



Creating a Supportive Classroom Environment Through Effective Feedback: Effects on Students' School Identification and Behavioral Engagement

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Previous research revealed the connection between students' behavioral and emotional engagement and a supportive classroom environment. One of the primary tools teachers have to create a supportive classroom environment is effective feedback. In this study, we assessed the supportive classroom environment using the perception shared by all students from the same classroom of teachers' use of effective feedback. We aimed to explore the effect of such an environment on students' behavioral engagement and school identification. Using a probabilistic sample of 1,188 students from 75 classrooms across 6th, 7th, 9th, and 10th grades, we employed multilevel regression modeling with random intercept and fixed slopes. We explored the effects of both individual perceptions of teachers' use of effective feedback and the supportive classroom environment on student engagement. The analyses identified that students who perceived that their teachers use more effective feedback had a higher level of behavioral engagement and school identification. Once we controlled the effects of these individual perceptions of teachers' effective feedback, we still observed the effect of a supportive classroom environment on student engagement. So, in classrooms where teachers used more effective feedback creating a supportive classroom environment, students had higher school identification and behavioral engagement levels, regardless of their individual perceptions of teachers' feedback. The association between variables remained significant even after controlling students' characteristics (gender, nationality, mother's level of education, history of grade retention) and classroom characteristics (grade level, type of school, number of students at grade level). Our findings support the potential of teachers' feedback practices to foster students' school identification and behavioral engagement to build a more inclusive school environment and value students' diversity.

Keywords: teachers' feedback practices, school identification, behavioral engagement, supportive classrooms, multilevel analysis, middle school, secondary school

INTRODUCTION

Students' behavioral engagement and school identification are considered a critical catalyst for their learning and performance (Korpershoek et al., 2019). Students who value school and feel that they belong there are more likely to behaviorally engage in school activities, experience more in-depth learning, and improve their academic achievement (Voelkl, 2012). These feelings can contribute to reducing school dropout and social exclusion. According to Voelkl (2012), the development of a sense of identification is mediated by contextual factors—namely, perception of teacher support. These factors can be modified to improve school outcomes. According to Voelkl (2012), a caring, supportive teacher can impact students' identification with school. If students feel that they are cared for and are allowed to participate actively in classroom activities, they believe that the school climate is positive, supportive and it promotes the sense of belonging and value of the school (Adomnik, 2012). Therefore, understanding what teachers can do to support and foster students' engagement is vital. In the present study, we investigated one factor identified as having critical effects on students' achievement and students' engagement: teachers' feedback (Wisniewski et al., 2020). When performing learning tasks and activities, feedback is a relevant aspect present in the teacher-student relationship that can create a positive and supportive classroom environment (Black and Wiliam, 1998; Black et al., 2004; Voelkl, 2012). Feedback may have consequences on students' school experience, subsequently improving or impairing their school identification and behavioral engagement and, in turn, affecting their academic achievement (Reeve, 2012; Reschly and Christenson, 2012; Voelkl, 2012; Burns et al., 2019; Wang and Zhang, 2020). Previous research has demonstrated that students' perception of teachers' use of feedback plays a significant role in student engagement (Koka and Hein, 2005; Koka and Hein, 2006; Price et al., 2011; Leh et al., 2014; Conboy et al., 2015; Burns et al., 2019; Kyaruzi et al., 2019; Wang and Zhang, 2020). Most of this research had investigated perceived teacher feedback at the individual level (e.g., Koka and Hein, 2005; Koka and Hein, 2006; Leh et al., 2014; Conboy et al., 2015; Vattøy and Smith, 2019; Wang and Zhang, 2020). This means that the effectiveness of teacher feedback can promote learning, increase achievement and foster student motivation and engagement.

Thus, as mentioned before, students' perception of teacher "feedback has individual effects on students" engagement and on their school identification (Pianta et al., 2012; Voelkl, 2012). However, the teaching and learning process is not only a simple relationship between the teacher and students, but also among students themselves. In this interrelation, teachers' behaviors are fundamental in promoting positive interactions in the classroom (Conroy et al., 2009). As teachers and students share several learning environments and experiences, they build perceptions about the teaching-learning process that allows them to make interpretations about the interactive dynamics in the classroom in a very consistent way. In these interactions, teachers can help model constructive feedback and can help develop the group's competence to give effective

feedback and create a positive classroom climate, increasing students' engagement.

Consequently, it is relevant to understand how the context created by teachers' feedback are likely to impact on students' behavioral engagement and on their school identification. Based on previous studies (e.g., Burns et al., 2019; Kyaruzi et al., 2019), we suggest that the use of effective feedback (assessed by the shared perceptions among students of the same classroom about their teachers' feedback) create a supportive classroom environment that will positively influence of students' school identification.

The majority of research regarding students' perceived feedback and their engagement has focused on the student-level characteristics with less consideration for the contexts in which they are taught (Burns et al., 2019). Therefore, in the present study, we used a multilevel design to investigate how these factors function at both the student and classroom level. We studied the link between perceived teachers' use of effective feedback and students' levels of school identification and behavioral engagement at the individual and classroom levels. The central question is whether the supportive classroom environment created by the teachers' use of effective feedback affects students' behavior after controlling their individual perceptions and the differences at the individual level and at classroom-level.

Teachers' Feedback

One of the primary tools teachers have to create this supportive class environment is feedback (Price et al., 2011; Reeve, 2012; Reschly and Christenson, 2012). Feedback is conceptualized as information students receive about their performance or understanding (Hattie and Timperley, 2007) that reduces the discrepancy between what the student knows and what is aimed to be known. Students must also make sense of that information and use it to enhance their learning (Carless and Bound, 2018).

Much has been studied about the effectiveness of feedback, but there is much more to learn about how to optimize its power in the classroom. As Janosz (2012) indicated, the feedback information that students receive and interpret from their schooling experience plays a crucial role in assisting students in improving their motivation and engagement and is a decisive factor implicated in academic achievement (Hattie and Timperley, 2007). Nevertheless, we also know that the variability of feedback effectiveness is vast and that there are certain types of feedback that are more effective than others (Hattie and Yates, 2014). Thus, different types of feedback allow the student to close the gap between current knowledge and a more desirable level of achievement with different levels of effectiveness. Hattie and Timperley (2007) specified some forms it should take; The authors use three feedback questions such as where am I going (feeding up), how am I going (feeding back) and where to next (feeding forward) to clarify the goals and criteria for students. For feedback to be effective, these questions must be answered by the student and feedback needs to work at different levels of cognitive complexity: Task and product level, i.e., corrective feedback; Process level, i.e., providing task processing strategies and cues for information search so students can develop their own learning strategies; Self-regulation level, i.e., providing students with information that allows them to improve their competence to

monitor their own learning and progress. According to the authors (Wisniewski et al., 2020), feedback is more effective the more information it contains. So high-information feedback contains information on task, process and (sometimes) self-regulation.

