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School social organization influences adolescents' cognitive engagement with school: The role of school support for learning and of autonomy support

Paulo A.S. Moreira[a]

Valerie E. Lee[b]

[a]*Instituto de Psicologia e de Ciências da Educação, Universidade Lusíada-Norte (Porto), Centro de Investigação em Psicologia para o Desenvolvimento (CIPD), Porto; Observatório da Melhoria e da Eficácia da Escola, Porto, Portugal. Email: paulomoreira@por.ulusiada.pt*
[b]*University of Michigan, USA. Email: velee@umich.edu*

Corresponding Author: Professor Paulo Moreira, Centro de Investigação em Psicologia para o Desenvolvimento (CIPD), Rua Dr. Lopo de Carvalho, 4369-006, Porto, Portugal
E-mail: paulomoreira@por.ulusiada.pt

Abstract

School-effects research has provided insights into what schools can do to keep their students engaged. Further studies with a multidimensional perspective of engagement are required to elucidate the precise roles of different features of school social organization in promoting different dimensions of engagement. This longitudinal study examined the influences of social support from teachers and peers, as well as autonomy support, on students' trajectories of cognitive engagement. The sample ($n = 2646$) included two cohorts of students who attended the same schools ($n = 70$) across two academic years: between 7th and 8th, and 10th to 11th grades. Given the multilevel nature of our research question, we used Hierarchical Linear Modeling (HLM) methods. Cognitive engagement declined over time. This decline was less pronounced in schools where social support from peers and autonomy support were more prevalent. These findings are important because they imply schools can lessen their students' declining cognitive engagement by promoting social support and autonomy support.

Keywords: Adolescence; student engagement; school social organization; longitudinal; multilevel.

School social organization influences adolescents' cognitive engagement with school:

The role of social support and autonomy support

1 Introduction

Students who are engaged with school typically feel a sense of connectedness with the school context, experience positive emotions in class, think that their schoolwork is relevant for future goals, use adaptive cognitive strategies to learn (Moreira, Inman, Rosa et al., 2020), and participate well in learning tasks (Appleton, Christenson, & Furlong, 2008; Fredricks, Blumenfeld, & Paris, 2004; Reschly & Christenson, 2012). A substantial body of research has shown that engaged students have a tendency to achieve better academic performance (Chase, Hilliard, Geldhof, Warren, & Lerner, 2014; Wang & Eccles, 2012a), better wellbeing (Paloș, Maricuțoiu, & Costea, 2019; Wang, Chow, Hofkens, & Salmela-Aro, 2015), and to have a reduced risk of early dropout (Wang & Fredricks, 2014). Given its potential to foster positive development and address educational problems such as school dropout, the importance of engaging all students is well understood by schools and educators (Fredricks, Filsecker, & Lawson, 2016). However, a challenge to promoting engagement and its associated outcomes is the observed trend for students to disengage with school as they progress through their academic careers (Engels et al., 2017; Janosz, Archambault, Morizot, & Pagani, 2008; Wang & Eccles, 2012a, 2012b). In brief, the general objective of the present study was to develop our understanding of what schools can do to keep their students engaged.

1.1 Student Engagement: Theoretical Framework

A prevalent conceptualization of student engagement with school is of a construct with multiple characteristics. Firstly, student engagement is typically regarded to have

three major dimensions, each with numerous indicators, that capture the way individuals

feel (emotional), think (cognitive), and act (behavioral) in the context of school

(Appleton, Christenson, Kim, & Reschly, 2006; Fredricks et al., 2004; Moreira, Cunha, &

Inman, 2019). A second characteristic of student engagement is that it manifests as the

interaction between contextual factors and outcomes (Appleton et al., 2006; Connell &

Wellborn, 1991). It is, therefore, normally assumed that student engagement is malleable

(Fredricks et al., 2004). To capture its interactive nature, multiple student engagement

frameworks incorporate students' perceptions of important social influences as a way to

assess the 'goodness of fit' between students and their school contexts (Appleton et al.,

2006; Fredricks et al., 2016; Moreira et al., 2019).

It is possible to understand this interactive characteristic of student engagement

via Self-Determination Theory (SDT; Deci & Ryan, 2008; Reeve, 2002), a macrotheory

of human motivation. According to basic needs theory, one of the component

minitheories of SDT, student engagement is influenced by the degree to which the school

context provides conditions for the student to meet three basic psychological needs.

These needs are for competence (sense of self-efficacy and capacity to achieve),

autonomy (sense of agency and control), and relatedness (sense of support from others

and connectedness) (Connell & Wellborn, 1991; Ryan & Deci, 2000). Thus, student

engagement is maximized when schools provide conditions that allow students to feel

competent, autonomous, and supported by others.

1.2 School Social Organization

As described in section 1.1, student engagement is responsive to, and shaped by,

contextual factors (Appleton et al., 2006; Connell & Wellborn, 1991). A clear implication

of this characteristic is that students' engagement depends on the schools they attend and the teachers who instruct them. An important question that follows concerns discerning the specific characteristics of schools and teachers that are most relevant to promoting engagement.

A robust body of evidence, particularly in the sociology of education, describes schools as complex social organizations. Conceptual frameworks suggest that schools may be characterized along several major dimensions including; school structure (e.g. school size and type), social composition (student demographics), academic organization (e.g. curricula on offer), and social organization (interpersonal structures) (Lee & Burkam, 2003; Wang & Degol, 2016). Our focus is on the last of these dimensions, school social organization, which describes the interpersonal structures for providing students with the conditions they need to meet their basic psychological needs. We focus on this particular dimension because there is considerable evidence that these interpersonal structures are important for understanding how schools influence their students (Engels et al., 2017; Moreira et al., 2018; Roorda, Jak, Zee, Oort, & Koomen, 2017; Wang & Eccles, 2012b). To understand more fully what schools can do to engage their students it is important to acknowledge that school social organization is itself multidimensional, and that its impact on student functioning happens via various routes (Curtin & McGarty, 2016). For the purpose of the present study, we shall consider how school social organization influences developmental trajectories of engagement via the provision of social support and autonomy support.

1.2.1 Social support. Social support captures the functions of emotional, informational, and instructional assistance performed for the individual by others within

primary and secondary social groups (Thoits, 2011). A distinction can be made between types of supporters; those deemed to be important to the individual but who may not have direct experience with a certain stressor (significant others), and those who share a common experience (similar others). Teachers and peers thus represent two distinct sources of support at school. In the school context, teachers are primary agents for providing various forms of support (see Lei, Cui, & Chiu, 2018) but do not share a common experience with students. Thus they can be considered as significant others, but not similar others. In contrast, students' peers represent experientially similar others, with students' close friends at school being both significant others and similar others. According to Thoits (2011), both types of supporter offer emotional sustenance and active coping assistance, although the forms and relative efficacy of these types of support will differ for each. Instrumental support and the provision of information, advice, and coping encouragement are argued to be more frequent from significant others. For similar others, empathic understanding, knowledgeable advice, and role modelling are likely to be major and effective forms of support.

