

Article

Secondary School Students' Engagement in Learning Activities: Validation of a Short Scale

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Abstract

Student engagement is a multidimensional construct strongly associated with learning outcomes and academic success. However, its measurement remains challenging, as existing instruments often conflate engagement in learning activities with engagement in the school community. In addition, brief measures are scarce despite their increasing value, and most available instruments do not incorporate agentic engagement. Assessing student engagement in learning activities is, therefore, crucial for monitoring academic progress, identifying students at risk of dropping out, and predicting academic success. This study aimed to validate the 12-item Secondary School Student Engagement in Learning Activities: Short Scale, adapted from a higher education measure, which focuses solely on student engagement in learning activities and comprises four dimensions: cognitive, affective, behavioral, and agentic engagement. The validation study involved 566 students, 61.7% from middle school and 38.3% from high school. Confirmatory factor analysis supported the four-factor structure that was found in the original scale. Subsequent analyses also demonstrated the scale's reliability, convergent, discriminant, concurrent, and predictive validity, and measurement invariance. The study discusses the benefits and implications of utilizing this measure, offering a promising tool for evaluating student engagement and learning outcomes in secondary student populations.

Keywords: student engagement; engagement in learning; agentic engagement; scale validation; secondary education

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1. Introduction

1.1. Background and Purpose

Educators and researchers have recently taken a keen interest in student engagement (SE) due to its strong correlation with student outcomes, such as academic performance and school retention (Abbott-Chapman et al., 2014; Wong et al., 2024). However, the concept of SE is currently at a crucial stage marked by a lack of clarity in its definition (Lam et al., 2014; Reschly & Christenson, 2012), which in turn affects the quality of the assessment tools used to measure it (Fredricks et al., 2016). This lack of clarity is not just a hurdle but a pressing issue that needs to be addressed to improve education.

To address this ambiguity, Veiga et al. (2025) have identified and reflected on various issues surrounding the concept of SE, offering suggestions to mitigate them. One aspect the authors emphasize is that indicators of SE have been conflated with predictors and outcomes, leading to significant conceptual confusion (Appleton et al., 2006; Liem & Martin, 2012). For instance, the item “My teachers are there for me when I need them,” included in the Student Engagement Instrument (SEI; Appleton et al., 2006), is an antecedent of SE.

It is essential to note that Veiga et al. (2025) emphasize the importance of viewing SE as comprising two components: student engagement in learning activities (SELA) and student engagement in the school community (SESC), aligning with Wong and Liem (2022). This distinction is crucial because students may be engaged in school but not in learning, and vice versa. However, this distinction may not always be evident in current secondary education assessment tools. For example, “Other students at school care about me” reflects SESC, whereas “Most of what is important to know I learn in school” reflects SELA. Both statements appear on the same scale (SEI; Appleton et al., 2006).

As to the instruments that measure SE, the number of dimensions and the content of the items differ (e.g., Zhoc et al., 2019). Thus, the conceptual clarification proposed by Veiga et al. (2025) is crucial for the audience in our field, and it needs the eradication of three pollutants: overgeneralizations, jingle-jangle fallacies, and ambiguity of the object of SE (Reschly & Christenson, 2012; Wong & Liem, 2022). The control of these pollutants accompanied the construction of the measure Higher Education Student Engagement in Learning Activities: A Short Scale (HESELA-SS), which took place in two studies, using exploratory factor analysis (EFA) (Study 1, $N = 205$) and confirmatory factor analysis (CFA) (Study 2, $N = 404$). The findings supported good psychometric qualities and corroborated the four-dimensional factorial structure with cognitive, affective, behavioral, and agentic dimensions.

Cognitive engagement involves elaboration and deep processing of information instead of mere memorization (Walker et al., 2006). Affective engagement involves the positive emotional experience during the learning activity, as indicated by the interest and enjoyment experienced by the student (Kong et al., 2003; Lam et al., 2014; Skinner et al., 2009). Behavioral engagement refers to the student’s observable conduct during learning, gauged by the investment of attention, effort, and persistence (Appleton et al., 2006; Kong et al., 2003; Skinner et al., 2009). Agentic engagement describes the student’s initiative during the learning activity, assessed by making suggestions, asking questions, and communicating preferences (Reeve & Tseng, 2011; Veiga et al., 2025).

The current research aimed to validate the Secondary School Student Engagement in Learning Activities: Short Scale (S3ELA-SS); like the original study, it is grounded in a conceptual framework with two components of SE (SELA and SESC), and with the four dimensions of SELA (cognitive, affective, behavioral, and agentic). Personal factors, namely competence and relatedness, are considered to impact SELA (Chiu, 2022; Reeve & Tseng, 2011), and academic achievement is regarded as an outcome of SELA (Abbott-

Chapman et al., 2014). In Portugal, secondary education comprises lower secondary (grades 7–9) and upper secondary (grades 10–12), typically serving students aged 12–18. This educational stage is marked by increasing curricular differentiation, higher academic demands, and growing expectations regarding students' autonomy, participation, and responsibility for learning.