Hattie and Timperley (2007) considered that the feedback needs to focus on the appropriate question and level of cognitive complexity. If not, it risks being ignored and misunderstood and never used by the student. Generally, it has been shown that feedback at the process and self-regulation levels seems to be more effective in enhancing deeper learning, improving task confidence and self-efficacy, and leading to more internal attributions about success or failure (Hattie and Yates, 2014). Furthermore, the meta-analyses of Wisniewski et al. (2020) also suggest that feedback is more effective the more information it contains, while simple forms of reinforcement and punishment have low effects.

The literature also suggests that feedback is related to a positive student-teacher relationship, which is an essential aspect of a positive classroom environment (e.g., Burnett, 2002; Gutierrez and Buckley, 2019). Burnett (2002) observed that students who perceived receiving feedback focused on their effort were more likely to report a positive teacher-student relationship. The author also reported that students who perceived receiving frequent ability feedback from their teachers were also more likely to perceive the classroom environment in a positive way. On the contrary, teacher praise was not related to students' perception of the classroom environment or their relationships with their teachers.

Therefore, teachers' feedback is crucial in improving this supportive class environment by establishing good relationships with students and offering both personal and academic support (Allen et al., 2018). Studies have also determined that a supportive class environment could improve students' school identification and behavioral engagement (Voelkl, 2012; Allen et al., 2018; Olivier et al., 2020). Students need to be supported and cared for by teachers to develop and maintain a sense of identification with the school that reinforces their behavioral engagement with the school's activities (Voelkl, 2012). So, Burnett (2002) recommends that teachers should be careful when providing feedback to students as their relationships with students can influence how students perceive the classroom environment.

In sum, feedback is more effective if it helps students understand what mistakes they made, why they made these mistakes, and what they can do to avoid them in future (Wisniewski et al., 2020). Therefore, the effective feedback sets clear standards and expectations that promote a supportive classroom environment, encouraging students' autonomy, school identification and engagement (Pianta et al., 2012; Voelkl, 2012).

Behavioral Engagement and School Identification

The role of student engagement has been considered to be relevant in the literature since authors identified that it improves achievement and persistence in secondary school (Finn and Zimmer, 2012; Korpershoek et al., 2019). Engagement is a complex multidimensional construct defined as

the energy and effort that students employ within their learning community, observable via any number of behavioral, cognitive or affective indicators across a continuum. It is shaped by a range of structural and internal influences, including the complex interplay of relationships, learning activities and the learning environment (Bond et al., 2020, p. 3).

Similarly, well supported by research, school identification has become an important educational goal (e.g., Christenson et al., 2008; Christenson et al., 2008; Reschly and Christenson, 2012; Voelkl, 2012). School identification can be defined as students' attitudes about their school, and it is an affective form of student engagement comprising two needs: Belongingness and Valuing. Belongingness refers to "feelings that one is a significant member of the school community, is accepted and respected in school, has a sense of inclusion in school, and includes school as part of one's self-definition." (Voelkl, 1996, p. 762). On the other hand, Valuing has been defined as students "feeling that school and school outcomes have personal importance and/or practical importance" (Voelkl, 2012, p. 198).

School identification, also referred to in the literature as affective engagement (Christenson et al., 2008; Reschly and Christenson, 2012), is strongly related to behavioral engagement (Voelkl, 2012; Korpershoek et al., 2019); the latter is associated with students' active participation and involvement in school and classroom activities, their effort, attendance, active classroom participation, paying attention and homework completion (Appleton et al., 2006; Fredricks et al., 2011). Students who identify with school tend to engage in classroom activities more than others. Research shows that students' behavioral engagement mediates the relation between school identification and students' academic trajectories (Reschly and Christenson, 2006; Voelkl, 2012). Students who develop a sense of identification with the school are more involved in classroom work, actively participating in their learning and autonomously developing new activities, improving their academic achievement (Korpershoek et al., 2019). As indicated by Voelkl (2012), "classroom participation is the most proximal outcome of identification" (p. 208). Contrarily, students who do not have a sense of belonging or value their school are more likely to disengage or withdraw, and soon drop out (Voelkl, 2012; Lovelace et al., 2014; Lovelace et al., 2017).

Teachers' Feedback, School Identification and Engagement

Although recent meta-analyses had found that feedback that contains information on task, process and self-regulation levels is more effective for cognitive outcomes, like students' achievement (Wisniewski et al., 2020), research also supports that it enhances academic engagement and motivational outcomes (Gettinger and Ball, 2007; Valente et al., 2015; Wisniewski et al., 2020). In addition, according to Wang and Zhang (2020), learning engagement had a mediating effect on the relationship between teachers' feedback and students' academic

performance. The association between teachers' feedback and students' engagement seems to exist regardless of the students liking or disliking the learning subject (Valente et al., 2015), although the utility of the feedback depends on how students perceive it (Handley et al., 2011; Kyaruzi et al., 2019; Wang and Zhang, 2020). Feedback that "draws attention away from the task and toward self-esteem can have a negative effect on attitudes and performance" (Black and Wiliam, 1998, p. 13). Hattie (2009) indicates that feedback directed to the self or at the self-level, even if it is positive, like praise, often directs attention away from the task, diluting the power of feedback. Negative and uninformative feedback has the most evident negative influences, because it reduces the experience of autonomy and self-efficacy and because students need to feel that they belong in learning and that there is a trusting relationship between them, their teachers and their peers (Hattie, 2009; Wisniewski et al., 2020). For example, Strambler and Weinstein (2010) observed that students who perceive teachers' feedback as negative or unsupportive respond by devaluing the importance of school, which was negatively related to students' academic achievement.

The types of interactions teachers have with their students can promote or inhibit student engagement in the classroom. If teachers offer challenging and fun learning activities, encourage students' participation and provide feedback about how to reach their goals, they are promoting students' engagement (Pianta et al., 2012). Authors like Voelkl (2012) believe that school identification has its roots in earlier school grades and becomes stronger over time due to the interactions and school experiences. Consequently, if students feel accepted by their peers and supported by teachers, it is expected that they develop an identification with school. According to this author, the development of identification is mediated by contextual factors, namely perceptions of teacher support. Supportive interactions with teachers contribute to positive self-perceptions such as identification with the school, promoting student engagement with academic activities.