Although from different school-based sources, social support from both teachers and peers corresponds theoretically to the fulfillment of students' basic psychological needs. The provision of emotional sustenance by teachers and peers in particular, according to SDT, is likely to fulfil students' needs for relatedness. This association is largely supported by research evidence (Cox, Duncheon, & McDavid, 2009; Sparks, Dimmock, Lonsdale, & Jackson, 2016). Moreover, according to attachment perspectives (Birch & Ladd, 1997; Bowlby, 1988), students with secure personal relationships at

school are more likely to approach school with confidence and a sense of security, thus helping to fulfil the needs of autonomy and competence (Cox & Williams, 2008).

Because engagement should be maximized when students' psychological needs are met (Connell & Wellborn, 1991), it follows that engagement with school should be associated closely with social support from teachers and peers, and indeed this hypothesis is typically supported by engagement research. As an illustration, a meta-analyses found an overall effect size of $r = .39$ across 61 studies for the association between positive teacher support and engagement (Roorda, Koomen, Spilt, & Oort, 2011). A more recent meta-analysis with an updated sample further demonstrated that this effect was still evident when only considering longitudinal studies (Roorda et al., 2017). Such meta-analyses have not yet been conducted to test the link between peer-support and student engagement, although numerous studies provide evidence of this association. A study by Engels et al. (2017), for example, showed that students' acceptance by his/her peer group was positively associated with student emotional and behavioral engagement in the seventh grade. A one-year longitudinal study by Wang and Eccles (2013) showed that peer emotional support in the seventh grade was significantly predictive of behavioral, emotional, and cognitive engagement in the eighth grade. Further studies have shown that the quality of peer friendships is linked to behavioral engagement with school (Lynch, Lerner, & Leventhal, 2013), and that membership in larger, more stable, friendship groups is associated with increased engagement (Kindermann, 2007). Finally, Wang and Eccles (2012) showed that peer emotional support reduces the tendency for student engagement to decrease between the seventh and 11th grades. Both peer- and teacher-

support have been shown to be important buffers against the negative influence of poor academic performance on cognitive engagement (Moreira et al., 2018).

1.2.2 Autonomy support. In addition to social support, we also focus on teachers' promotion of autonomous learning. Schools that offer autonomy support have teaching staff that give students the freedom to determine their own behaviors and provide classroom activities that are congruent with students' goals (Assor, Kaplan, & Roth, 2002). Such schools are characterized by a provision of choice (or clear rationales for mandatory tasks), few external controls, and shared decision-making between students and teachers (Fredricks et al., 2004).

According to basic needs theory, the provision of autonomy support by teachers should satisfy all three psychological needs. Numerous studies support this theoretical proposition. For example, a cross-sectional study by Jang, Reeve, Ryan, and Kim (2009; Study 2) showed that autonomy support was positively linked to autonomy satisfaction (β = .47), competence satisfaction (β = .40), and relatedness satisfaction (β = .37). Based on these findings it is unsurprising that research also links autonomy support to higher student engagement. A recent longitudinal study by Jang, Kim, and Reeve (2016), for example, showed that perceived autonomy support was linked to increases in engagement over time via changes in need fulfilment. Finally, a study of university students revealed moderate-to-large associations between perceived autonomy support and a composite measure of student engagement (Gutiérrez & Tomás, 2019).

1.3 School Social Organization and Cognitive Engagement

As we have outlined, basic needs theory posits that certain school characteristics, including the provision of social support and autonomy support, will promote student

engagement via the satisfaction of their needs for autonomy, relatedness, and competence (Connell & Wellborn, 1991). We have provided multiple examples of studies that describe positive associations between school social characteristics and student engagement. There are, however, reasons to continue to examine these associations in more detail. We shall focus on the interesting finding that despite the predictions of SDT, features of school social organization do not appear to influence student cognitive engagement consistently across studies.

The longitudinal study by Wang and Holcombe (2010), for example, showed that neither students perceptions of autonomy support nor students perceptions of teacher social support in the 7th grade were significantly associated with student cognitive engagement at the end of 8th grade. A second longitudinal study by Wang and Eccles (2013) also failed to identify direct effects between students perceptions of autonomy support and teacher social support in the 7th grade, and students' cognitive engagement in the 8th grade. Further, a multilevel study by Hospel and Galand (2016) found that cognitive engagement was unrelated to autonomy support at the classroom level. In contrast, other studies using similar measures have shown significant positive associations between cognitive engagement and autonomy support (Wang et al., 2017).

One possible explanation for this pattern of results concerns the way these authors conceptualized cognitive engagement. Engagement theorists have argued that an accurate description of cognitive engagement requires the integration of constructs from the learning and instruction literature (i.e. cognition and learning strategies), and constructs from the study of psychological investment and motivation (i.e. students' perceptions, beliefs, goals, and attitudes about school) (Fredricks et al., 2004). In line with this

perspective, current frameworks, such as that of Appleton et al. (2006, 2008), define cognitive engagement as an integration of constructs, such as "self-regulation, relevance of schoolwork to future endeavors, value of learning, and personal goals and autonomy" (p. 429). It is noteworthy that the studies by Wang and colleagues (Wang & Eccles, 2013; Wang & Holcombe, 2010) and Hospel and Galand (2016) all defined cognitive engagement uniquely in terms of the use of self-regulated learning strategies, thus failing to capture the motivational component of cognitive engagement. Because SDT states that students should be more motivated when their basic needs are met, it is likely that a stronger association between features of school social organization and cognitive engagement will be observed if studies measure the motivational, rather than self-regulatory, aspects of this dimension. Indeed, a further study by Wang and Eccles (2012b) showed that increased peer and teacher social support, modelled at the school-level, were linked to reduced decreases in student motivation and task valuing in school.

1.4 Aims and Hypotheses

In the present study, using a longitudinal design (Hypothesis 1), we aimed to expand our understanding about the effects of different features of school social organizations (both social support and autonomy support) on student cognitive engagement with school. This was done in the context of the Portuguese education system. All children and adolescents in Portugal have been required to complete 12 years of compulsory education since 2009. Since the 2009 law extending compulsory education to 12 years, the increase of students attending secondary school has been a challenge for the Portuguese educational system. Specifically, Portuguese schools have faced the challenge of keeping the first waves of students obliged to attend secondary school

engaged. These unique policy circumstances suggest that research focusing on the interaction between school features and adolescents' engagement in Portugal may provide useful insights on how schools can improve students' educational prospects.

