching aspect	14.53*** (0.90)	13.79*** (0.96)	12.69*** (0.93)
Covariate at the student level			
Female	24.88*** (1.46)	24.83*** (1.46)	25.31*** (1.46)
SES Index	13.82*** (0.80)	14.14*** (0.80)	14.34*** (0.80)
Covariate at the school level			
School Mean SES Index	46.45*** (2.84)	46.10*** (2.84)	46.10*** (2.84)
Intercept	370.26*** (5.13)	373.57*** (5.18)	376.65*** (5.14)
Intraclass correlation coefficient	0.35	0.34	0.34
Level 1 Variance	3,637.30	3,663.88	3,674.78
Level 2 Variance	493.73	494.17	494.62
% Variance explained at Level 1	11.20	9.65	14.58
% Variance explained at Level 2	77.07	62.33	85.26
Number of students	7,050	7,050	7,050
Number of schools	187	187	187

Note: The table presents regression coefficients from hierarchical linear models regressing reading test score on need-supportive teaching, with individual-level and school-level demographic predictors. Standard errors are written in parentheses. *** $p < 0.001$

Appendix C: Supplementary Material to Chapter 4

Table C1

Structural Equation Model (Model 1) Estimates of Need-Supportive Leadership, Autonomous Motivation, and Need-Supportive Teaching (Without Teacher Background Covariates)

Paths	*Estimate*	*SE*	*95% C.I.*	*β*
Need-supportive Leadership→ Teacher Autonomous Motivation	0.29	0.04	[0.21-0.37]	0.34***
Teacher Autonomous Motivation→ Need-supportive Teaching	0.34	0.03	[0.27-0.40]	0.57***
Need-supportive Leadership→ Need-supportive Teaching	0.03	0.02	[-0.02-0.07]	0.05
Indirect Effect (*Need-supportive Leadership →Teacher Autonomous Motivation →Need-supportive Teaching*)	0.10	0.02	[0.07-0.13]	0.20***
Total Effect	0.13	0.02	[0.08-0.17]	0.25***
Explained Variance in Autonomous Motivation	0.15			
Explained Variance in Need-supportive Teaching	0.40			

Note: Fit indices: (χ^2(df) = 1982.81(889), p < 0.001; CFI = 0.91; TLI = 0.90; RMSEA[95% CI] = 0.05[0.04, 0.05]; and SRMR = 0.05). To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 14 schools (F. Huang, 2016).

****p* < .001 ***p*<.01 **p*<.05

Table C2

Structural Equation Model (Model 2) Estimates of Need-Supportive Leadership, Autonomous Motivation, and Need-Supportive Teaching (With Teacher Background Covariates)

Paths	*B*	*SE*	*95% C.I.*	*β*	*Covariates*	
					Gender	Teaching Experience
Need-supportive Leadership→ Teacher Autonomous Motivation	0.30	0.04	[0.22-0.38]	0.35***	0.02	0.08**
Teacher Autonomous Motivation→ Need-supportive Teaching	0.33	0.03	[0.27-0.40]	0.57***	-0.02	0.02
Need-supportive Leadership→ Need-supportive Teaching	0.03	0.02	[-0.02-0.07]	0.06		
Indirect Effect (*Need-supportive Leadership→Teacher Autonomous Motivation→Need-supportive Teaching*)	0.10	0.02	[0.07-0.13]	0.20***		
Total Effect	0.13	0.02	[0.08-0.17]	0.25***		
Explained Variance in Autonomous Motivation	0.17					
Explained Variance in Need-supportive Teaching	0.40					

Note: Fit indices: (χ^2(df) = 2091.23(951), $p < 0.001$; CFI = 0.91; TLI= 0.90; RMSEA[95%CI] = 0.05[0.04, 0.05]; and SRMR = 0.05). To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 14 schools (F. Huang, 2016). Covariate estimates are standardized. ***$p < .001$ **$p<.01$ *$p<.05$

Table C3

Structural Equation Model (Model 1) Estimates of Need-Supportive Teaching, Autonomous Motivation, and Student Engagement (Without Student Background Covariates)