High-quality or effective feedback provides students with rich information about the quality of the student answer but principally about the ways to get the right answer and be sure that students use that information to promote learning. This process implies frequent exchanges of information between the student and the teacher. Teachers' feedback to students' responses are critical in their engagement in the learning activities (Pianta et al., 2012). Therefore, supportive class environments are essential to develop and maintain students engagement. The use of high-quality feedback by the teacher over time contributes to progressively increase the sense of belongingness and the value the students attribute to school. This development of school identification can facilitate and promote students' engagement (Voelkl, 2012).

In sum, previous research suggests that students' perceptions of teachers' feedback play an important role in creating a supportive classroom environment (Price et al., 2011; Reeve, 2012; Reschly and Christenson, 2012). Furthermore, supportive classroom environments have been found to significantly impact students' engagement (Voelkl, 2012; Allen et al., 2018). Therefore, we suggest that students' shared

perceptions of teachers' use of feedback will positively influence students' engagement and school identification.

Present Study—The Contextual Effect of Teachers' Feedback

Previous research had explored the link between students' individual perceptions of teachers' feedback, students' behavioral engagement and school identification at the individual level (e.g., Conboy et al., 2015; Carvalho et al., 2020). Results confirmed that students' perceptions about teachers' use of effective feedback were associated with increased behavioral engagement via increased school identification. In the present study we started by confirming that students' individual perception of teachers' use of effective feedback was positively related to their school identification and behavioral engagement.

The second purpose of the present study was to expand previous research by analyzing the effects of teachers' use of effective feedback as an indicator of a supportive classroom environment that influences students' school identification and behavioral engagement. We considered that a classroom where students shared the perception that their teachers use effective feedback frequently was a classroom with supportive environment. We hypothesized that in a supportive classroom environment students would have greater levels of school identification and behavioral engagement, even after controlling for the effect of their individual perceptions of teachers feedback (if confirmed in our first hypothesis) and after controlling other differences at the individual and at the classroom-level. This means that if two students perceived that their teacher used little effective feedback, the student that is in a classroom with a highly supportive environment will still present higher levels of behavioral engagement and school identification than the student that is in a classroom with lower supportive environment.

Previous studies have reported that when teachers' behavior or characteristics are assessed via students' reports, they should be studied as classroom or school level constructs from a multilevel perspective (e.g. Marsh et al., 2012). As a result, we implement multilevel analyses to examine the climate effect of a supportive classroom environment created by the use of effective feedback.

Climate studies evaluate whether school, classroom, or teacher characteristics contribute to predicting students' outcomes beyond what can be explained by students' individual characteristics (Marsh et al., 2012). A climate analysis model includes the same variable at both the individual and group levels. Such analyses represent an effort to explain dependent variables (in this case, students' school identification and behavioral engagement) using a combination of individual and group level independent variables (in this case, students' perceptions about teachers' use of effective feedback) (Blalock, 1984). These models allow researchers to investigate the climate effects that teachers' feedback is presumed to have on the individual students over and above the effect of any individual-level variable that may be operating (Blalock, 1984).

TABLE 1 | Sample characteristics.

Variable	Category	<i>n</i>	%	<i>M</i>	<i>SD</i>
Students level (<i>n</i> = 1,188)					
Gender	Female	626	52.7	—	—
Nationality	Portuguese	1,128	95.8	—	—
Grade retention	Retained	205	17.6	—	—
Mother's higher level of education	1st cycle	119	10.0	—	—
	2nd cycle	189	15.9	—	—
	3rd cycle	266	22.4	—	—
	Secondary	306	25.8	—	—
	Higher	237	19.9	—	—
Father's higher level of education	Don't know	71	6.0	—	—
	1st cycle	141	11.9	—	—
	2nd cycle	180	15.2	—	—
	3rd cycle	264	22.2	—	—
	Secondary	247	20.8	—	—
Grade level	Higher	170	14.3	—	—
	Don't know	186	15.7	—	—
	6th	314	26.4	—	—
	7th	346	29.1	—	—
	9th	304	25.6	—	—
Age	10th	224	18.9	—	—
	—	—	—	13.41	1.70
Feedback ^a	—	—	—	-0.04	0.67
School identification ^a	—	—	—	-0.01	0.66
Engagement ^a	—	—	—	-0.03	0.80
Classroom level (<i>n</i> = 75)					
Number of students in grade level	—	—	—	116.94	82.11
Grade level	6th	20	26.7	—	—
	7th	23	30.6	—	—
	9th	20	26.7	—	—
	10th	12	16.0	—	—
Type of school	Classroom in priority intervention territories (TEIP) school	12	16.0	—	—

^aFactor scores.

METHODS

Participant and Procedures

Data collected for this study were part of a broader research project (Carvalho and Conboy, 2015), the main aim of which was to understand the dynamics of teacher feedback in developing students' identity and the consequences of this dynamic on students' school trajectories. This project's target population consisted of middle school and early secondary education students from Portuguese public schools. In Portugal, basic education level is divided into three cycles: first (1st to 4th grades), second (5th to 6th grades), and third cycle (7th to 9th grades). The project focuses on students attending the transitional years between study cycles (6th, 7th, 9th, and 10th grades). In these grade levels, students have several teachers, each one teaching a different subject (Eurydice, 2019).

The sample was selected through a probabilistic, multi-stage sampling procedure in continental Portugal, based on the number of students enrolled in the chosen grades by each Territorial Unit for Purposes Statistics (NUTS II—with five regions). Schools were randomly selected for each grade level. Only one or two classrooms of the same grade were collected in each school.

The final sample consisted of 1,188 students spread over 75 classrooms in 48 schools in continental Portugal. The average number of students by classroom was 16. The sample presented

similar patterns of population distribution for grade level and NUTS II region, which indicated that the sample was representative of the Portuguese population. Overall sample characteristics are illustrated in **Table 1**.