1.2. Existing Scales

Various measures have been created and validated to evaluate SE in secondary education, differing in the number of dimensions and items. In an overview of self-report measures published between 2009 and 2020, Fredricks (2022) discusses thirteen measures. The number of dimensions in these measures ranges from two (Yang et al., 2020) to seven (Wang et al., 2014), and the total number of items ranges from nine to thirty-five. Three of the measures are short scales with fewer than 15 items. Ten measures were employed in samples of secondary education students.

Table S1 presents some of the most common scales of SE for secondary education, specifying dimensions, target groups, number of items, strengths, and weaknesses. The scales encompass three to five dimensions and consist of 24 to 57 items.

Generally, these scales are focused on learning and are not brief. Notably, none of these scales include the agentic dimension introduced by Reeve and Tseng (2011). These authors developed and validated the Agentic Engagement Scale (AES), which comprises five items to evaluate secondary students' agentic engagement. Subsequently, Reeve and colleagues (2020) administered this scale to another sample of secondary education students, confirming that agentic engagement was a distinct predictor of students' outcomes, unlike other engagement dimensions. Therefore, the authors emphasize the necessity of incorporating agentic engagement.

Additionally, some scales have been validated for different school levels. The Student Engagement Instrument (SEI) has also been validated for elementary, secondary, and college samples (Waldrop et al., 2019). The Classroom Engagement Inventory (CEI; Wang et al., 2014) can be administered to students from the 4th to 12th grade, making it suitable for a wide age range of students. The Motivation and Engagement Scale (MES; Martin, 2007) has been validated across various educational levels and curricular subjects (see Liem & Martin, 2012, for a review) for use across a broad academic lifespan, including primary school, high school, and university/college.

In contrast, the S3ELA-SS focuses exclusively on SELA, incorporates agentic engagement as a core dimension grounded in self-determination theory, and offers a concise format suitable for school-based and large-scale research (Reeve & Tseng, 2011; Reeve et al., 2020). Short engagement measures are designed to provide efficient, theory-driven indicators that are suitable for large samples, repeated assessments, and applied educational settings where respondent burden and feasibility are critical constraints (Fredricks, 2022; O'Donnell & Reschly, 2020). Brief scales have been shown to be particularly useful for monitoring engagement trajectories and identifying students at risk, especially when engagement is assessed as a multidimensional construct (Reschly & Christenson, 2012).

O'Donnell and Reschly (2020) suggest that expanding an SE scale to different age groups yields benefits, including identifying at-risk students, monitoring student progress (with adjustments to interventions based on changes in engagement levels), and offering a comprehensive view.

Additionally, validating existing scales for new educational levels or populations has become increasingly valued in recent research. For instance, Guilarte et al. (2025) conducted a psychometric validation of a satisfaction scale with education degree students, without developing a new instrument. This highlights that validation-focused studies,

such as the present one, are both relevant and recognized by high-impact journals, including Education Sciences.

1.3. Need to Include the Agentic Engagement

Given the growing recognition of the importance of agentic engagement, the present research included this dimension as an essential component of the SELA scale. In doing so, we sought to fill the gap identified in previous instruments, which—focusing on the behavioral, affective, and cognitive dimensions—did not sufficiently contemplate the student's active role as an agent in his educational process.

The importance of valuing agentic engagement stems from several reasons (Fredricks, 2022; Mameli & Passini, 2017; Reeve & Tseng, 2011; Zambrano et al., 2022). Firstly, promoting agentic engagement empowers students to take ownership of their learning and enhances their self-regulation skills, which apply to various life situations (Fredricks, 2022; Mameli & Passini, 2017). Through their agency and initiative, students elevate the quality of their learning environment, leading to increased motivation, growth, and academic advancement (Reeve & Jang, 2022). Moreover, numerous studies have demonstrated correlations between agentic engagement and students' academic success, resilience, and decreased risky behaviors (Reeve & Tseng, 2011; Zambrano et al., 2022), expanding beyond the typical dimensions of cognitive, affective, and behavioral aspects. UNESCO (2021) also supports these research findings on agentic SE, emphasizing the significance of empowering students to take initiative in their learning journey. Considering the principles of 21st-century Learning and Teaching (Şentürk & Baş, 2020), which aim to prepare students for a rapidly evolving world, educational institutions should endorse learning autonomy, foster critical thinking, and encourage students' proactive roles.