Paths	*Estimate*	*SE*	*95% C.I.*	β
Need-supportive Teaching→ Student Autonomous Motivation	0.34	0.02	[0.31 - 0.37]	0.65***
Student Autonomous Motivation→ Student Engagement	1.15	0.05	[1.04 - 1.25]	0.85***
Need-supportive Teaching→ Student Engagement	0.08	0.02	[0.05 - 0.12]	0.11***
Indirect Effect (*Need-supportive Teaching →Student Autonomous Motivation →Student Engagement*)	0.40	0.02	[0.35 - 0.44]	0.55***
Total Effect	0.48	0.02	[0.44 - 0.52]	0.66***
Explained Variance in Autonomous Motivation	0.46			
Explained Variance in Student Engagement	0.85			

Note: Fit indices: (χ^2(*df*) = 5224.51(936), $p < 0.001$; CFI = 0.91; TLI = 0.90; RMSEA[95% CI] = 0.05 [0.04, 0.05]; and SRMR = 0.04). Two sets of engagement items were allowed to covary ("I try hard to do well in class" with "In class, I work as hard as I can" and "When learning about a new topic for my subjects, I usually try to summarize it in my own words with "When I am reading for my subjects I try to connect the ideas I am reading about with what I already know"). To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 14 schools (F. Huang, 2016).

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

Table C4

Structural Equation Model (*Model* 2) Estimates of Need-Supportive Teaching, Autonomous Motivation, and Student Engagement (With Student Background Covariates)

Paths	*B*	*SE*	*95% C.I.*	*β*	*Covariates*		
					Gender	Grade Level	Subjective Social Status
Need-supportive Teaching→ Student Autonomous Motivation	0.35	0.02	[0.31-0.38]	0.65***	0.09*	0.04*	-0.01
Student Autonomous Motivation→ Student Engagement	1.15	0.05	[1.05-1.26]	0.85***	-0.07**	-0.02	0.02
Need-supportive Teaching→ Student Engagement	0.08	0.02	[0.04-0.11]	0.11***			
Indirect Effect (*Need-supportive Teaching →Student Autonomous Motivation →Student Engagement*)	0.40	0.02	[0.35-0.44]	0.55***			
Total Effect	0.48	0.02	[0.44-0.52]	0.66***			
Explained Variance in Autonomous Motivation	0.46						
Explained Variance in Student Engagement	0.85						

Note: Fit indices: χ^2(df) = 5563.01(1032), p<.001; CFI=0.90; TLI = 0.90; RMSEA = 0.04 (90% CI = 0.04,0.05); SRMR = 0.04. Two sets of engagement items were allowed to covary ("I try hard to do well in class" with "In class, I work as hard as I can" and "When learning about a new topic for my subjects, I usually try to summarize it in my own words with "When I am reading for my subjects I try to connect the ideas I am reading about with what I already know"). To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 14 schools (F. Huang, 2016). Covariate estimates are standardized.

***p < .001 **p<.01 *p<.05

Appendix D: Supplementary Material to Chapter 5

Table D1

Path Estimates ff Associations Among Need-Supportive Leadership Practices, Autonomous Motivation, Well-being and Ill-being Without Covariates (Model 1)

Path Estimates	Estimate	95% Bca CI	SE	β
A. Direct Effects				
NSL → Autonomous Motivation	0.33	[0.25 - 0.40]	0.04	0.38***
NSL→ Emotional Well-being	0.46	[0.12 - 0.80]	0.17	0.11**
NSL→ Social Well-being	1.17	[0.53 - 1.82]	0.33	0.15***
NSL→ Psychological Well-being	0.64	[-0.03 - 1.30]	0.34	0.08
NSL→ Anxiety	-0.26	[-0.49 - -0.03]	0.12	-0.10*
NSL → Depression	-0.18	[-0.37 - 0.01]	0.10	-0.08
Autonomous Motivation→ Emotional Well-being	2.10	[1.61 - 2.60]	0.25	0.43***
Autonomous Motivation → Social Well-being	3.70	[2.79 - 4.62]	0.47	0.39***
Autonomous Motivation → Psychological Well-being	4.26	[3.28 - 5.24]	0.50	0.45***
Autonomous Motivation→ Anxiety	-0.56	[-0.86 - -0.27]	0.15	-0.19***
Autonomous Motivation → Depression	-0.73	[-0.99 - -0.47]	0.13	-0.28***
B. Indirect Effects				
NSL→ Autonomous Motivation→ Emotional Well-being	0.68	[0.47 - 0.91]	0.11	0.16***
NSL → Autonomous Motivation→ Social Well-being	1.21	[0.82 - 1.60]	0.20	0.15***
NSL → Autonomous Motivation→ Psychological Well-being	1.39	[0.96 - 1.83]	0.22	0.17***
NSL → Autonomous Motivation→ Anxiety	-0.18	[-0.29 - -0.08]	0.05	-0.07***
NSL → Autonomous Motivation→ Depression	-0.24	[-0.34 - -0.14]	0.05	-0.11***
Variance Explained (R^2)				
Emotional Well-being	0.29			
Social Well-being	0.32			
Psychological Well-being	0.29			
Anxiety	0.10			
Depression	0.17			
Autonomous Motivation	0.18			