Measures

The students responded to a paper-and-pencil questionnaire that included a first section intended to measure students' school identification, a second section focused on behavioral engagement and a third section that assessed student perception of teacher feedback. The instrument also included a demographic section: gender (0 = girls; 1 = boys), age, nationality (0 = Portuguese; 1 = other nationalities), year of schooling (6th, 7th, 9th or 10th grade), and mother/stepmother's and father/stepfather's level of education (1 = 1st cycle of basic education, 2 = 2nd cycle, 3 = 3rd cycle, 4 = secondary education, 5 = higher education).

Students' Perceptions of Teachers' Use of Effective Feedback

To measure students' perceptions of their teachers' feedback practices, we used eight items from the Teachers' Feedback Scale, developed by Carvalho et al. (2015). Students reported their perceptions about teachers' use of effective feedback in a subject they like. The instruction stated, "Think of a subject that

you like”. The reason for including this instruction was to avoid negative experiences associated with a discipline that could interfere with their perceptions of the feedback. The questionnaire included items questioning the feedback at the process level (e.g., “Teachers clearly describe what is not correct and make suggestions for improvement”) or self-regulation level (e.g., “The teachers ask questions that help us reflect on the quality of our work”). Items were answered on a four-point scale (0 = never and 3 = always).

To confirm that the design on the survey did not cause raters to bias their response, we assessed the common method variance (CMV) through the Harman Single Factor technique, as described by Eichhorn (2014). The common latent factor explained less than 50% of the variance (47.22%), indicating that common method bias was not present (Eichhorn, 2014). We conducted confirmatory factor analyses (CFA) to verify the measure’s structural validity in our sample, using the Weighted Least Square Mean and Variance (WLSMV) estimator. Good fit index values were adequate (χ^2 (18) = 61.30, $p < 0.001$; comparative fit index (CFI) = 0.992; Tucker-Lewis index (TLI) = 0.987; root mean square error of approximation (RMSEA) = 0.045, 90% IC = [0.033, 0.058], $p = 0.716$). The measure presented adequate levels of reliability (Composite Reliability, CR = 89) (complete results are presented in the **Supplementary Material**).

Students’ perceptions of teachers’ effective feedback were aggregated at the classroom level to create a climate variable that reflects the supportive classroom environment. Climate variables are classroom aggregations of ratings by students in which each student is asked to rate a particular classroom characteristic (in this case, the frequency of effective feedback used by the teacher of the discipline they like) that is common to all students (Marsh et al., 2012). Since students like different disciplines, the aggregation of the ratings provides an indicator of the frequency of effective feedback received by students during the time they are in the school. Students’ rates of teachers’ use of effective feedback were aggregated at the classroom level using a manifest measurement–latent aggregation approach (Marsh et al., 2009). The manifest-latent approach uses multilevel models to aggregated student-level responses (the manifest observed variable) to form an unobserved latent variable as an indicator of the climate construct. This procedure permitted correct sampling errors in the aggregation of individual-level constructs to form classroom level climate variables (Marsh et al., 2009). Hence, our supportive classroom environment construct was a latent variable at the classroom level based on shared perceptions among different students with the same teachers. Differences among students within the same classroom (the variable at the student level) do not reflect the classroom environment, representing each student’s unique perceptions that are not explained by the shared perception of different students (Marsh et al., 2012). If there was no significant agreement among students from the same classroom about teachers’ use of feedback, then it could be argued that the classroom level variable did not reflect the classroom environment (Marsh et al., 2012). Consequently, we test the agreement between students in the same classroom using intraclass correlation (ICC2, Lüdtke et al., 2009) to indicate the

reliability of our classroom environment latent variable. The measure presented an ICC2 of 0.77, which falls within the acceptable threshold of 0.70 and 0.85 recommended by Lüdtke et al. (2009).

Students’ Behavioral Engagement

A nine-item scale authored by Carvalho et al. (2016) was used to assess the behavioral engagement of the students in the school. The scale assesses two dimensions: academic work, with six items (e.g., “I study the material given in class”) and class participation, with three items (e.g., “I raise my hand to answer a question”). Students answered each on a four-point Likert scale (0 = never and 3 = always). Students were asked to think of a subject they liked. We only used the global measure composed by these dimensions.

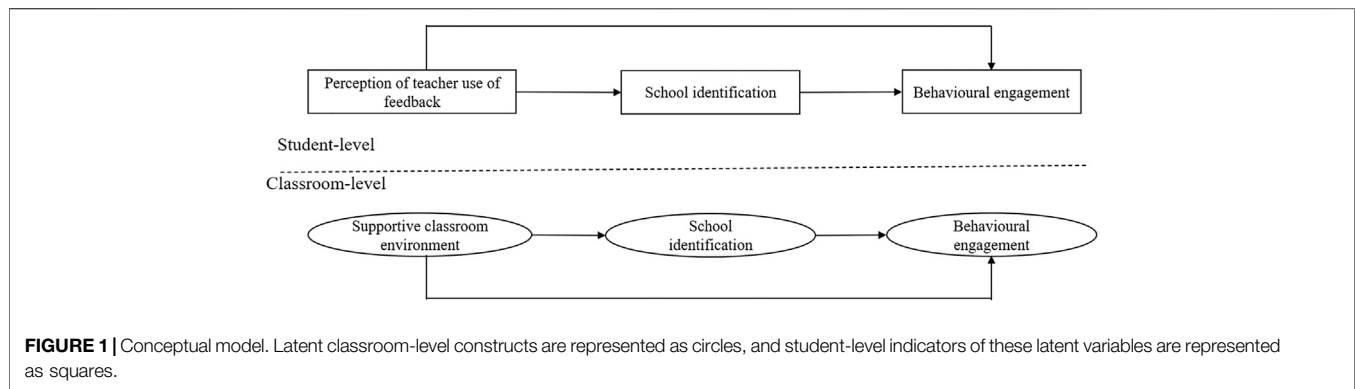
We also assessed the CMV of this scale through the Harman Single Factor technique. There was no evidence that common method bias was present (the common latent factor explained only 39.21% of the variance). To confirm the validity of the two-dimensional hierarchical structure of the measure in our sample, we conducted a CFA using the WLSMV estimator. The results indicated that there was also evidence of structure validity (χ^2 (27) = 60.38, $p = 0.002$; CFI = 0.992; TLI = 0.990; RMSEA = 0.032, 90% IC = [0.021, 0.043], $p = 0.996$). Composite reliability was also adequate for the global measure (CR = 0.88) (complete results are presented in the **Supplementary Material**).

Students’ behavioral engagement outcome variable was aggregated at the classroom level. Once again, we used the manifest-latent approach and calculated the ICC2 as an indicator of reliability (Lüdtke et al., 2009; Marsh et al., 2012). The value of ICC2 was 0.67, just below the 0.70 value recommended by Lüdtke et al. (2009).