Incorporating the agentic dimension offers a more comprehensive understanding of SE, and Reeve and Jang (2022) suggest that it may be the most crucial type of engagement for students. Nonetheless, current measures of SE have overlooked the agentic dimension (Bologna Declaration, 1999; Sinval et al., 2018). Hence, it is reasonable to apply the same four dimensions validated in higher education (cognitive, affective, behavioral, and agentic) to these school environments, understanding that their specific expressions may vary depending on developmental and contextual factors (Appleton et al., 2006; Kong et al., 2003; Lam, 2014; Reeve & Tseng, 2011). This conceptual advancement is operationalized through the S3ELA-SS, which fully integrates the agentic dimension into a brief, age-appropriate instrument for secondary education.

1.4. SELA and Developmental Needs in Secondary Education

The concept of SELA is closely aligned with adolescents' developmental needs in secondary education, promoting participation, emotional connection, and agency in learning (Reeve & Tseng, 2011; Woolfolk, 2018). Studies show that engaged students tend to achieve more, feel more motivated, and show greater well-being, while engagement protects against dropout and underperformance (Fredricks et al., 2016; Wong et al., 2024). SELA also fosters autonomy (Zimmerman, 2002), belonging (Osterman, 2000), competence (Marsh & Martin, 2011), and future orientation (Schueller & Seligman, 2010), making it a key factor in students' academic and personal development. In this way, SELA not only supports learning but also contributes to identity formation and life skills acquisition, helping students navigate adolescence and prepare for adulthood.

2. Materials and Methods

2.1. Participants

This research was conducted with 624 secondary education students selected through non-probabilistic convenience sampling. Within this convenience sample, a computerized random selection procedure was applied at the student level, ensuring that each participant had an equal probability of being retained for the final analyses. This procedure follows recommendations for mitigating bias within non-probabilistic sampling designs (Taherdoost, 2016). Specifically, the unit of randomization was the individual student. After data collection, all students with complete responses were pooled, and a computerized random number generator in IBM SPSS (version 29) was used to randomly retain cases for the final analyses. The participating institutions catered to students from all socio-economic backgrounds, predominantly from middle-level strata.

A preliminary analysis was conducted to identify and exclude outliers, removing 58 severe ones. As a result, the final sample consisted of 566 students, representing approximately 90.7% of the original convenience pool, which is generally considered adequate in applied research contexts (Kellar & Kelvin, 2012).

Among these, 349 students (61.7%) were from middle school, and 217 (38.3%) were from high school. The gender distribution was 301 females (53.2%) and 265 males (46.8%).

Additionally, the sample included 157 students from the 7th grade (27.7%), 192 from the 9th grade (33.9%), 108 from the 10th grade (19.1%), and 109 from the 12th grade (19.3%). Furthermore, 212 students (37.5%) were enrolled in public schools, while 354 (62.5%) attended private schools in the Lisbon metropolitan area. The students were between 11 and 18 years old, averaging 14.36 ($SD = 1.77$).

2.2. Measures

2.2.1. HESELA-SS

The HESELA-SS is a 12-item self-report measure initially developed and validated for use in higher education in Portugal by Veiga et al. (2025; the scale has been published as a preprint and is currently under review for publication in PLOS ONE). It is structured into four dimensions—cognitive, affective, behavioral, and agentic—each containing three items. Respondents answer the items using a 5-point Likert-type scale (1 = totally disagree to 5 = totally agree). Higher scores on the scale indicate higher SELA. Some words in the questionnaire were adjusted to fit the context of secondary education environments (e.g., replacing “university/college” with “school”). The HESELA-SS has confirmed solid psychometric properties, with a total explained variance of 68.07%. Additionally, the Composite Reliability (CR) coefficients were appropriate: 0.70 for the cognitive dimension, 0.82 for the affective dimension, 0.78 for the behavioral dimension, and 0.83 for the agentic dimension.

2.2.2. Other Measures

Concurrent validity was evaluated using items from the “Student Engagement Questionnaire” (SEQ; Lam et al., 2014), which was selected because it also contains items related to SELA. Item selection followed a theory-driven, semantic-matching approach, prioritizing items that most clearly represented the defining characteristics of each engagement dimension and aligned conceptually with the SELA framework. To avoid ambiguity, item numbering is reported using dimension-specific suffixes: cognitive engagement (3cog, 9cog, 12cog; e.g., “I make an effort to understand how the things I learn in school relate to each other”), affective engagement (1aff, 4aff, 6aff; e.g., “I enjoy learning new things in class”), and behavioral engagement (8beh, 9beh, 12beh; e.g., “If I have trouble understanding a problem, I review it until I understand it”). Participants responded to the

items using a 5-point Likert scale (1 = totally disagree, 5 = totally agree). Additionally, in all cases, higher scores indicated greater and more favorable perceptions. The three SEQ dimensions demonstrated acceptable reliability in the current study ($\omega = 0.52$ for the cognitive dimension; $\omega = 0.70$ for the affective dimension; $\omega = 0.60$ for the behavioral dimension; $\omega = 0.72$ for the full scale). The SEQ has exhibited satisfactory internal reliability and construct validity across different cultures (Lam et al., 2016).