Note: NSL refers to Need-supportive leadership practices. To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 15 schools (F. Huang, 2016). ***p < .001 **p<.01 *p<.05

Table D2

Path Estimates of Associations Among Autonomy-Support, Autonomous Motivation, and Well-being and Ill-being

Path Estimates	Estimate	SE	β	Covariates	
				Gender	Teaching Experience
A. Direct Effects					
Autonomy Support →Autonomous Motivation	0.26	0.04	0.32***	-0.01	0.13**
Autonomous Motivation→Emotional Well-being	2.04	0.25	0.42***	0.00	0.18***
Autonomy Support → Emotional Well-being	0.45	0.16	0.12**		
Autonomous Motivation→Social Well-being	3.75	0.46	0.40***	-0.03	0.09*
Autonomy Support →Social Well-being	0.95	0.30	0.13**		
Autonomous Motivation→Psychological Well-being	4.21	0.49	0.44***	0.02	0.13**
Autonomy Support →Psychological Well-being	0.52	0.30	0.07		
Autonomous Motivation→Anxiety	-0.50	0.14	-0.17***	0.08*	-0.19***
Autonomy Support →Anxiety	-0.26	0.10	-0.11*		
Autonomous Motivation→Depression	-0.69	0.13	-0.26***	0.00	-0.19***
Autonomy Support →Depression	-0.17	0.09	-0.08		
B. Indirect Effects					
Aut Supp → Aut Mot→ Emotional Well-being	0.52	0.09	0.13***		
Auto Supp→ Aut Mot→Social Well-being	0.96	0.17	0.13***		
Aut Supp→ Aut Mot→ Psychological Well-being	1.08	0.19	0.14***		
Aut Supp→ Aut Mot→ Anxiety	-0.13	0.04	-0.05**		
Aut Supp→ Aut Mot→ Depression	-0.18	0.04	-0.08***		

Note: Fit indices: χ^2(df) = 399.60(246), $p < 0.001$; CFI = 0.97; TLI = 0.96; RMSEA[95% CI] = 0.03[0.03, 0.04]; and SRMR = 0.03. To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 15 schools (F. Huang, 2016). ***p < .001 **p<.01 *p<.05

Table D3

Path Estimates of Associations Among Competence-Support, Autonomous Motivation, Well-Being and Ill-Being

Path Estimates	Estimate	SE	β	Covariates	
				Gender	Teaching Experience
A. Direct Effects					
Competence Support →Autonomous Motivation	0.26	0.03	0.35***	-0.03	0.17**
Autonomous Motivation→Emotional Well-being	1.99	0.24	0.42***	0.00	0.19***
Competence Support → Emotional Well-being	0.34	0.14	0.10*		
Autonomous Motivation→Social Well-being	3.60	0.46	0.39***	-0.04	0.11**
Competence Support →Social Well-being	0.84	0.27	0.12**		
Autonomous Motivation→Psychological Well-being	4.05	0.48	0.44***	0.02	0.14**
Competence Support →Psychological Well-being	0.47	0.28	0.07		
Autonomous Motivation→Anxiety	-0.56	0.14	-0.19***	0.09*	-0.19***
Competence Support →Anxiety	-0.07	0.10	-0.03		
Autonomous Motivation→Depression	-0.68	0.12	-0.26***	0.01	-0.20***
Competence Support →Depression	-0.11	0.08	-0.06		
B. Indirect Effects					
CompSupp → Aut Mot→ Emotional Well-being	0.51	0.09	0.15***		
Comp Supp→ Aut Mot→Social Well-being	0.93	0.16	0.14***		
Comp Supp→ Aut Mot→ Psychological Well-being	1.04	0.17	0.15***		
Comp Supp→ Aut Mot→ Anxiety	-0.15	0.04	-0.07**		
Comp Supp→ Aut Mot→ Depression	-0.18	0.04	-0.09***		