Students’ School Identification

The School Identification Scale, authored by Carvalho et al. (2015), was used to measure students’ school identification. The scale assesses three dimensions of school identification. Three items assess students’ perceptions about their school’s practical value (e.g., “My future depends on what I do in school”). Three items question their feelings of belonging and well-being in school (e.g., “I am happy in this school”). Finally, four items assess students’ perceptions of their capacity and will (e.g., “My skills make me confident about my future”). Items were answered on a four-point Likert scale (0 = completely disagree to 3 = completely agree). In the present study, we only used the global measure composed by these dimensions to avoid multicollinearity problems.

The Harman Single Factor test indicates there was no evidence that common method bias was present in this scale either (the common latent factor explained only 32.25% of the variance). We conducted a CFA to confirm the validity of the three-dimensional hierarchical structure of the measure in our sample using the WLSMV estimator. Good fit index values were adequate (χ^2 (31) = 177.35, $p < 0.001$; CFI = 0.969; TLI = 0.955; RMSEA = 0.063, 90% IC = [0.054, 0.072], $p = 0.008$). The global measure presented good levels of reliability (CR = 0.84) (complete results are presented in the **Supplementary Material**).



Students' school identification outcome variable was also aggregated at the classroom level, again using the manifest-latent approach. We tested the ICC2 (Lüdtke et al., 2009) to assess the classroom-average identification level latent variable's reliability. The value of ICC2 was 0.77, indicating adequate reliability levels (Lüdtke et al., 2009).

Data Analyses

All models were estimated using Mplus 8.4. Missing data (1.6% of all data) was handled by allowing missingness to be a function of the observed covariates but not the observed outcomes, the default Mplus procedure (Muthén and Muthén, 2017). Factor scores of the measures were saved and used as observed manifest variables to make the models more parsimonious, reducing the number of variables involved (Wang and Wang, 2020).

We employ multilevel regression modeling with random intercept and fixed slopes using the robust maximum likelihood (MLR) estimator. Respondents (level 1) were "nested" within the classroom (level 2) to account for classroom-level baselines in students' perceptions. We ran an intercept-only model to examine ICC2 that indicated the proportion of the total variance explained by differences between schools. Next, we estimated two models to evaluate the supportive classroom environment created by teachers' use of effective feedback. For all the models tested, the predictor variables, except the dichotomous variables, were grand-mean-centred.

In Model 1, we assess a model already tested in previous publications (Conboy et al., 2015; Carvalho et al., 2020) based on Voelkl (2012) theory. At the individual level, students' perceptions of teachers' feedback contribute to students' school identification and behavioral engagement. At the classroom level model, the supportive classroom environment contributed to students' school identification and behavioral levels. We also propose that school identification (both at the individual and classroom levels) contribute to students' behavioral engagement (see Figure 1).

In Model 2, we incorporated the control variables. It was important to consider and neutralize individual and group variables that could explain our outcome variables (students' engagement and school identification) (Creswell, 2012). This will allow us to assess more accurately the relationship between teachers' feedback and our outcomes because of a reduction in

the number of errors (Creswell, 2012). At the individual level, we control gender, mother's and father's education level, history of grade retention and nationality. These variables had previously been shown to be related to students' engagement and school identification (Allen et al., 2018; Bear et al., 2019; Cunha et al., 2019; Olivier et al., 2020). At the classroom level, we control grade level and the number of students at the grade level in the school. Previous studies indicated that the odds of a student having low levels of engagement and school identification increased in classrooms in schools with a large number of students (Finn and Voelkl, 1993; Willms, 2003; Weiss et al., 2010). Moreover, students in the lower grades tend to perceive that their teachers use more effective feedback (Carvalho et al., 2020) and present higher engagement levels (Eccles et al., 1993; Mahatmya et al., 2012). We also control for classrooms in schools that were part of the Portuguese TEIP Program for priority intervention educational areas, whose aim was to promote educational inclusion in schools located in socially and economically disadvantaged areas (European Commission, 2013).

Model fit was assessed using the indices and cut-off points suggested by Hu and Bentler (1999): non-significant values of chi-square (χ^2) or less than three times the degrees of freedom; values higher than 0.95 of CFI and TLI; and values lower than 0.08 of RMSEA and Standardized Root Mean Square Residual (SRMR).

RESULTS

Preliminary Analyses

The unconditional "null" model showed that the ICC2 was between 0.111 and 0.179; in other words, between approximately 11.1 and 17.9% of the total variance in the target variables was associated with classroom characteristics (see Table 2). Still, the largest proportion of the variance was associated with individual characteristics. Considering that the average cluster size was 16 students, the design effects were between 2.66 and 3.68. Muthén and Satorra (1995) indicated that design effects higher than 2.00 suggest systematic variation between groups that deviate from simple random sampling. Therefore, we confirm that multilevel modeling was necessary (Heck and Thomas, 2015). In Table 2, we also present the correlation between variables at the student and classroom levels.

TABLE 2 | Classroom Level Intraclass Correlations (ICC) and intercorrelations at students and classroom level.

Variable	ICC	Design effect	Student level		Classroom level	
			1	2	1	2
1. Teachers' feedback	0.179	3.68	—	—	—	—
2. School identification	0.173	3.59	0.354***	—	0.631***	—
3. Behavioral engagement	0.111	2.66	0.514***	0.466***	0.806***	0.502***

Notes: ***p < 0.001.

TABLE 3 | Coefficients of the multilevel models tested.