The general inquiry included other measures about perceived competence and relatedness to assess predictive validity. Previous research has established a relationship between these measures and SE (Chiu, 2022; Schnitzler et al., 2021). Recognizing a potential bidirectional nature of the relationship between perceived competence and relatedness and SE, as antecedents to engagement, they can also be considered outcomes. Perceived competence was assessed through three items (e.g., “I consider myself able to successfully learn”; $\omega = 0.78$). In comparison, perceived relatedness was evaluated using three items (e.g., “I feel integrated into existing school groups”; $\omega = 0.79$). These items were adapted from Reeve and Tseng (2011), not having been validated for the Portuguese population yet. For both measures, participants responded using a 5-point Likert scale (1 = totally disagree, 5 = totally agree).

The study utilized academic achievement and grades in Portuguese as indicators of school outcomes and to assess predictive validity, consistent with previous research (e.g., Lei et al., 2018). Academic achievement was evaluated using a 5-point Likert scale based on students’ self-assessment, ranging from “very low” (1) to “very high” (5). Additionally, students were asked to report their final Portuguese grades from the previous year. In the Portuguese education system, middle school students are graded on a five-point scale converted to match the 20-point scale used in high school.

2.3. Procedure

The research study adhered to ethical standards for human subject research, following the Declaration of Helsinki and the Oviedo Convention. The Ethics Committee of the Institute of Education of the University of Lisbon approved the study (N.º 1525 Proc. IDOK de 27 November 2023). Parental informed consent was obtained prior to the data collection. Students were given access to a website providing information about the research objectives, questionnaires, and procedures. We ensured the confidentiality and anonymity of the data collected by the written informed consent that was included in the beginning section of the questionnaires.

Questionnaires were completed in classrooms, submitted anonymously online using the Google Forms platform in 2023, under the supervision of a teacher or psychologist. The online platform required responses to all questions. The link to complete the questionnaires was distributed via email to the directors of secondary education, who then forwarded it to selected supervisors.

2.4. Data Analyses

The data analyses were conducted using IBM SPSS and AMOS, version 29. To assess the normality of item distribution, the skewness and kurtosis values were checked, falling within the recommended range: skewness $< |3.0|$ and kurtosis $< |8.0|$ (Kline, 2011). Ensuring there was no multicollinearity, all tolerance values were >0.10 , and variance inflation factor (VIF) values were <10 (Kline, 2011). Univariate outliers were identified by computing z-scores for each S3ELA-SS dimension and classifying values with z-scores ± 3.29 as outliers. This threshold was chosen because it includes around 99.9% of the normally distributed S3ELA-SS z-scores (Field, 2017).

In terms of construct validity, according to Flora and Flake (2017), if a scale has already demonstrated validity through both EFA and CFA in a previous study, CFA can be

directly applied to new data to evaluate model fit and confirm underlying constructs. Therefore, a four-factor CFA was conducted using maximum likelihood estimation to evaluate construct validity and ascertain the fit of the four-dimensional structural model to the data. Although Likert-type items are ordinal, 5-point response scales may be treated as approximately continuous when distributional assumptions are met, a practice commonly adopted in structural equation modeling (Kline, 2011). Additionally, a second-order model was tested to examine whether the four dimensions of engagement could be conceptually grouped under a broader meta-construct, SE. We assessed the model fit based on established criteria: a χ^2/df ratio between 1 and 3 (Bollen, 1989), CFI and GFI values exceeding 0.90 (Kline, 2011), and RMSEA values below 0.08 (Hair et al., 2019). Standardized residuals were examined, with residuals below $|2.5|$ considered not indicative of any model issues (Hair et al., 2019). Factor loadings were appraised as excellent (>0.71), very good (>0.61), or good (>0.55) according to the criteria outlined by Comrey and Lee (1992).

To assess convergent validity, we computed the average variance extracted (AVE), considering values of ≥ 0.50 as indicative of acceptable convergent validity (Fornell & Larcker, 1981). To establish discriminant validity, we looked for the square root of the AVE to be higher than the correlations among the four-dimension scale scores and for AVE values to be higher than MSV values (Fornell & Larcker, 1981; Hair et al., 2019). We also calculated the composite reliability (CR), with values over 0.70, considered a satisfactory reliability measure.

For concurrent validity, we computed Pearson correlation coefficients with SEQ items. We evaluated the magnitude of the correlations using Cohen's (1988) criteria: $r = 0.10$ for a small effect, $r = 0.30$ for a moderate effect, and $r = 0.50$ for a large effect. To examine predictive validity, multiple linear regressions were used to assess whether the SELA dimensions predicted independent variance in perceived competence, perceived relatedness, self-reported academic achievement, and grade in the Portuguese language.