Note: Fit indices: χ^2(df) = 496.76(277), $p < 0.001$; CFI = 0.97; TLI = 0.95; RMSEA[95% CI] = 0.04[0.03, 0.04]; and SRMR = 0.03. To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 15 schools (F. Huang, 2016). ***$p < .001$ **$p<.01$ *$p<.05$

Table D4

Path Estimates of Associations Among Relatedness-Support, Autonomous Motivation, Well-Being and Ill-Being

Path Estimates	Estimate	SE	β	Covariates	
				Gender	Teaching Experience
C. Direct Effects					
Relatedness Support →Autonomous Motivation	0.27	0.03	0.39***	0.00	0.13**
Autonomous Motivation→Emotional Well-being	1.97	0.25	0.40***	0.00	0.18***
Relatedness Support → Emotional Well-being	0.43	0.14	0.13**		
Autonomous Motivation→Social Well-being	3.53	0.47	0.38***	-0.03	0.10**
Relatedness Support →Social Well-being	1.03	0.26	0.16***		
Autonomous Motivation→Psychological Well-being	4.00	0.49	0.42***	0.02	0.14**
Relatedness Support →Psychological Well-being	0.72	0.27	0.11**		
Autonomous Motivation→Anxiety	-0.45	0.15	-0.15**	0.08	-0.19***
Relatedness Support →Anxiety	-0.29	0.09	-0.14**		
Autonomous Motivation→Depression	-0.63	0.13	-0.24***	0.00	-0.20***
Relatedness Support →Depression	-0.22	0.08	-0.12**		
D. Indirect Effects					
Rel Supp → Aut Mot→ Emotional Well-being	0.53	0.09	0.16***		
Rel Supp→ Aut Mot→Social Well-being	0.95	0.16	0.15***		
Rel Supp→ Aut Mot→ Psychological Well-being	1.08	0.17	0.16***		
Rel Supp→ Aut Mot→ Anxiety	-0.12	0.04	-0.06**		
Rel Supp→ Aut Mot→ Depression	-0.17	0.04	-0.09***		

Note: Fit indices: χ^2(df) = 445.73(277), $p < 0.001$; CFI = 0.97; TLI = 0.96; RMSEA[95% CI] = 0.03[0.03, 0.04]; and SRMR = 0.04. To account for nesting of data, schools were represented as dummy variable and entered as covariates to control for clustering effects. Since we are only interested on the fixed effects, we no longer showed here the regression coefficients of the 15 schools (F. Huang, 2016). ***$p < .001$ **$p<.01$ *$p<.05$

Table D5

LPA Fit and Summary Statistics

Classes	BIC	SABIC	Entropy	BLRT *p*-value
1	1190.15	1184	1.00	NA
2	1148.59	1136	0.79	0.01
3	1161.50	1142	0.35	1.00

Table D6a

Supplementary Analysis Auto-Clustering Fit Indices

Number of Clusters	Schwarz's Bayesian Criterion (BIC)	BIC Change[a]	Ratio of BIC Changes[b]	Ratio of Distance Measures[c]
1	21.76			
2	14.11	-7.66	1.00	0.00[d]

Notes: We used IBM SPSS version 27 (IBM Corp., 2020) in conducting the auto-clustering supplementary analysis.

a. The changes are from the previous number of clusters in the table.

b. The ratios of changes are relative to the change for the two-cluster solution.

c. The ratios of distance measures are based on the current number of clusters against the previous number of clusters.

d. Since the distance at the current number of clusters is zero, auto-clustering will not continue.

Table D6b

Supplementary Analysis Cluster Distribution

		N	% of Combined	% of Total
Cluster	1	128	20.90	20.90
	2	456	74.60	74.60
	Outlier (-1)	27	4.40	4.40
	Combined	611	100.0	100.0
Total		611		100.0