To address a pattern of null results in prior works (described in section 1.3), we defined cognitive engagement in terms of psychological investment and motivation (i.e. students' perceptions, beliefs, goals, and attitudes about school) rather than the use of self-regulated learning strategies (Hypotheses 2 and 3, respectively). We tested the three specific research hypotheses via HLM:

1. Hypothesis 1: students' cognitive engagement with school will decrease over time, indicating a trajectory of disengagement.

2. Hypothesis 2: school-level social support (from two distinct sources, i.e. teachers and peers) will be positively related to change in students' cognitive engagement.

3. Hypothesis 3: school-level autonomy support will be positively related to change in students' cognitive engagement.

2 Method

2.2 Sample

The student sample comprised adolescent participating in the first two waves of a longitudinal study into the influence of school characteristics on student engagement. The sample was representative of students and schools in Portugal. We collected Wave 1 data at the start of the academic year starting in 2013 (September - December 2013). We collected Wave 2 data at the end of the following academic year (May - June 2015). The two Waves thus correspond closely to the completion of two academic years. The Wave-1 sample comprised 4,054 students (attending 104 schools), from two cohorts of

approximately equal size. The first cohort consisted of students enrolled in the first year of middle school (7th grade). The second cohort was composed of students enrolled in the first year of secondary school (10th grade).

The educational system in Portugal is organized in four phases: First cycle (Grades 1 to 4; age 6 - 10 years), Second cycle (Grades 5 and 6; age 10 - 12), Third cycle (Grades 7 to 9; age 12 – 15 years), and Secondary education (Grades 10 to 12; age 15 – 18 years). Most schools are public, and most private schools are Catholic. For the present study, the sampled schools were of three types: Middle schools (offering second and third cycles), Secondary Schools (offering secondary education), and Mixed-grade schools (offering third cycle and secondary education). These types of schools do not present substantive differences with the exception of the phases of education they offer. Any student can go to any type of school provided that the desired type of school exists in the area in which he/she resides.

To identify the sample for the current study, we followed a complex rationale (see Appendix A). The selection criteria resulted in a decline in sample size between Waves 1 and 2 of about one-third. The reasons for sample decline explained in Appendix A are not unusual for longitudinal studies.

Although smaller, the final longitudinal Wave 2-sample was sufficiently large to support our analytic methods. The Wave-2 longitudinal sample consisted of 2,646 students attending 70 schools (see Table 1). The longitudinal sample contained more students in the younger than the older cohort (55% vs 45%), and more females than males (53% vs. 47%). At Wave 1, students in the younger cohort had a mean age of 12.4 years ($SD = 0.6$) and students in the older cohort had a mean age of 15.5 years ($SD = 0.9$). The

70 schools attended by the longitudinal sample students were mostly public (21% private schools). The schools were of three types: Middle schools (26%), Mixed-grade schools (62.9%), and Secondary schools (11%).

2.3 Data collection.

　　2.3.1 Schools. Prior to collecting data, we obtained approval from the Ethics Committee of the [*anonymous*], Portugal. We adopted the national territorial distribution of schools as strata for school sampling. Schools in Portugal are located in five regions: Northern, Central, Lisbon, Southern, and the Islands. We selected schools from the Northern, Central, and Lisbon regions. These are the most populated regions and thus where most schools are located. We considered middle and mixed-grade schools that included 7th to 9th grades, and all secondary schools in these regions.

　　2.3.2 Students. When recruiting students at Wave 1 from the selected schools, we requested that schools provide an average test score (based on standardized national exams in Math and Portuguese from the previous year) for each of the classes in the 7th and/or 10th grades. Our purpose was to maximize the representativeness of our student sample in terms of academic performance. We then recruited students from three classes from each target grade in all schools (thus in mixed-grade schools we recruited students from six classes). These classes corresponded to those with a lower-than-average, average, and higher-than-average ability, based on average test scores. To allow for a natural variance of classroom characteristics and student demographics all students from the selected classes were asked to participate in the study. At Wave 2, we returned to the same samples of schools and students from Wave 1.

Our data collection strategy at Wave 2 was identical to at Wave 1. In each participating school, a member of school staff acted as a liaison between the school and the research team. This school representative planned the internal procedures for data collection. Questionnaires were administered to classes of students, gathered in a single room, under the supervision of the school representative. Classroom sizes had an average size for typical Portuguese schools (about 10-15 students per class).

2.4 Measures

2.4.1 Student cognitive engagement. To measure the major dependent construct, we used the cognitive engagement scale of the Student Engagement Instrument (SEI; Appleton, Christenson, Kim, & Reschly, 2006). A Portuguese version of this instrument has been validated for use with Portuguese adolescents (Moreira & Dias, 2018; Moreira, Vaz, Dias, & Petracchi, 2009). The cognitive engagement scale of the Portuguese SEI (see Appendix B for items) comprises two dimensions: perceptions of control and relevance of schoolwork (6 items; e.g. "What I'm learning in my classes will be important in my future"), and future aspirations and goals (3 items; e.g. "I plan to continue my education following high school"). The internal consistency of the cognitive engagement scale in the study sample was good ($\alpha = .77$). Each item requires a response from 1 (*strongly disagree*) to 4 (*strongly agree*).

2.4.2 Student control variables. Our analytic models included several student characteristics for the purpose of statistical control, including gender (female = 1, male = 0) and parent education (median score for both parents based on a scale ranging from 1 = 4th grade to 9 = PhD). Student cohort was coded as 10th grade at Wave 1 = 1; 7th grade at Wave 1 = 0. We used students' scores on standardized national Math and Portuguese

exams as our measure of academic performance. For each data collection wave, scores were for the exams taken at the end of the prior year (including the year prior to Wave 1). The Math exam, for which students could take up to 2 hours, comprised two parts; one in which a calculator is allowed and a second where it is forbidden. Questions were of mixed format, including some multiple-choice questions and other computational questions. The Portuguese exam, which also had a limit of 2 hours, comprised one paper with multiple choice, short answer, and an essay question. For all students these exams were graded on a scale between 0 and 5. We obtained these scores from school records. For our analyses, we used the mean exam score across the Math and Portuguese tests.

2.4.3 School social support. We measured students' perceptions of social support at school from two distinct sources: teachers and peers. This was done using two scales from the Portuguese SEI (Moreira et al., 2009):

2.4.3.1 School social support (teachers). We measured students' perceptions of social support from teachers using the SEI's Teacher-Student Relationships scale. This has 8 items (e.g. "My teachers are there for me when I need them") that require a response between 1 (*strongly disagree*) and 4 (*strongly agree*). The internal consistency of this measure in our sample was good ($\alpha = .81$).