We conducted multigroup CFA to assess the measurement invariance based on gender (male vs. female) and school year (middle vs. high school) to test the four-factor model of SE for configural and metric (weak) invariance. Initially, an unconstrained model served as the baseline for subsequent testing. Next, we constrained the factor loadings to be equal across groups to evaluate metric invariance. Invariance was assessed based on two criteria: the $\Delta\chi^2$ test comparing the fit of constrained and unconstrained models (Satorra & Bentler, 2001) and the $\Delta\text{CFI} < 0.01$ between the two models (Cheung & Rensvold, 2002).

3. Results

3.1. Construct Validity

Results revealed a good model fit, with $\chi^2(48) = 111.80$, $p < 0.001$, $\chi^2/\text{df} = 2.33$, GFI = 0.967; CFI = 0.970; RMSEA = 0.049, and factor loadings ranging from 0.51 to 0.83, indicating that all items adequately represented their respective dimensions (Figure 1).

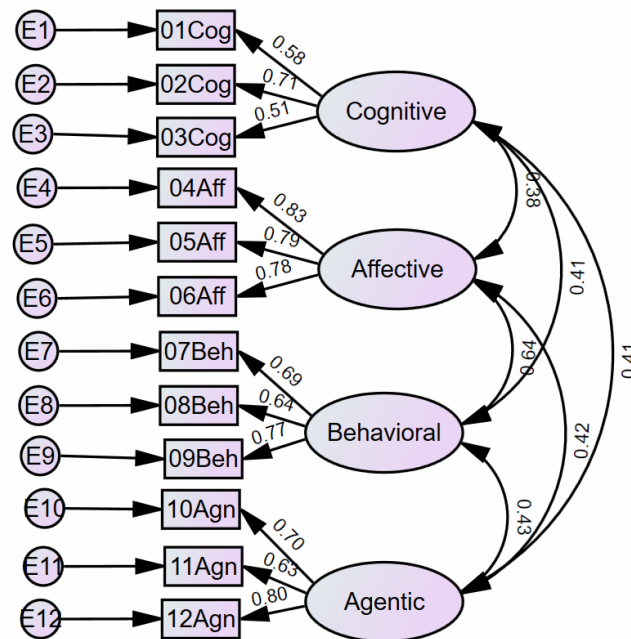


Figure 1. Confirmatory Factor Analysis: Four-factor Model.

Significant correlations were observed among all four dimensions ($p < 0.001$), with the strongest correlation observed between the affective and behavioral dimensions (0.64), and the weakest between the cognitive and affective dimensions (0.39). Furthermore, significant positive correlations were found between all four dimensions and the total scale ($p < 0.001$). In summary, the results of the CFA lend support to the four-dimensional model. The 12 validated items of the scale used in the CFA are found in Table S2.

A second-order model was examined (Figure 2), with SELA as a higher-order factor and cognitive, affective, behavioral, and agentic engagement as first-order factors. All four factors were found to have significant relationships with SE ($p < 0.001$), with behavioral engagement showing the most robust relationship ($\beta = 0.81$) and cognitive engagement showing the weakest ($\beta = 0.54$). The model demonstrated a good fit: $\chi^2(50) = 119.32$, $p < 0.001$, $\chi^2/df = 2.39$, GFI = 0.965; CFI = 0.967; RMSEA = 0.050. However, despite the good fit, this second-order model showed a decrease in fit ($\Delta CFI = 0.003$; $\Delta RMSEA = 0.001$) compared to the previous four-factor model, and this difference was statistically significant ($p = 0.023$), suggesting that the four-factor model provides a better fit.

Upon reviewing the standardized residuals for each model, it was observed that only two were between $|2.5|$ and $|4.0|$. As these respective items did not present other concerns, no modifications were made to the models, in line with the recommendation by Hair et al. (2019).