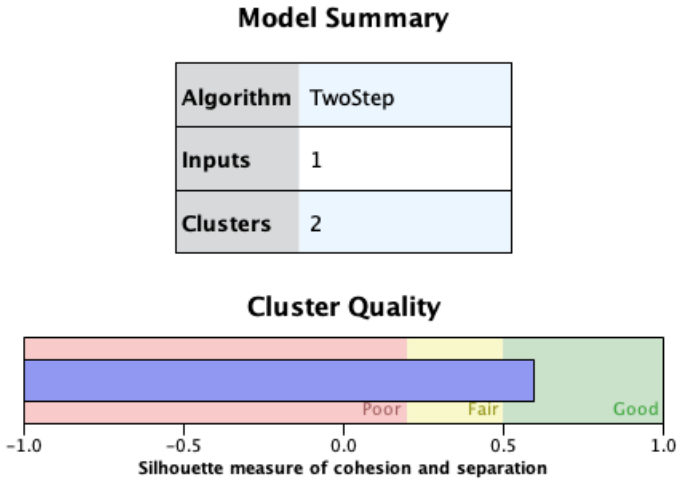
Table D6c

Supplementary Analysis Cluster Distribution (Need Supportive Leadership Practices)

		Mean	Std. Deviation
Cluster	1	0.77	0.15
	2	-0.12	0.42
	Outlier (-1)	-1.67	.37
	Combined	0.00	.63

Figure D1

Model Summary of Two-Step Cluster Analysis



Appendix E: Teacher Questionnaire Used in Studies 3 and 4

Information Sheet

This research aims to examine how the teachers' supportive practices motivate high school students towards school achievement. It also aims to investigate how school leaders motivate teachers to teach in a supportive way. Lastly, it aims to study whether school leaders influence the students' motivation and achievement by supporting their teachers. Your experience as a high school teacher will be a valuable information for this research.

The study will involve at least 60 High School and Senior High School teachers and about 2,880 students from different schools in the Philippines. You will answer an online survey which will take 15 - 30 minutes.

No potential risks or discomfort are expected in this study. Please understand that your participation is voluntary. You have every right to withdraw from the study at any time without negative consequences. All your personal information will remain confidential and will be identifiable by codes known only to the researcher.

The researchers will be presenting results of the study to scholars and school administrators in the form of journal articles, educational conferences, and professional development sessions. However, all responses will be anonymized, and we will only present the average results from all the participants in the study. Your privacy will be respected, and all your answers will be anonymized. Data will be used purely for research purposes.

If you would like to obtain more information about this study, please contact Mr. Joseph Haw by email at [redacted] or his supervisor Dr. Wing Sze Wincy Lee at wwslee@eduhk.hk. If you have any concerns about the conduct of this research study, please do not hesitate to contact the Human Research Ethics Committee by email at hrec@eduhk.hk or by mail to Research and Development Office, The Education University of Hong Kong.

Thank you for your interest in participating in this study.

Joseph Yap Haw
Principal Investigator

Conforme

I hereby consent to participate in the captioned project. I understand that information obtained from this research may be used in future research and may be published provided that my right to privacy will be retained. I have read the procedure as set out in the information provided and I understand the benefits and risks involved. My participation in the project is voluntary. I acknowledge I we have the right to question any part of the procedure and can withdraw at any time without negative consequences.

School Principal Behavior Scale (Rothmann & Fouché, 2018)

Our school leaders

1. encourage me to participate in important decisions
2. encourage me to speak up when I disagree with a decision
3. encourage everyone to speak about what they feel
4. listen carefully to different points of view before making conclusions
5. seek feedback to improve interactions with others
6. take the time to learn about my career goals and aspirations
7. care about whether or not I achieve my goals
8. make sure I get the credit when I accomplish something substantial on the job
9. give me helpful feedback about my performance
10. give me helpful advice about improving my performance when I need it
11. support my attempts to acquire additional training or education to further my career
12. treat people fairly
13. are committed to protecting my interests
14. do what they say they will do
15. can be trusted
16. are accessible
17. have confidence in my abilities

Revised Motivation at Work Scale (Gagné et al., 2015)

Why do you or would you put efforts into your current job as a teacher?
1. Because I have fun doing my job.
2. Because what I do in my work is exciting.
3. Because the work I do is interesting.
4. Because I personally consider it important to put efforts into this job.
5. Because putting efforts into this job aligns with my personal values.
6. Because putting efforts into this job has personal significance to me.