Effect	Model 1			Model 2		
	b	b*	SE	b	b*	SE
Intercept						
Feedback	—	—	—	0.128	0.275	0.061
School identification	-0.018	-0.066	-0.030	-0.010	-0.038	0.037
Engagement	-0.021	-0.078	0.027	0.020	0.082	0.037
Students level model						
Feedback → school identification	0.206***	0.354***	0.016	0.200***	0.342***	0.018
Feedback → engagement	0.293***	0.399***	0.020	0.293***	0.398***	0.020
School identification → engagement	0.409***	0.324***	0.036	0.399***	0.316***	0.037
Gender → grade retention	—	—	—	0.070*	0.183*	0.033
Gender → feedback	—	—	—	-0.122 ⁺	-0.119 ⁺	-0.064
Gender → school identification	—	—	—	0.073*	0.121*	0.036
Gender → engagement	—	—	—	-0.095**	-0.126**	0.037
Mother's EL → grade retention	—	—	—	-0.039**	-0.130**	0.011
Mother's EL → school identification	—	—	—	0.047**	0.100**	0.016
Mother's EL → engagement	—	—	—	0.051**	0.086**	0.016
Father's EL → grade retention	—	—	—	-0.026*	-0.086*	0.011
Father's EL → school identification	—	—	—	0.053**	0.114**	0.017
Grade retention → feedback	—	—	—	-0.218**	-0.081**	0.082
Grade retention → school identification	—	—	—	-0.230***	-0.146***	0.048
Classroom level model						
Feedback → school identification	0.359***	0.631***	0.056	0.250**	0.437**	0.084
Feedback → engagement	0.452***	0.815***	0.085	0.455***	0.855***	0.053
Grade-level → feedback	—	—	—	-0.220***	-0.701***	0.034
Grade-level → school identification	—	—	—	-0.060*	-0.334*	0.027
Number of students → school identification	—	—	—	0.001*	0.162*	<0.001
Number of students → engagement	—	—	—	0.001*	0.160*	<0.001

Notes: ⁺ p < 0.060; *p < 0.050; **p < 0.010; ***p < 0.001.

Teachers' Feedback Effects on School Identification and Behavioral Engagement

The multilevel analysis results indicate that students' individual perceptions about teachers' use of effective feedback were positively related to both students' school identification and behavioral engagement (see Model 1 in Table 3). Students who perceived that their teachers used more effective feedback presented a higher level of school identification and behavioral engagement. More importantly, the results indicated that, after controlling the individual effect, the supportive classroom environment had a significant effect on school identification and behavioral engagement levels. These results indicated that students in classrooms where teachers used more effective feedback, thus creating a supportive classroom environment, had higher levels of school identification and behavioral engagement, regardless of their individual perceptions of teachers' use of effective feedback.

Students' school identification also predicted students' behavioral engagement, but only at the individual level. We

observed that students in classrooms with more students with higher school identification levels did not present higher engagement levels as expected. Indeed, individual levels of school identification were more relevant in explaining students' behavioral engagement.

In model 2, we added the control variables at the individual level (gender, nationality, mother's education level and history of grade retention) and classroom level (grade-level, number of students in the grade-level, TEIP school). To make the model parsimonious, we removed all non-significant paths that did not affect the fit or the predictive power of the model. The final model results are presented in Table 3 and Figure 2.

At the individual level, besides students' perceptions of teachers' feedback, mother's education level also contributed to students' school identification and behavioral engagement. The fathers' educational level only contributed to students' school identification but not to their behavioral engagement. Gender explained students' behavioral engagement and school

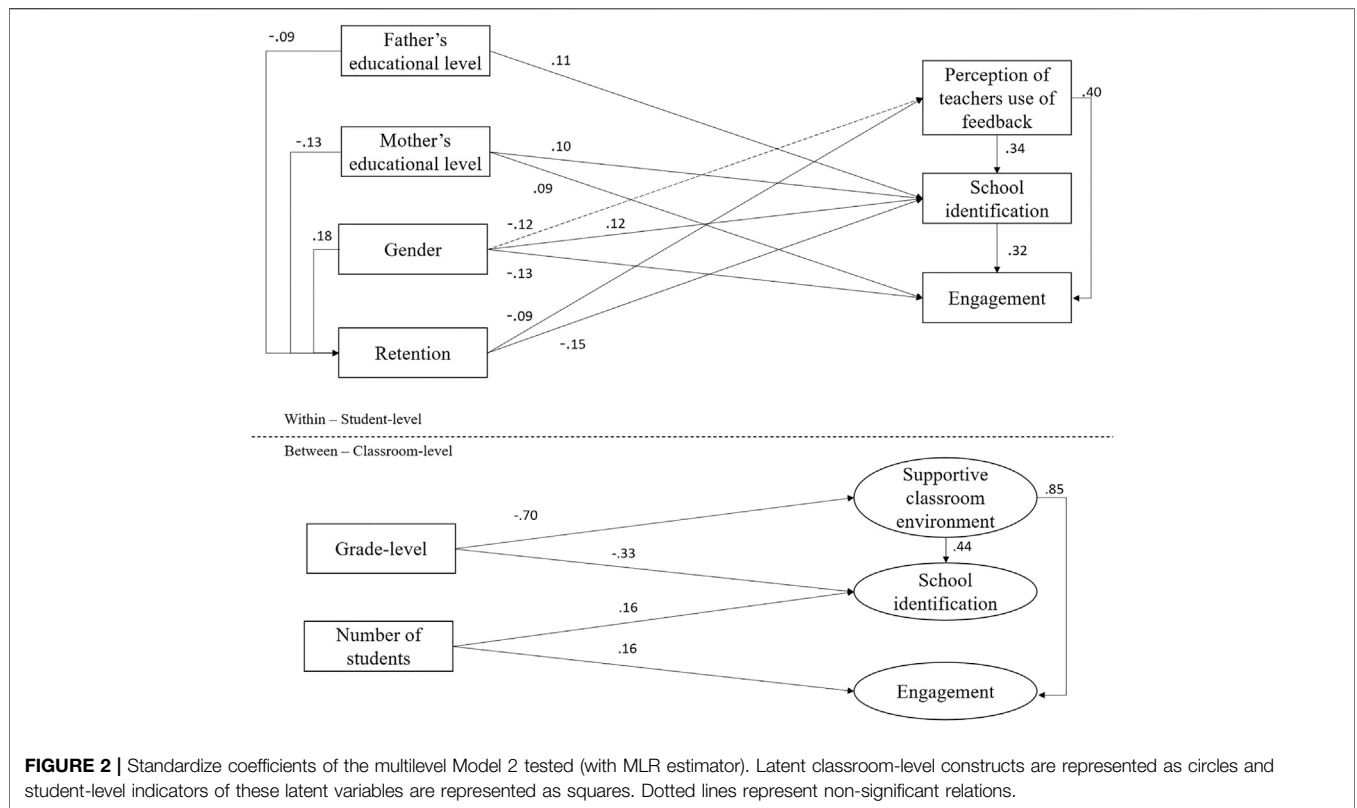


FIGURE 2 | Standardize coefficients of the multilevel Model 2 tested (with MLR estimator). Latent classroom-level constructs are represented as circles and student-level indicators of these latent variables are represented as squares. Dotted lines represent non-significant relations.

identification, while grade retention explained only school identification. Male students, non-retained students, students whose mother and father had a higher level of education and students who perceived that their teachers used more effective feedback presented higher school identification levels. Female students, students whose mother had a higher level of education, students with a higher level of school identification and students who perceived that their teachers used more effective feedback had higher behavioral engagement levels. Students' nationality was not related to any variable under study.