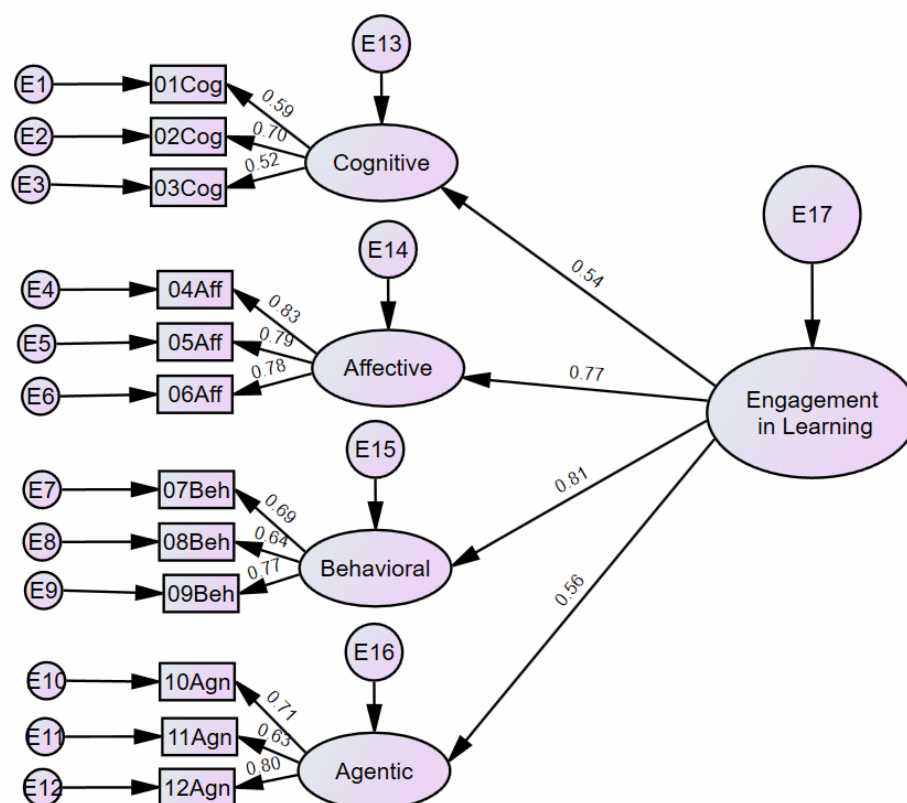


Figure 2. Confirmatory Factor Analysis: Second-order Model.

3.2. Reliability

Table 1 presents the descriptive statistics and reliability of the four SELA dimensions. All dimensions scored three or higher, with the cognitive dimension scoring the highest and the agentic scoring the lowest. In terms of reliability, all four dimensions showed CR values between 0.63 (cognitive dimension) and 0.84 (affective dimension), surpassing the recommended benchmark of 0.70, except for the cognitive dimension, which showed a slightly lower value. This indicates that this measure demonstrates adequate reliability and internal consistency; the items consistently represent the same latent construct.

Table 1. Reliability, Descriptive Statistics, Convergent and Discriminant Validity.

	Mean (SD)	Skewness	Kurtosis	CR	AVE	MSV	Cognitive	Affective	Behavioral	Agentic
Cognitive	3.56 (0.65)	−0.07	−0.10	0.63	0.37	0.17	0.61	0.39	0.41	0.41
Affective	3.43 (0.75)	−0.23	0.17	0.84	0.64	0.41		0.80	0.64	0.42
Behavioral	3.52 (0.69)	−0.23	−0.13	0.75	0.50	0.41			0.71	0.43
Agentic	3.00 (0.87)	−0.13	−0.29	0.76	0.51	0.19				0.72
Total										
S3SELA-SS	3.38 (0.53)	0.02	0.07							

Note. The bold elements of the diagonal matrix are the square root of the average variance extracted; inter-construct correlations are shown off-diagonal. The range of scores for each item on the scale is 1 to 5.

3.3. Convergent and Discriminant Validity

In terms of convergent and discriminant validity (Table 1), all dimensions exhibited AVE values equal to or above 0.50, except for the cognitive dimension, which showed a lower AVE value (0.37). However, despite the low AVE value, this dimension

demonstrated a CR higher than 0.60, which indicates acceptable convergent validity (Fornell & Larcker, 1981).

Furthermore, results also supported discriminant validity, as the square root of the AVE values exceeded the observed correlations between dimensions, and AVE values surpassed MSV values (Hair et al., 2019). These findings offer strong evidence of this scale's convergent and discriminant validity.

3.4. Concurrent Validity

Regarding concurrent validity (Table 2), a strong and positive correlation was found between the SELA's total score and the SEQ total ($r = 0.72$, $p < 0.001$), indicating the concurrent validity of the measure when related to the SEQ. When looking at the dimensions, moderate positive correlations were observed between the two instruments. Therefore, support was also found for concurrent validity.

Table 2. Correlations between the S3ELA-SS and the SEQ.

		SEQ			
		Cognitive	Affective	Behavioral	Total
S3SELA-SS	Cognitive	0.49 ***	0.25 ***	0.33 ***	0.47 ***
	Affective	0.28 ***	0.69 ***	0.34 ***	0.58 ***
	Behavioral	0.32 ***	0.51 ***	0.57 ***	0.62 ***
	Agentic	0.28 ***	0.35 ***	0.31 ***	0.41 ***
	Total	0.47 ***	0.63 ***	0.53 ***	0.72 ***

*** $p < 0.001$.

3.5. Predictive Validity

All four SELA dimensions showed positive and significant correlations with all outcome criterion variables, except for the affective and agentic dimensions with the Language grade. Consequently, we conducted multiple linear regressions to determine if each dimension could predict unique variance in each outcome while accounting for the variance explained by the other dimensions (Table 3). All the combined four-predictor models yielded statistically significant results ($p < 0.001$).