Teacher as a Social Context – Teacher Version (Iglesias-García et al., 2020)

In my classes…
1. I talk with my students.
2. The students can count on me to be there for them.
3. I spend time with the students.
4. I understand my students very well.
5. When my students don't comprehend the material, I take a different approach.
6. I show the students different ways to solve problems.
7. I try to be clear with the students about what I expect of them in class.
8. When the students don't understand something, I explain it in a lot of different ways.
9. I encourage the students to think about how schoolwork can be useful for them.
10. I explain to the students why we learn certain things in school.
11. I try to give my students a lot of choices about classroom assignments.
12. I let my students make a lot of their own decisions regarding schoolwork.

Mental Health Continuum Short Form (Keyes et al., 2008)

In the past month, how often did you feel…

1. Happy
2. Interested in life
3. Satisfied
4. That you had something important to contribute to society
5. That you belonged to a community (like a group of friends, at school or in the neighborhood)
6. That our society is becoming a better place for people
7. That people are basically good
8. That the way our society works makes sense to you
9. That you liked most parts of your personality
10. Good at managing the responsibilities of your daily life
11. That you had warm and trusting relationships with others
12. That you have experiences that challenge you to grow and become a better person
13. Confident to think or express your own ideas and opinions
14. That your life has a sense of direction or meaning to it

General Anxiety Disorder Scale and Patient Health Questionnaire Ultrashort Form (GAD2 and PHQ2; Kroenke et al., 2009; Staples et al., 2019)

Please rate yourself how often do you experience the following situations.

1. Feeling nervous, anxious, or on edge.
2. Not being able to stop or control worrying.
3. Little interest or pleasure in doing things
4. Feeling down, depressed, or hopeless.

Appendix F: Student Questionnaire Used in Study 3

Information

In this online survey, you will find questions that asks about some personal information, your views about your teacher, your dispositions, and beliefs in studying and learning. There are no right or wrong answer and your answers will in no way affect your grades. We are only interested to know your views. This survey will take about 15-20 minutes to complete depending on your pace. Please answer as accurately as you can.

As part of the research, the principal investigator also asks your permission to obtain from the school a copy of your general grade average at the end of the grading period. Your grades will be treated confidentially and will not be shared to anybody. The study intends to correlate your answers with your grade. It is therefore essential that you enter your valid student identification number. Your student ID number is accessible only to the principal investigator and will only be used for the study. Your identity will be kept confidential.

The principal investigator will be presenting the results of the study to scholars and school administrators in the form of journal articles, educational conferences, and professional development sessions. However, all responses will be anonymized, and we will only present the average results from all the participants in the study. Your privacy will be respected, and all your answers will be anonymized. Data will be used purely for research purposes.

No potential risks or discomfort are expected in this study. Please understand that your participation is voluntary. You have every right to withdraw from the study at any time without negative consequences.

If you would like to obtain more information about this study, please contact Fr. Joseph Haw by email at [redacted] or his supervisor Dr. Wing Sze Wincy Lee at wwslee@eduhk.hk. If you have any concerns about the conduct of this research study, please do not hesitate to contact the Human Research Ethics Committee by email at hrec@eduhk.hk or by mail to Research and Development Office, The Education University of Hong Kong.

Thank you for your interest in participating in this study.

Fr. Joseph Yap Haw,SJ
Principal Investigator

Conforme

I hereby agree to participate in the abovementioned project. I understand that information obtained from this research may be used in future research and may be published. However, my right to privacy will be retained (i.e., my personal details will not be revealed). I fully understand and agree with the procedure as set out in the attached information. I understand the benefits and risks involved. My participation in the project is voluntary. I acknowledge I we have the right to question any part of the procedure and can withdraw at any time without negative consequences

Teacher as a Social Context – Student Version (Ahn et al., 2019)

In my class, my teachers
1. ...give me a lot of choices about how I do my schoolwork.
2. ...listen to my ideas.
3. ...talk about how I can use the things we learn in school.
4. ...explain why what I do in school is important to me.
5. ...like me.
6. ...really care about me.
7. ...spend time with me.
8. ...talk with me.
9. ...make sure I understand before they go on with the lesson.
10. ...check to see if I'm ready before they start a new topic.
11. ...make it clear what they expect of me in class.
12. ...show me different ways to try when I can't solve a problem.

Academic Self-regulation Scale (Vansteenkiste et al., 2009)

Why are you studying for your classes? I am studying because...
1. …I want to learn new things.
2. …it is personally important to me.
3. …this represents a meaningful choice to me.
4. …this is an important life goal to me.
5. …I am highly interested in doing this.
6. …I enjoy doing it
7. …it's fun.
8. …it's an exciting thing to do.