2.4.3.2 School social support (peers). We measured students' perceptions of peer social support using the SEI's Peer Support for Learning scale. This has 6 items (e.g. "Other students at school care about me") scored from 1 (*strongly disagree*) and 4 (*strongly agree*). In our sample, the internal consistency of this measure was good ($\alpha = .75$).

2.4.4 School autonomy support. We used 6 items from the Students' Perceptions of School Success Promoting Strategies Inventory (Moreira, Oliveira, Dias, Vaz, & Torres-Oliveira, 2014) to assess students' perceptions of the strategies used by their teachers to foster autonomous learning (see Appendix C). These items were rated on a 4-point Likert scale from 1 (*totally disagree*) to 4 (*totally agree*). The internal consistency of this measure in our sample was good ($\alpha = .75$).

We aggregated the measures of social support (teachers and peers) and autonomy support to the school level. Thus, we do not focus on how students' views in the same school differ on these measures of school social organization. Rather, we focus on agreement between students in the same school, and how schools differ, based on reports from their samples of students. Thus, our focal measures of school social organization define schools.

2.4.5 School control variables. We included measures of school structure and composition for the purpose of statistical control. The measures of school structure included sector (public vs. private), and type of school (middle school, mixed-grade school, or secondary school). We controlled for school composition by including school average parental education. In Portugal, differences in academic organization (i.e. curricular offer) vary as a function of school structure and so we did not include additional control variables.

2.5 Data analysis.

The initial phase of analysis involved testing differences between students and schools in the longitudinal Wave 2 sample, and students and schools that were in Wave 1 but not in Wave 2 (the study dropout group). We tested differences between these two

independent groups of students and schools with t-tests for continuous variables and cross-tabulation for categorical variables.

To test change in cognitive engagement over time we used a repeated-measures ANOVA. We were interested in both the direction of change and whether there was a difference in engagement change between the two cohorts of students. Thus, our ANOVA also explored a possible interaction between wave and cohort.

2.5.1 Hierarchical linear modeling. As our major research questions were multilevel, we employed Hierarchical Linear Modeling (HLM) using HLM 7 (Raudenbush et al., 2011). For a detailed explanation of this methodology we refer you to Raudenbush and Bryk (2002). We explored a 2-time-point change in HLM using a two-moment longitudinal design, with cognitive engagement at Wave 2 as the dependent variable and cognitive engagement at Wave 1 as an independent variable. Using a simple difference score was not appropriate for this study. Even though on average students' cognitive engagement declined over the two waves (see Figure 1), for some students cognitive engagement either did not change or actually increased (see also Janosz et al., 2008). Such directional ambiguity of the phenomenon under study suggested that using a simple difference score as the dependent variable would make interpretation of results impossible. Moreover, using a difference score requires the assumption that without school effects there would be no change in cognitive engagement between waves (Wright, 2019).

We used 2-level HLM models, with students (Level 1) nested in schools (Level 2). The Level-1 HLM model included several student-level independent variables, most importantly cognitive engagement at Wave 1, but also statistical controls for cohort

(older vs. younger), gender (females vs. males), parental education (a proxy for socioeconomic status), and academic performance at Wave 2. Because the large majority of variance in cognitive engagement at Wave 2 was explained by cognitive engagement at Wave 1, the amount of residual variance in Wave-2 engagement between schools left to explain was modest. Thus, the Level-2 HLMs, which tested hypotheses 2 and 3, included the two measures of school social organization separately. We also included controls for school structure and composition.

A 2-Level HLM exploration of school-effects typically includes three steps (Lee, 2000). Step 1, the fully unconditional model (Model 1), partitions the variance in the dependent variable into its with-school and between-school components. This analysis allows us to compute the Intra-Class Correlation (ICC): the proportion of overall variance in the dependent variable that lies systematically between schools. Only the between-school variance in the outcome may be modeled as a function of school variables. Step 2 was the Level-1 (within-school) model (Model 2), the equation for which is:

$$ENGAGMENT\ W2_{ij} = \beta_{0j} + \beta_{1j}*(GENDER_{ij}) + \beta_{2j}*(COHORT_{ij}) + \beta_{3j}*(ENGAGMENT\ W1_{ij}) + \beta_{4j}*(ACADEMIC\ PERF\ W2_{ij}) + \beta_{5j}*(PARENT\ EDUCATION_{ij}) + r_{ij} \qquad (1)$$

$$\beta_{0j} = \gamma_{00} + u_{0j} \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (2)$$
$$\beta_{1j} = \gamma_{10}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30} + u_{3j}$$
$$\beta_{4j} = \gamma_{40}$$
$$\beta_{5j} = \gamma_{50}$$

In Step 3, we tested hypotheses 2 and 3 (Models 3 - 5). Because of the extensive controls in the Level-1 HLM model (especially prior cognitive engagement), the Level-2 HLM models allows us to identify whether (and how) school social organization is

related to decline over time in students' cognitive engagement with school, after taking

into account several other important demographic and academic characteristics of

students and schools. The equation for Model 3 is:

$ENGAGMENT\ W2_{ij} = \beta_{0j} + \beta_{1j}*(GENDER_{ij}) + \beta_{2j}*(COHORT_{ij}) + \beta_{3j}*(ENGAGMENT\ W1_{ij})$
$+ \beta_{4j}*(ACADEMIC\ PERF\ W2_{ij}) + \beta_{5j}*(PARENT\ EDUCATION_{ij}) + r_{ij}$ $\qquad$ (3)

$\beta_{0j} = \gamma_{00} + \gamma_{01}*(TEACHER\ SOCIAL\ SUPPORT_j) + \gamma_{02}*(MEAN\ PARENT\ EDUCATION_j) +$
$\gamma_{03}*(PRIVATE\ VS\ PUBLIC_j) + \gamma_{04}*(MIDDLE\ VS\ MIXED_j)$
$+ \gamma_{05}*(SECONDARY\ VS\ MIXED_j) + u_{0j}$ $\qquad$ (4)
$\beta_{1j} = \gamma_{10}$
$\beta_{2j} = \gamma_{20}$
$\beta_{3j} = \gamma_{30} + u_{3j}$
$\beta_{4j} = \gamma_{40}$
$\beta_{5j} = \gamma_{50}$

For Models 4 and 5, the equation was the same with the exception that teacher

social support was replaced by peer social support and then autonomy support. To

simplify the interpretation of the results from our HLM analyses, we re-scaled all

continuous variables to Z-scores, and converted all categorical variables to dummy

variables.