In terms of competence, the individually significant dimensions were cognitive ($p = 0.001$), behavioral ($p = 0.002$), and agentic ($p = 0.012$). For relatedness, the individually significant dimensions were affective ($p = 0.002$) and agentic ($p < 0.001$). For academic achievement, the individually significant dimensions were cognitive and behavioral (both with $p < 0.001$). Similar results were observed regarding the Language grade.

Table 3. SELA dimensions as Predictors of Competence, Relatedness and Academic Achievement.

	<i>B</i> (SE)	β	<i>p</i>
Competence			
Cognitive	0.24 (0.04)	0.23	<0.001
Affective	0.05 (0.04)	0.06	0.188
Behavioral	0.31 (0.04)	0.32	<0.001
Agentic	0.08 (0.03)	0.10	0.012
Relatedness			
Cognitive	0.07 (0.06)	0.05	0.230
Affective	0.18 (0.06)	0.15	0.002
Behavioral	0.08 (0.06)	0.06	0.225
Agentic	0.18 (0.05)	0.17	<0.001

Language			
Cognitive	10.20 (0.23)	0.26	<0.001
Affective	−0.46 (0.24)	−0.11	0.052
Behavioral	0.83 (0.26)	0.18	0.002
Agentic	−0.21 (0.18)	−0.06	0.251
Achievement			
Cognitive	0.35 (0.05)	0.29	<0.001
Affective	−0.08 (0.05)	−0.07	0.109
Behavioral	0.38 (0.05)	0.34	<0.001
Agentic	0.01 (0.04)	0.02	0.723

Note. $N = 566$; For Competence, Adjusted $R^2 = 0.27$, $F = 53.99$, $p < 0.001$; for Relatedness, Adjusted $R^2 = 0.10$, $F = 16.50$, $p < 0.001$; for Language, Adjusted $R^2 = 0.09$, $F = 11.38$, $p < 0.001$; for Achievement, Adjusted $R^2 = 0.22$, $F = 40.65$, $p < 0.001$.

3.6. Measurement Invariance

We examined measurement invariance based on gender and school year using a series of nested models and equivalence indicators (Table 4). The results indicated that this measure demonstrated full configural and metric invariance across genders and school years; metric invariance for gender was only achieved using Cheung and Rensvold's (2002) ΔCFI criterion. These findings suggest that there is measurement invariance based on gender and academic year.

Table 4. Measurement Invariance: Model Comparisons for Gender and School Year.

	χ^2	df	χ^2/df	CFI	$\Delta\chi^2$	ΔCFI
Invariance for gender						
Configural (factor structure)	157.63	96	1.64	0.971		
Metric	179.10	104	1.72	0.964	21.47 **	0.007
Invariance for school year						
Configural (factor structure)	161.98	96	1.69	0.969		
Metric	166.41	104	1.60	0.970	4.43	0.001

** $p < 0.01$.

4. Discussion

4.1. Characteristics and Psychometric Properties

The findings mirror those of the original scale, confirming a four-dimensional factor structure: cognitive, affective, behavioral, and agentic, with an overarching second-order factor representing SELA, measured by 12 items. Like the original version, the four-factor and second-order models demonstrate good fit, allowing for separate measurements of each dimension and overall scale scoring. Although the second-order model showed a statistically significant decrease in fit relative to the four-factor model, the practical differences were small. Therefore, the resulting instrument was titled Secondary Education Student Engagement in Learning Activities: Short Version (S3ELA-SS).

The internal consistency, convergent, and discriminant validity results were satisfactory, although the cognitive dimension showed slightly lower convergent validity and reliability. This finding aligns with the original study, where the nature of cognitive engagement was a topic of debate (Veiga et al., 2025). This finding reflects the construct's conceptual and operational characteristics rather than age- or educational-level effects (Veiga et al., 2025). It is possible that these results stem from items that emphasize broad integrative learning processes ("I try to integrate my previously learned knowledge to solve new problems", the item with the lowest factor loading) rather than explicit critical

thinking or self-regulatory strategies, warranting caution in interpreting individual scores and suggesting the need for more targeted indicators in future research (Fredricks, 2022; Reeve, 2012).

The concurrent validity findings for the S3ELA-SS were consistent with those of the original scale, showing moderate positive correlations with the SEQ. Regarding predictive validity, the agentic dimension positively predicted competence and relatedness. The cognitive and behavioral dimensions were also positive predictors of competence and students' academic achievement, but not relatedness. The affective dimension positively predicted relatedness, potentially due to the close semantic relationship between affective engagement and social integration within the school community. These findings align with previous research and appear to support the self-determination theory (Reeve, 2012; Ryan & Deci, 2000). Additionally, measurement invariance was found across genders and school years, indicating that the S3ELA-SS can be used in future studies involving different genders and school years. However, because scalar invariance was not tested, the present results do not support comparisons of latent means. Therefore, future studies should test scalar (and ideally strict) invariance before supporting latent mean comparisons across groups.