Student Engagement Subscales (Jang et al., 2016)

1. I listen very carefully.
2. I pay attention in class.
3. I try hard to do well in class.
4. In class, I work as hard as I can.
5. I participate in class discussions.
6. When we work on something in class, I feel interested.
7. My class is fun.
8. When I'm in class, I feel good.
9. I enjoy learning new things in my class
10. When we work on something in this class, I get involved.
11. When I am reading in my subjects, I try to explain the key concepts in my own words.
12. When learning about a new topic, I usually try to summarize it in my own words.
13. When I am reading for my subjects, I try to connect the ideas I am reading about with what I already know
14. When thinking about the concepts in my subjects, I try to generate examples to help me understand them better.
15. I try to explain the key concepts in my own words.
16. When learning about a new topic for my subjects, I usually try to summarize it in my own words.
17. When I am reading for my subjects I try to connect the ideas I am reading about with what I already know

Appendix G: Ethics Approval

香港教育大學
The Education University of Hong Kong

8 January 2021

Mr HAW Joseph Yap
Doctor of Education Programme
Graduate School

Dear Mr Haw,

Application for Ethical Review <Ref. no. 2020-2021-0171>

I am pleased to inform you that approval has been given by the Human Research Ethics Committee (HREC) for your research project:

Project title: Antecedents and Consequences of Need Supportive Teaching

Ethical approval is granted for the project period from 8 January 2021 to 15 September 2021. If a project extension is applied for lasting more than 3 months, HREC should be contacted with information regarding the nature of and the reason for the extension. If any substantial changes have been made to the project, a new HREC application will be required.

Please note that you are responsible for informing the HREC in advance of any proposed substantive changes to the research proposal or procedures which may affect the validity of this ethical approval. You will receive separate notification should a fresh approval be required.

Thank you for your kind attention and we wish you well with your research.

Yours sincerely,

[redacted]

Patsy Chung (Ms)
Secretary
Human Research Ethics Committee

Appendix H: Publications Statement

Details of publication:
Full title: ***Need supportive teaching is associated with greater reading achievement: What the Philippines can learn from PISA 2018***
Authors: Joseph Y Haw, Ronnel B King, & Jose Eos R Trinidad
Journal or book name: International Journal of Educational Research (EdUHK Rank: A)
Volume/page numbers: Volume 10 Article 101864
Date accepted/published: 09 September 2021 https://doi.org/10.1016/j.ijer.2021.101864

Status [1]	*Published*	✓	*Accepted and In press*		*In progress (submitted)*	

The Candidate's Contribution to the Work
Methods (parallel computational analysis in lme4 package in R), Formal analysis; Writing - Original Draft / Review & Editing

Candidate's Name	*Candidate's Signatu*	*Date (dd/mm/yy)*
Joseph Y Haw	[redacted]	24 May 2022

Co-author's Contribution to the Work (Name of co-author: Dr. Ronnel B King) [2]
Conceptualization; Supervision; Validation; Writing – Review & Editing

Co-author's Contribution to the Work (Name of co-author: Jose Eos R Trinidad) [2]
Methods (draft methods section, parallel computational analysis in HLM), Validation, Writing – Review & Editing

Co-authors' Declaration I declare that:
- I have read the declaration from the all authors
- The information is correct and the description of their contribution is in accordance with my view

Co-author's Name	*Co-author's Signature*	*Date (dd/mm/yy)*
Dr. Ronnel B King	[redacted]	25 May 2022
Co-author's Name	*Co-author's Signature*	*Date (dd/mm/yy)*
Jose Eos R Trinidad	[redacted]	24 May 2022

Details of publication:
Full title: ***Need-supportive teaching is associated with reading achievement via intrinsic motivation across eight cultures***
Authors: Joseph Y Haw & Ronnel B King
Journal or book name: Learning and Individual Differences (EdUHK Rank: A)
Volume/page numbers: [redacted] Volume 97, Article 102161 (advanced online version)
Date accepted/published: [redacted] Accepted 15 May 2022 doi: 10.1016/j.lindif.2022.102161

Status [1]	*Published*	✓	*Accepted and In press*	[redacted]	*In progress (submitted)*	

The Candidate's Contribution to the Work
Conceptualization; Writing - Original Draft / Review & Editing; Methods, Formal analysis

Candidate's Name	*Candidate's Signa*	*Date (dd/mm/yy)*
Joseph Yap Haw	[redacted]	24 May 2022

Co-author's Contribution to the Work (Name of co-author: Dr. Ronnel B King) [2]
Conceptualization; Supervision; Validation; Writing – Review & Editing

Co-authors' Declaration I declare that:

- I have read the declaration from the all authors.
- The information is correct and the description of their contribution is in accordance with my view.