3 Results

3.1 Descriptive Statistics

3.1.1 Retained vs. dropped schools and students. The sample at Wave 1

comprised 4,054 students in 104 schools. The Wave 2 longitudinal sample (a subset of

the original Wave-1 sample) contained 2,646 students in 70 schools. Table 1 displays the

differences between these two samples.

Table 1

3.1.2 Student-level variables. Table 1 (Panel A) indicates that the longitudinal

sample comprised more students from the younger cohort (54.6%). In contrast, most of

the students dropped from the study were from the older cohort (54.3%). Gender

compositions of the longitudinal and study dropout groups were statistically equivalent.

Considering cognitive engagement at Wave 1, the longitudinal sample started the study

significantly more engaged (3.38 vs. 3.31; $d = .17$), although the magnitude of the effect

did not represent a practically significant difference (Ferguson, 2009). The longitudinal

sample had significantly higher academic performance at Wave 1 than the study dropout

group (3.51 vs. 3.28; $d = .31$). Finally, the parents of the longitudinal sample were more

educated (3.35 vs. 3.06; $d = .18$), although again the magnitude of the effect was small.

 3.1.3 School-level variables. The results in Panel B of Table 1, which represent

differences between the 70 retained schools in Wave 2 and the 34 dropped schools,

reflect changes in the samples of students. The longitudinal school sample contained

more private schools and fewer secondary schools than the sample of dropped schools.

The proportion of mixed-grade schools in the longitudinal sample was higher (62.9%)

than the dropout group (47.1%), a trend that was similar for middle schools (25.7% of

retained schools vs. 8.8% of dropped schools). However, the proportion of secondary

schools was considerably higher in the dropped than the longitudinal sample (32.4% vs.

11.4%). Although not statistically significant, it is noteworthy that the percentage of

private schools in the longitudinal school sample was higher than in the dropout sample,

(21.4% vs. 8.8%).

 3.1.4 Describing schools and students in the longitudinal sample. Detailed

descriptive statistics for the students (split by cohort) in the longitudinal sample are

presented in Table 2. Table 3 presents descriptive statistics for the schools in this sample.

The sample of 2,646 Wave-2 students contained more females than males (53.3% vs.

46.7%), with more from the younger than the older cohort (54.6% vs. 45.4%). The

retained schools included a combination of middle (25.7%) and mixed-grade schools,

(62.9%), and over a fifth of the schools were private (21.4%). Schools had a mean

aggregate teacher social support score of 3.08 (SD = .18, range = 2.27 – 3.43) and a mean

aggregate peer social support score of 3.22 (SD = .17, range = 2.29 – 3.54). The mean

aggregate score for autonomy support across schools was 2.86 (SD = .16, range = 2.40 –

3.19).

Table 2

Table 3

3.2 Change in Cognitive Engagement

Figure 1 shows that students' cognitive engagement declined over time for both

cohorts of students. An ANOVA indicated the main within-subjects effect of Wave was

small but statistically significant, $F(1, 2631) = 410.88$, $p < .001$, $\eta^2_p = .14$, with cognitive

engagement decreasing from 3.38 (SD = .41) at Wave 1 to 3.19 (SD = .41) at Wave 2.

The between-subjects effect of cohort was also small but statistically significant, $F(1,$

$2631) = 307.89$, $p < .001$, $\eta^2_p = .11$. Finally, the Wave × Cohort interaction was

statistically significant, $F(1, 2631) = 13.03$, $p < .001$, $\eta^2_p = .01$, although the effect size

was so small that it indicated the effect was not practically relevant.

Figure 1##

3.3 Multilevel Results

3.3.1 Partitioning variance with HLM. The purpose of Model 1 was to partition

the total variance in Wave-2 cognitive engagement into its within- and between-school

components. The results of this fully-unconditional HLM model are presented in Table 4.

An important result presented in Table 4 is the variance in the Level-2 intercept

(tau, τ). Tau represents the variance in the dependent variable that lies systematically

between schools, pooled across the 70 schools. In this study, tau was .10. The total

variance that lies between students in the same schools, pooled across schools (sigma

squared, σ^2), was .91. From these values, the ICC was calculated to be .099, indicating

that roughly 10% of the variance in cognitive engagement measured at Wave 2 is

between schools. This proportion was statistically significant ($p < .001$).

3.3.2 Within-school HLM analysis. Model 2 is the Level-1 within-school HLM

model. These results indicate that cognitive engagement measured at Wave 1 was

strongly and positively related to cognitive engagement at Wave 2, $\gamma = .28$, $t(69) = 7.83$,

$p < .001$. However, even with prior cognitive engagement controlled, students' academic

performance remained significantly related to Wave-2 cognitive engagement, $\gamma = .08$,

$t(2502) = 3.66$, $p < .001$. This result suggests that higher-performing students are more

cognitively engaged with school, even after controlling for prior cognitive engagement.

Reflecting on results from Figure 1, we see that the younger cohort had higher cognitive

engagement at Wave 2, $\gamma = -.25$, $t(2502) = -2.86$, $p = .004$. Once prior cognitive

engagement and academic performance are controlled, gender and parental education

were unrelated to cognitive engagement at Wave 2.

The structure of Model 2 allowed us to interpret the dependent variable as change

in student cognitive engagement over time. The Random Effects at the bottom of Table 4

suggested that even with the full Level-1 model, the variance in residual Wave-2 cognitive engagement between schools was still statistically significant, $\chi^2(69) = 330.54$, $p < .001$. Indeed, the proportion of between-school variance in the dependent variable increased (ICC = .14), from .099 in the fully unconditional model (Model 1). This is because the Level-2 HLM model is more precisely defined; that is, it provides a better explanation of the proportion of the overall variance explained by the Level-1 model due to including Cognitive Engagement at Wave 1 as a random effect.

3.3.3 Between-schools HLM analysis. Models 3 - 5 address hypotheses 2 and 3. We found that social support from teachers (Model 3) was not significantly related to change in students' cognitive engagement, $\gamma = .10$, $t(64) = 1.33$, $p = .190$. In contrast, social support from peers (Model 4) was positively and significantly related to change in students' cognitive engagement, $\gamma = .28$, $t(64) = 4.83$, $p < .001$. In the final model (Model 5), we found that autonomy support was the most strongly related to the change in students' cognitive engagement, $\gamma = .43$, $t(64) = 7.08$, $p < .001$. The 2-level HLM between-school models include the full set of student controls (Fixed Effects at Level 1), as well as school-level controls for structure and composition. Most of the school-level controls were unrelated to change in cognitive engagement. Exceptions are in Model 3, where school average parental education and secondary school vs. mixed/middle schools were positively related to cognitive engagement; and Model 5, where school average parental education and middle school vs. secondary/middle schools were also positively related to cognitive engagement.