4.2. Contributions and Implications for Practice

The S3ELA-SS assesses SE within the cognitive, affective, behavioral, and agentic dimensions, confirming the multifaceted nature of engagement. As Reeve and Tseng (2011) supported, this scale highlights the importance of integrating the agentic dimension into the study of SE among high school students.

Agentic engagement is particularly valuable as it addresses the psychological developmental needs of students, as noted by Zelazo (2013). Secondary education students frequently share concerns about autonomy, identity, and complex ideas (Miller, 2002). Their pursuit of autonomy is supported by agentic engagement, enabling them to actively shape their learning experiences in alignment with their preferences (Woolfolk, 2018). Additionally, engaging with teachers and peers through agentic involvement fosters social awareness, an important aspect of their development (Skinner et al., 2016). Furthermore, agentic engagement plays a crucial role in developing students' sense of self-efficacy, essential for identity formation (Skinner et al., 2016). The proactive engagement in learning driven by their desire for competence further underscores the importance of agentic involvement (Miller, 2002; Reeve & Tseng, 2011).

The study is a valuable addition, showing that the four-dimensional engagement model can be applied across different educational levels, including secondary and higher education. Previous studies (e.g., Waldrop et al., 2019) have also confirmed the validity of a scale for these educational levels.

Like the original scale, the S3ELA-SS is concise, focused solely on learning, and has shown strong psychometric properties. It is a clear scale, distinguishing it from other secondary education measures (Table S1). In addition, unlike existing scales, the S3ELA-SS identifies agentic engagement as a fourth dimension of SELA, which is a notable advancement because it predicted a significant and unique portion of student achievement, not explained by other dimensions (Reeve et al., 2020). Agentic engagement provides the most comprehensive insight into how students actively participate in the learning process during teacher instruction (Reeve & Tseng, 2011). The solid psychometric properties of this scale make it suitable for use by teachers and school principals to assess SELA, informing both the school and the students about their specific skills. Armed with this information, educators can design intervention programs, whether individualized or group-based, to support students with lower levels of SELA, ultimately promoting greater student inclusion.

4.3. Limitations and Future Research

The findings of this study should be approached with caution due to their limitations, which highlight the need for future research. While sufficient for the current objectives, there is room for improvement in assessing cognitive engagement, as the CFA revealed items with the lowest factor loadings, a finding similar to that in higher education (Veiga et al., 2025).

It is also worth noting that this study relied mainly on self-reported student data, as SE was evaluated based on students' reports. Future studies should complement this assessment with teachers' perspectives on SE. Furthermore, the lower reliability of the SEQ cognitive may attenuate correlations, thereby limiting the concurrent validity test.

It is important to acknowledge a limitation of this research, which is that the sample was chosen for convenience. The participants were selected from average-to-high-achieving schools in Lisbon, likely with a higher proportion of engaged students. These types of schools typically have parents with higher educational levels, which is known to be correlated with SE (Fullarton, 2002). These factors should be taken into consideration before generalizing the findings. Although the scale used in this study has solid psychometric qualities, the findings cannot be extended to other types of schools, cultures, or countries. Future studies could benefit from including more diverse samples, such as schools in educational priority areas, students with disabilities, students with immigrant parents, and students from low socioeconomic backgrounds.

Additionally, while brief scales are particularly useful, they are not designed to capture all underlying psychological processes, which may limit the semantic density of the measured construct. Future research may benefit from complementing this measure with more extensive instruments when in-depth diagnostic or intervention-focused assessment is required (Fredricks et al., 2016; O'Donnell & Reschly, 2020).

Furthermore, given that SELA can vary significantly depending on the subject and learning environment (Reeve et al., 2020; Shernoff & Schmidt, 2008), researchers may find it valuable to focus on specific academic subjects, such as mathematics, science, or native language. It may be helpful to assess students' engagement simultaneously in each subject by asking questions like, "Describe your learning engagement in mathematics," followed by similar questions for science, and so on. The SELA scale can be adapted to assess these different subjects, and the findings could provide insights into how the curriculum may influence SELA.

5. Conclusions

The findings of this study strongly support the four-factor S3ELA-SS as a reliable and valid scale for assessing SELA in Portuguese secondary education students. The S3ELA-SS provides a more comprehensive and illuminating model of how students engage in learning activities, encompassing their cognitive, affective, behavioral, and agentic dimensions.

Furthermore, the S3ELA-SS is clear and concise, consisting of only 12 items, and proves to be an efficient and user-friendly tool for educators and researchers. These results suggest that it is applicable across different educational levels, enabling SELA to be operationalized across various age groups and educational levels, thereby contributing to our understanding of students' academic trajectories.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/educsci16020279/s1>. Table S1: Student Engagement Scales for Secondary Education—Some of the Most Common. Table S2: Secondary School Student Engagement in Learning Activities: A Short-Scale (S3ELA-SS).

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