Results also indicated that students' perception of teachers' feedback was related to students' history of grade retention. Retained students perceived that their teachers used less effective feedback than non-retained students. Despite this, the relation was very weak.

At the classroom level, we observed that the classroom environment effect on school identification and behavioral engagement levels remained significant, with considerable size effects. Students in classrooms with higher levels of supportive environments (i.e., where teachers used more effective feedback) had higher school identification and behavioral engagement levels. Additionally, students in classrooms from schools with fewer students also had higher school identification and behavioral engagement levels. The number of students was not related to the supportive classroom environment.

Table 3 shows that students in classes from lower grade levels presented higher levels of school identification and indicated a more supportive environment where teachers used more effective feedback. There was a less supportive environment in classrooms

from higher grade levels. Belonging to a TEIP school was not related to the supportive classroom environment, school identification or behavioral engagement levels.

The final model presented very good indicators of model fit: $\chi^2(8) = 6.53, p = 0.588; CFI = 1.000; TLI = 1.004; RMSEA < 0.001; SRMR = 0.009$ (within), 0.029 (between). The model clearly explained the variance, both at the individual and classroom levels, in students' behavioral engagement (37.3 and 75.0%, respectively) and school identification (19.6 and 52.8%, respectively). Teachers' feedback variance is only distinctly explained by the variables at the classroom level (1.1 and 49.2%, respectively).

DISCUSSION

In this study, we aimed to understand if a supportive learning environment generated by teachers' use of effective feedback can boost students' school identification and behavioral engagement. We used teachers' feedback as an indicator of a supportive classroom environment. Our results confirm previous studies that indicated that students' perceptions about teacher feedback are positively related with their school identification and behavioral engagement (e.g., Koka and Hein, 2005; Koka and Hein, 2006; Leh et al., 2014; Conboy et al., 2015; Vattøy and Smith, 2019; Carvalho et al., 2020; Wang and Zhang, 2020). The feedback directly experienced by students enhance their sense of autonomy and self-efficacy by offering information about where they are going, how they are going there and how to reach their goals (Hattie, 2009; Wisniewski et al., 2020). Therefore, by

offering effective feedback, the teacher is communicating to the student (and, by extension, to all students in the classroom) that learning is essential and relevant to students' personal goals (where they are going), that they can succeed and are valued by the teacher (by caring about how they are going) and informing them about the behaviors they need to exhibit to better meet expectations in the future (where to next). In other words, effective feedback reinforces the value of school for the students, their feelings of belongingness and their behavioral engagement in school activities, avoiding dropout and social exclusion.

Our results also indicated that other individual variables like mother's and father's educational level, gender and grade retention were related to students' school identification and behavioral engagement, all of which is consistent with previous studies (e.g., Allen et al., 2018; Bear et al., 2019; Cunha et al., 2019; Olivier et al., 2020). We found that mothers' educational level was positively related to students' school identification and behavioral engagement levels, while the fathers' educational level was only positively related to students' school identification. Parents' educational attitudes and beliefs are considered to be significant influences on their children's educational attitudes. Mothers with higher education levels are more intellectually involved in school activities, providing intellectual resources and helping with schoolwork, thus creating a positive environment in which students develop their school identification and behavioral engagement (Bempechat and Shernoff, 2012). According to Vieira (2013), recent research on families and family dynamics in Portugal confirm that mainly mothers are the ones that help children with schoolwork, take them to school, and talk with them about school and their studies. Therefore, behavioral engagement seems to be more affected by the mothers' level of education than for the fathers' level of education.

Previous studies have also indicated that female students score higher in all engagement dimensions, especially in the behavioral engagement (e.g., Lietaert et al., 2015). Still, our results were not completely consistent with previous studies. In the present study, girls presented higher levels of behavioral engagement, as expected, while males presented higher levels of school identification. It is possible that our results differ from previous research because of the dimensions that were assessed by the school identification measure. Research indicates that males have higher levels of academic self-efficacy (e.g., Huang, 2013). In the present study, the school identification measure included a dimension that assesses students' perceptions of their capacity and will, which contribute greatly to the school identification latent factor (see **Supplementary Figure S2** in the Supplementary Material). Therefore, males' higher levels of school identification might be related to a higher sense of self-efficacy.

Researchers suggest that girls scored higher in their behavioral engagement because activities are focused on language and verbal learning, competences stereotypically related to girls (Lietaert et al., 2015). Still, Lietaert et al. (2015) observed in their study that teachers offered less support to male students, which was related to their lower engagement compared to girls. Authors suggest that teachers offer more support to girls because they are less

tolerant of negative behaviors from boys. In contrast, they associated more positive behaviors (more compliance, better organization skills, etc.) to girls. Portuguese teachers also described boys as being disconnected and irresponsible and girls as more focused and responsible (Wall et al., 2017). Although we only find a marginally significant effect of gender on students' perception of teachers' feedback, our results seem to correspond to Lietaert et al. (2015) findings: boys perceive that teachers used less effective feedback than girls. Nevertheless, given that the gender bias in feedback observed in this study was small, it could be argued that these students believe that their teachers do not make much difference between genders in the use of effective feedback. Additionally, Lietaert et al. (2015) indicated that it is possible that these lower levels of engagement from boys could explain why teachers are less supportive. Consequently, future research may need to consider the reciprocal effect between teacher support through effective feedback and engagement to better understand this classroom dynamic.

Regarding the effect of grade retention, previous studies indicated that retention seems to leave a significant mark on students that lead them to develop a more negative attitude toward school, associating school with negative experiences (e.g., Martin, 2011, Santos et al., submitted). A highly interesting finding from our study was that retained students also perceived that their teachers used less effective feedback. Although the effect was small, it could indicate that teachers had lower expectations about retained students (e.g., OECD, 2012), using less effective feedback with students with lower achievements. For example, Gentrup et al. (2020) observed that teachers communicate their expectations through different feedback practices, giving less positive feedback and more negative feedback to students for whom they have low expectations. Furthermore, Monteiro et al. (2019) observed that teachers gave less feedback at the process and self-regulation levels to students with low achievement. In Santana's study (Santana, 2019), a number of Portuguese school directors admitted that teachers tend to ignore retained students.