Table 4

4 Discussion

The objective of the present study was to contribute to research on school effects on students' engagement trajectories. Specifically, it follows from SDT that the satisfaction of students' basic psychological needs via features of school social organization will optimize student cognitive engagement (Connell & Wellborn, 1991), although past research findings have not always aligned with this prediction (e.g. Wang & Holcombe, 2010). Because of this incongruence in the literature, we tested whether student cognitive engagement (defined in terms of psychological investment and motivation) decreases over time, as commonly found in longitudinal studies (e.g. Janosz et al., 2008), and whether school-level social support from teachers and peers, as well as autonomy support reduce this decrease in cognitive engagement over time.

A main contribution of this study to school-effects research is that it highlights the need to acknowledge the broad qualitative nature of engagement and its component dimensions. As we described, cognitive engagement is a combination of concepts from two distinct literatures: psychological investment (motivation literature) and self-regulation (learning and instruction literature) (Fredricks et al., 2004). Past studies adopting a narrow definition of cognitive engagement, i.e. only in terms of students' use of self-regulated learning strategies, have failed to identify clear associations with features of school social organization (Hospel & Galand, 2016; Wang & Eccles, 2013; Wang & Holcombe, 2010). This suggests that, students' use of learning strategies (e.g. checking to make sure schoolwork has been done correctly) may be relatively unaffected by social support and autonomy support. In contrast, the present study showed that alternative cognitive indicators of engagement, including perceptions of school relevance and future aspirations, were influenced by aspects of school social organization.

4.1 Students' cognitive engagement with school decreases over time

Concerning our first hypothesis, we found that in our large sample of students and schools, considered broadly representative of students and schools in Portugal, younger students were more cognitively engaged than older students. In addition, regardless of student age, cognitive engagement was shown to decrease over a period of nearly two academic years (e.g. beginning of 7th grade to end of 8th grade). The decrease in cognitive engagement was larger for the younger students than the older students, although the size of this interaction effect was so small that its practical relevance is questionable. Nevertheless, these findings thus add to a growing body of research that shows students typically disengage with school as they progress along their academic trajectories (e.g. Janosz et al., 2008; Wang & Eccles, 2012a).

4.2 Student cognitive disengagement is lower in schools with better social support

Consistent with our second hypothesis, the decline in student cognitive engagement was generally less pronounced in students attending schools with a more supportive social environment. However, it was notable that this effect was different dependent on the source of social support. Consistent with past studies (e.g. Engels et al., 2017; Kindermann, 2007; Li, Lynch, Kalvin, Liu, & Lerner, 2011), we found that students attending schools with more supportive and accepting peers displayed less cognitive disengagement over time. In comparison, we found this effect was not statistically significant for teacher social support. Similar to past research, this study therefore indicates that different sources of social support are not equally as important on student engagement with school, but it also contradicts the finding that teacher social support has a greater impact on cognitive engagement than peer social support (e.g.

Wang & Eccles, 2012b). Instead, this finding aligns with studies that have shown teacher

support is not associated with cognitive aspects of engagement (Wang & Holcombe,

2010). One possibility is that our finding reflects the common conclusion that peer

relations are more salient and a greater priority in adolescence (Brown & Larson, 2009).

A second explanation is that our study measured only the social/emotional, rather than

informational or instrumental, forms of support from teachers. According to Thoits

(2011), the form, relative efficacy, and underlying mechanisms of support will differ

between teachers and peers. Thus, it is possible that emotional sustenance from teachers

is less effective at promoting cognitive engagement (particularly perceptions about

relevance of schoolwork and future aspirations) than informational or instrumental

support. It may also be the case that informational and instrumental support from peers

are less relevant for student cognitive engagement that peer emotional support. Future

studies are required to further explore the interaction effects of support type and support

source on changes in engagement over time.

4.3 Student cognitive disengagement is lower in schools with better autonomy
support

Consistent with our third hypothesis, we found that the observed tendency for

cognitive disengagement was less pronounced when students attended schools that offer

better autonomy support. Schools offering better autonomy support have teachers that

encourage independence and allow students to direct their own learning. Such teachers

allow students to define class goals and make their own decisions about learning/task

content. This indicates that teacher's pedagogical behaviors, measured at the school-

level, are important for helping students maintain their psychological investment and

motivation in school. Our finding thus adds to a growing body of research that links

school autonomy support to increased student engagement (Gutiérrez & Tomás, 2019;

Jang et al., 2016), and directly contradicts at least one past study that concluded

autonomy support is unrelated to some components cognitive engagement (Wang &

Holcombe, 2010). This discrepancy across studies suggests that autonomy support keeps

adolescent students motivated – students who can shape their learning experiences

consider their academic content more relevant to their personal goals – but has less

influence on their use of self-regulated learning strategies.

4.5 Study Limitations

Our study has one weakness that is almost endemic to longitudinal studies.

Between Waves 1 and 2 of data collection for this study, we lost about one third of the

original samples of students and schools. We have tried to explain our sample losses (see

Appendix A). A second weakness is that the pattern of change in student's engagement in

school over time is not completely clear in a two-time point study, and analysis of two-

time-point data is somewhat ambiguous. With future studies using three or more time

points of data, it should be possible to define more specifically students' trajectories of

engagement, rather than just simple change.

A third weakness is our decision to focus on only two aspects of school social

organization. Although we made every effort to create distinct measures of social

organization, the fact is that schools that engage in some of these practices often engage

in other similar practices. Because the two social organization constructs in this study

were correlated, our HLM analytic models did not contain the two at the same time. It is

clear that both measures capture an underlying element defining variation across the 70

schools in this study. Both constructs capture the idea that schools that are high on these measures are places where human beings care about one another.

4.6 Practical Implications

Addressing the issue of student engagement is of particular interest to schools given this construct's association with a wide variety of positive academic and developmental outcomes (e.g. Chase et al., 2014; Moreira, Faria, Cunha, et al., 2020), and because of its malleable nature (Fredricks et al., 2004). Overall, our results imply that positive relationships with others at school, including those that support autonomy, are relevant for understanding trajectories of engagement, particularly when considering cognitive indicators such as students' perceptions, goals, and beliefs concerning school. Put more simply, schools have the power to improve the engagement of their students (or at least reduced declines in engagement over time) via the implementation of interventions that focus on fostering positive interactions between students and important others at school. The implementation of such school-based interventions should represent priorities for all teachers and school policy makers, although particularly in Portugal, the context of our study, where early school dropout remains a challenge in the educational system. Such interventions need to be focused on the interactions between teachers and students (Allen, Pianta, Gregory, Mikami, & Lun, 2011), thus acknowledging student development from an ecological perspective (Bronfenbrenner, 2005), and should aim to support all three major dimensions of engagement (Binning, Wang, & Amemiya, 2018; Wang, & Amemiya, 2019).