Co-author's Name [2]	*Co-author's Signature*	*Date (dd/mm/yy)*
Dr. Ronnel B King	[redacted]	25 May 2022

Details of publication:

Full title: ***Need-supportive leadership, need-supportive teaching, and student engagement: a self-determination theory perspective***

Authors: Joseph Y Haw & Ronnel B King

Journal or book name: Social Psychology of Education (EdUHK Rank: A)

Volume/page numbers: N/A

Date accepted/published: N/A (submitted May 23, 2022)

Status [1]	*Published*		*Accepted and In press*		*In progress (submitted)*	✓

The Candidate's Contribution to the Work

Conceptualization; Writing - Original Draft / Review & Editing; Methods, Formal analysis

Candidate's Name	*Candidate's Sig*	*Date (dd/mm/yy)*
Joseph Yap Haw	[redacted]	24 May 2022

Co-author's Contribution to the Work (Name of [illegible]or: Ronnel B King) [2]

Conceptualization; Supervision; Validation; Writing – Review & Editing

Co-authors' Declaration I declare that:

- I have read the declaration from the all authors.
- The information is correct and the description of their contribution is in accordance with my view.

Co-author's Name [2]	*Co-author's Signature*	*Date (dd/mm/yy)*
Dr. Ronnel B King	[redacted]	25 May 2022

Details of publication:

Full title: ***Need-supportive leadership optimizes teacher well-being: Variable and person-centered approaches***

Authors: Joseph Y Haw, Ma. Jenina N. Nalipay, & Ronnel B King

Journal or book name: Teachers and Teaching: Theory and Practice (EdUHK Rank: A)

Volume/page numbers: N/A

Date accepted/published: N/A (submitted May 1, 2022)

Status [1]	*Published*		*Accepted and In press*		*In progress (submitted)*	✓

The Candidate's Contribution to the Work

Conceptualization, Methods (data collection, computational analysis), Formal analysis; Writing - Original Draft / Review & Editing

Candidate's Name	*Candidate's Sign*	*Date (dd/mm/yy)*
Joseph Y Haw	[redacted]	24 May 2022

Co-author's Contribution to the Work (Name of co-author: Dr. Ma. Jenina N. Nalipay)

Conceptualization; Writing – Review & Editing

Co-author's Contribution to the Work (Name of co-author: Ronnel B King) Conceptualization; Supervision; Validation; Writing – Review & Editing		
Co-authors' Declaration I declare that: • I have read the declaration from the all authors • The information is correct and the description of their contribution is in accordance with my view		
Co-author's Name ***Dr. Ronnel B King***	*Co-author's Signature* [redacted]	*Date (dd/mm/yy)* 25 May 2022
Co-author's Name **Dr. Ma. Jenina N. Nalipay**	*Co-author's Signature* [redacted]	*Date (dd/mm/yy)* 24 May 2022

Candidate's Declaration

I declare that:

- I have complied with the Thesis Examination Procedure
- The publications I have include in the folio meet the requirements for the submission of folios, and the publications are listed below.

Name	**Signature**	**Date (dd/mm/yy)**
Joseph Y. Haw	[redacted]	25 May 2022

Principal Supervisor's Declaration

I declare that:

- The information above is accurate
- The thesis proposal presentation panel / qualifying examination panel has approved this candidate to submit their research work in the form of a folio (Date of approval: 10-December- 2020)
- All of the co-authors of the publications included have reviewed the above information and signed in the appropriate places

Supervisor's Name	**Supervisor's Signature**	**Date (dd/mm/yy)**
Dr. Wincy Lee Wing Sze	[redacted]	26 May 2022

Programme Director's Declaration

I declare that:

- The information above is accurate
- The listed publications are included in compliance with the requirements for the submission of folios
- The minimum requirements for the format of the folio have been met.

Name	**PD's Signature**	**Date (dd/mm/yy)**
Dr LEE Kwai Sang	[redacted]	22/6/2022