However, the central question of the present study is whether the aggregated classroom characteristic of teachers' feedback, as a measure of a supportive classroom environment, affects students' school identification and behavioral engagement after controlling for other inter-individual differences at the individual level. The answer was positive: Our findings demonstrated that the supportive environment created by teachers' feedback varies across schools and that students in classrooms where, on average, teachers used more effective feedback and created a supportive classroom environment, had higher levels of school identification and behavioral engagement than students in classrooms without this supportive environment. This was true regardless of students' individual perceptions about teachers' feedback.

These findings represent a significant contribution to the theoretical discussion about perceived feedback. Even if a student perceived that his/her teachers used little effective feedback, if s/he was in a classroom with a highly supportive environment, the student would have higher levels of school identification and behavioral engagement than if s/he was in a classroom with a less supportive environment. These results

suggest that feedback interactions may affect the learning and engagement of other students in the classroom because they are exposed to both their peers' behavior and performance and teachers' feedback to their peers, as observed by Conroy et al. (2009). By contrast, if teachers display differential feedback for some students based on their individual characteristics (gender, nationality or achievement levels), creating an unsupportive classroom environment, students' trust for or receptivity to the teacher as a source of support and feeling of belonging will be reduced (Voelkl, 2012). Therefore, similarly to what Hattie and Timperley (2007) and Wisniewski et al. (2020) have said, the feedback has huge power. The use (or not) of effective feedback can have an overall impact on the classroom environment and climate, increasing (or decreasing) students' engagement and school identification. This conclusion deserves to be studied more deeply in future research because students were asked to think about a discipline they liked. In a discipline where students have negative experiences, this impact can have other effects on their behavioral engagement and identification.

More importantly, the quality of the supportive classroom environment was not related to the number of students in the school, suggesting that teachers in schools with both large and small numbers of students were able to create a supportive environment using effective feedback. Nevertheless, our results indicated that students in classrooms from schools with fewer students had higher levels of school identification and behavioral engagement, which is coherent with previous studies (Finn and Voelkl, 1993; Willms, 2003; Weiss et al., 2010). However, the size effect of the number of students in the school is smaller than the effect of the supportive classroom environment. As a result, our findings indicated that the classroom environment is more critical than the number of students in the school to predict students' engagement. As mentioned by Weiss et al. (2010), the reduction of the number of students in a class does not guarantee that students will experience the same benefits as students in smaller schools, especially if their feedback environment is not adequate to prompt students' engagement.

At the classroom level, the results indicated that students in classes from lower grade levels presented higher school identification levels. This was expected since the literature indicates that affective engagement tends to decrease upon the transition to adolescence (Eccles et al., 1993; Mahatmya et al., 2012). Eccles et al. (1993) suggested that the mismatch between the needs of developing adolescences and the opportunities afforded by their social environments could decrease their school identification. Our results are consistent with this theory since we observed a less supportive classroom environment in classrooms from higher grade levels. Therefore, students in higher grades perceive that their teachers offer less feedback than what they feel they need. It could be that students in lower grade levels perceive a more supportive environment because in 6th and 7th grades teachers focused more on mastery than on performance (Guo, 2020). Teachers' primary goal in the middle school years is to help students master certain knowledge and skills to prepare for secondary school. Consequently, they may provide more feedback at the process and self-regulation levels to enhance learning habits and abilities (Guo, 2020). On the contrary, in

the higher grade levels, teachers may focus most on providing correct answers or solutions to students because teachers are more focused on performance to help students prepare for their upcoming examinations (Guo, 2020). Future studies could test this hypothesis by assessing both the supportive classroom environment and teachers' goals and beliefs about feedback in several grade levels.

Although the present investigation contributes to the theory about feedback and students' engagement by accounting for both individual and classroom factors that may impact students' schooling experience, it has some important limitations to consider for future research. For the assessment of the supportive classroom environment, we relied on the perception that students have of their teachers' feedback practices. Although classroom-level aggregated measures of students' perceptions are reliable indicators of a learning environment (Marsh et al., 2012), using classroom observations, interviews, and teacher reports would have provided a complementary evaluation of teachers' feedback practices. Additionally, we used a manifest-latent approach to aggregate the classroom level variable. Although it controlled sampling errors at the classroom level, we did not control measurement errors at the individual level. A doubly latent approach was necessary to control both types of errors (Marsh et al., 2009). Unfortunately, double latent models required a larger sample than used in the present study (Marsh et al., 2009). Future studies should replicate this research using a larger size sample, with a higher number of classrooms. Another limitation of this research was the use of a single research method. To produce in-depth and richer information in order to better understand the relations between the variables of the problem being studied, it would be better to have leaned toward a mixed methods approach to get potentialities that together give a more precise view of the role of feedback on school identification and student engagement (Hughes, 2016).

Despite these limitations, in the present study we found evidence that indicated that students' perceptions of teachers' feedback and the classroom environment created by the effective feedback were more critical for explaining students' school identification and behavioral engagement than their individual characteristics (like mother's level of education, gender and grade retention) or the size of the school. Therefore, improving teachers' use of effective feedback, especially in the upper grade levels, could impact students' engagement levels. It is essential to provide teachers with training that focuses on giving effective and high-quality feedback. This training should enable teachers to provide a supportive environment to all their students, independent of their gender or what achievements they expect from their students, based on their school trajectory.

Being competent as a teacher to develop a supportive environment in a classroom also means being alert to the expectations constructed around the students. If teachers hold different expectations based on achievement levels or gender, this can influence students' trust to see teachers as a source of support or as a person that allows her or him to develop feelings of school belonging (Voelkl, 2012).

The evidence suggests that teachers can improve school identification and behavioral engagement by using effective feedback. If there is a supportive environment developed by

teachers in the classroom through the use of effective feedback, students will learn better and achieve their psychological and social goals. A supportive environment will motivate the students to communicate with their teachers and peers, to engage in different activities and forms of learning environments and to increase their sense of school identification.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: The datasets generated for this study are available on request. Requests to access these datasets should be directed to Carolina Carvalho, cfcarvalho@ie.ulisboa.pt.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Comissão de Ética (CdE) of the Instituto de Educação (IE) da Universidade de Lisboa. Written informed

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

AUTHOR CONTRIBUTIONS

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

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2021.661736/full#supplementary-material>

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

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