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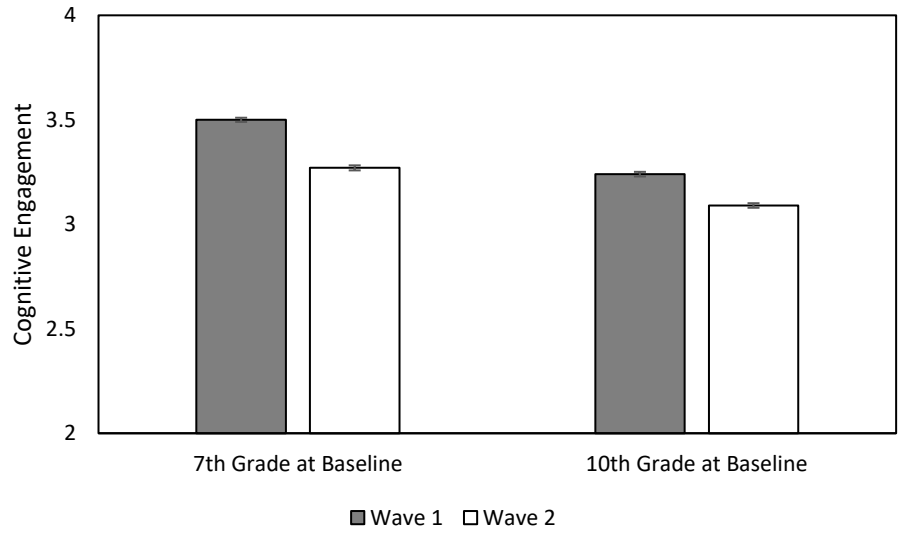
Figure 1. Means for engagement in school by cohort and wave (n = 2646 students).

Table 1.

Descriptive statistics comparing students and schools retained in wave 2 to students and schools in wave 1 but dropped from the sample (n=2,646 students in 70 schools, dropouts n = 1408 students in 34 schools).

	Panel A			
	Students from included schools (*N = 4054*)			
	Study dropout sample (*n* = 1408)	Longitudinal sample (*n* = 2646)	Difference tests	
	n (valid %)	*n* (valid %)	χ^2	*df*
Wave 1 grade level				
7th Grade	629 (45.7)	1442 (54.6)	28.39***	1
10th Grade	746 (54.3)	1204 (45.4)		
Missing	33	-		
Gender				
Female	735 (52.5)	1404 (53.3)	0.23	1
Male	664 (47.5)	1229 (46.7)		
Missing	9	13		
	M (SD)	*M (SD)*	*t*	*df*
Cognitive Engagement				
Cognitive Engagement with school at Wave 1	3.31 (0.43)	3.38 (0.41)	5.22***	4042
Academic Performance (Range = 0-5)				
Mean Performance	3.28 (0.71)	3.51 (0.75)	9.34***	2626.42
Socio-economic status				
Parent Education	3.06 (1.55)	3.35 (1.66)	5.41***	2940.8

	Panel B			
	Schools *(N = 104)*			
	Study dropout sample (*n* = 34)[a]	Retained Schools (*n* = 70)		
	n (%)	*n* (%)	χ^2	*df*
Private schools (*n* = 18)	3 (8.8)	15 (21.4)	1.86	1
Middle schools (*n* = 21)	3 (8.8)	18 (25.7)		
Mixed schools (*n* = 60)	16 (47.1)	44 (62.9)	9.83**	2
Secondary schools (*n* = 19)	11 (32.4)	8 (11.4)		

Table 2

Descriptive statistics for students (separated by cohort) in the longitudinal sample (N = 2646).

	Panel A					
	Middle School Cohort (*n* = 1442)					
	n	%				
Female	772	53.5				
Male	661	45.8				
	M	*SD*	Min	Max	Skew	Kurtosis
Wave 1						
Age	12.35	0.63	11.00	15.00	1.47	2.62
Cognitive Engagement with School	3.50	0.38	1.67	4.00	-0.83	0.54
Academic Performance	3.59	0.77	1.50	5.00	0.27	-0.81
Parent Education	3.40	1.70	1.00	9.00	0.96	0.72
Wave 2						
Cognitive Engagement with School	3.27	0.42	1.44	4.00	-0.51	0.64
	Panel B					
	Secondary School Cohort (*n* = 1204)					
	n	%				
Female	632	52.5				
Male	568	47.2				
	M	*SD*	Min	Max	Skew	Kurtosis
Wave 1						
Age	15.50	0.87	14.00	21.00	1.79	4.78
Cognitive Engagement with School	3.24	0.41	1.00	4.00	-0.55	0.83
Academic Performance	3.42	0.71	2.00	5.00	0.52	-0.55
Parent Education	3.29	1.61	1.00	9.00	0.98	0.83
Wave 2						
Cognitive Engagement with School	3.09	0.38	1.33	4.00	-0.10	0.68

Table 3

Descriptive statistics for schools in the longitudinal sample (N = 70).

	n	*%*				
Private schools	15	21.4				
Middle schools	18	25.7				
Mixed schools	44	62.9				
Secondary schools	8	11.4				

	M	*SD*	Min	Max	Skew	Kurtosis
Wave 1						
Cognitive Engagement	3.37	0.15	2.93	3.62	-0.63	-0.07
Academic Performance	3.22	0.37	2.52	4.27	0.50	0.01
Parent Education	3.26	0.91	1.91	6.62	1.26	1.91
Wave 2						
Cognitive Engagement	3.18	0.17	2.50	3.52	-0.74	2.38
School Social Support (Peers)	3.22	0.17	2.29	3.54	-2.05	9.77
School Social Support (Teachers)	3.08	0.18	2.27	3.43	-1.00	4.50
School Autonomy Support	2.86	0.16	2.40	3.19	-0.60	0.50

Table 4.

Fixed effects and random effects for HLM models testing the level-1 and level-2 predictors of one-year change in students' cognitive engagement with school (n = 2646 students in 70 schools).

	Model 1	Model 2	Model 3	Model 4	Model 5
	Fixed effects (SE)				
Level 2					
Cognitive Engagement at Wave 2					
Intercept	-.02 (.04)	.00 (.05)	.00 (.04)	-.00 (.04)	.00 (.03)
Private vs. Public			-.16 (.15)	-.08 (.10)	-.19 (.10)
Middle School vs. Mixed/Secondary			.27* (.12)	.14 (.13)	.16 (.10)
Secondary School vs. Mixed/Middle			-.03 (.16)	-.08 (.12)	-.30* (.11)
School Mean Parent Education			.11* (.05)	.06 (.05)	.12* (.04)
School Social Support (Teacher)			.10 (.08)	-	-
School Social Support (Peer)			-	.28* (.06)	-
School Autonomy Support			-	-	.43* (.06)
Level 1					
Gender ($♀$ vs. $♂$) Slope					
Intercept		.02 (.04)	.02 (.04)	.02 (.04)	.02 (.04)
Cohort (7th vs. 10th grade) Slope					
Intercept		-.25* (.09)	-.25* (.09)	-.25* (.09)	-.25* (.09)
Parent Education Slope					
Intercept		-.00 (.03)	-.00 (.03)	-.00 (.03)	-.00 (.03)
Academic Performance Slope					
Intercept		.08* (.02)	.08* (.02)	.08* (.02)	.08* (.02)
Cognitive Engagement at Wave 1 Slope					
Intercept		.28* (.04)	.28* (.04)	.28* (.04)	.30* (.04)
	Random effects (SD)				
Level-2 Intercept	.10* (.32)	.12* (.35)	.10* (.31)	.07* (.26)	.05* (.22)
Cognitive Engagement at Wave 1 Slope	-	.05* (.22)	.05* (.22)	.05* (.22)	.05* (.22)
Level-1 Effect	.91 (.96)	.74 (.86)	.74 (.86)	.74 (.86)	.74 (.86)
-2LL	7357.89	5250.57	5246.83	5230.18	5215.80
AIC	7361.89	5258.57	5254.83	5238.18	5223.80

Note. *p* < .05. Model 1 = fully unconditional model. Model 2 = within-school model. Model 3 = between-school model testing the effect of autonomy support. Model 4 = between-school model testing the effect of teacher support for learning. Model 5 = between-school model testing the effect of peer support for learning.

Appendix A. *Reasons Why the Samples of Students and Schools Were Reduced Between Waves 1 and 2 of this Longitudinal Study.*

Information about study dropout students was requested from teachers at Wave 2, although very few responses were returned. In total, there were 1214 missing cases from the group of 1408 students. As discussed, seven reasons were considered.

1. *Students dropped out of school completely.*
   - Five students were reported as discontinuing the study because they dropped out of school.

2. *Student went to another school not in our sample.*
   - Of the available data, 16 students were reported as discontinuing with the study due to moving school.

3. *Students might not be at the proper grade level (8th or 11th).*
   - Statistics obtained from the DGEEC (Direção-geral de estatísticas da educação e ciência) indicate that for the years 2012/2013 in the regions of North Portugal, there was a 14.2% retention/withdrawal rate for 7th graders, and 11.0% retention/withdrawal rate for 10th graders. Unfortunately, the available data did not distinguish between retentions and withdrawals, but instead was described as 'percentage of enrolled students who did not progress to the next grade'. This will therefore also partly explain reason (1).

4. *Schools may have decided not to participate.*
   - Of the 34 schools excluded from the analysis (< 5 respondents at wave 2), 22 enrolled zero students. Fifteen of these schools had between 20 and 142 respondents at wave 1 indicating that the lack of participation at Wave 2 may have been a school-level decision. We do not have the records to determine if this is the case. Note that at this time in Portugal, the economic crisis may have been an influence on this. Indeed, due to the resulting financial issues in the educational sector, many teachers were resistant to participating at Wave 2.

5. *Students might have been in those "dropout" schools.*
   - Naturally, if some discontinuation was at the school-level then some of the decline in students can be accounted for by this.

6. *Students is participating schools may have chosen not to participate.*
   - 172 students were reported as continuing school but choosing not to participate. Of the 1214 missing cases, it is probable that the majority fall under this category.

7. *Participating schools may have enrolled fewer than 5 follow-up students.*
   - A small number of students who responded at Wave 2 (n = 22) were excluded from the study because their schools (n = 12) enrolled < 5 students at Wave 2. Note that these students are not included in the study dropout group as this group only includes students from schools that enrolled > 5 students.

Appendix B.

The nine items of the cognitive engagement scale from the Portuguese version of the

Student Engagement Instrument (Moreira, Vaz, Dias, & Petracchi, 2009).

Item
1. The tests in my classes do a good job of measuring what I'm able to do.
2. Most of what is important to know you learn in school.
3. The grades in my classes do a good job of measuring what I'm able to do.
4. What I'm learning in my classes will be important in my future
5. Learning is fun because I get better at something
6. When I do well in school it's because I work hard.
7. I plan to continue my education following high school
8. Going to school after high school is important
9. School is important for achieving my future goals

Note. For ease, we present the original English items. The present study used Portuguese translations of these items. Original Student Engagement Instrument by Appleton et al. (2006).

Appendix C.

Exploratory factor analysis forcing the four factors revealed by parallel analysis

Original Instrument	Items (English versions)	F1	F2	F3	F4
SEI	Students at my school are there for me when I need them.	.79			
SEI	I enjoy talking to the students here.	.64			
SEI	Other students at school care about me.	.62			
SEI	Other students here like me the way I am.	.57			
SEI	Students here respect what I have to say.	.56			
SEI	I have some friends at school.	.48			
SEI	I enjoy talking to the teachers here.		.69		
SEI	The school rules are fair.		.67		
SEI	Adults at my school listen to the students.		.67		
SEI	Overall, my teachers are open and honest with me.		.64		
SEI	My teachers are there for me when I need them.		.63		
SEI	Most teachers at my school are interested in me as a person, not just as a student.		.56		
SEI	Overall, adults at my school treat students fairly.		.49		
SPSI	In this school, teachers give students the opportunity to develop their own projects.			.75	
SPSI	Teachers from this school give students several options and ask them to make their own choices.			.71	
SPSI	Teachers from this school involve students in the definition of the class's goals.			.66	
SPSI	Teachers from this school give students the opportunity of choosing their own options.			.60	
SPSI	Teachers from this school allow students to do things in a different way from what they suggest.			.51	
SPSI	Teachers from this school like that students learn original and creative things.			.49	
SEI	At my school, teachers care about students.				.83

Note. SEI = Student Engagement Instrument (Appleton et al., 2006). SPSI = Students' Perceptions of School Success Promoting Strategies Inventory (Anonymous, 2014). English versions of the items are provided but items were presented to participants in Portuguese.