Journal of Posthumanism
2025
Volume: 5, No: 7, pp. 882–896
ISSN: 2634-3576 (Print) | ISSN 2634-3584 (Online)
posthumanism.co.uk

DOI: https://doi.org/10.63332/joph.v5i7.2849

Unravelling Engagement: Exploring Factors Influencing University Students' Participation in Statistics Classes

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Abstract

This study examines the critical role of student engagement in academic success, focusing on university-level statistics courses. Using a sample of 120 undergraduate students from a Portuguese university, authors applied the University Student Engagement Inventory (USEI) to assess behavioral, emotional and cognitive engagement. Variables analyzed included teaching methodology (traditional vs. blended), gender, academic background and five key factors: learning environment, active strategies, feedback, sense of belonging, and technology use. Results indicate that a supportive environment, active learning and timely feedback significantly boost behavioral and cognitive engagement. Emotional engagement was lower among female students but improved with blended learning. Although technology alone was not a strong predictor, blended learning had a positive effect, particularly on emotional and behavioral dimensions. These findings highlight the value of adaptive, student-centered teaching and the importance of emotional and cognitive support in fostering engagement and offers practical insights for educators encouraging further research in academic settings.

Keywords: *Student Engagement, Blended Learning, Supportive Learning Environment, University Student Engagement Inventory*

Introduction

Research consistently demonstrates a positive relationship between student engagement and academic outcomes, including grades, retention, and graduation rates ((Fredricks, 2004); (Wang, 2012)), underscoring the importance of promoting engagement for student success. Engaged students tend to exhibit higher levels of academic achievement, greater persistence, and increased satisfaction with their college experience, with long-term implications for their educational attainment and career outcomes (Kuh G. D., 2009), (Wang, 2012).

In this paper, we focus on student engagement in statistics classes, recognizing the unique challenges posed by the difficult subject matter and the potential impact on student engagement (Freeman, 2014); (Skinner, 1993); (Zimmerman, 1990). Using survey data and drawing from the scientific literature, we aim to explore the factors influencing student engagement in statistics classes and provide practical recommendations for educators to promote engagement and support student success.

Student engagement in higher education has emerged as a focal point of both research and practice, acknowledged for its profound impact on academic success, retention rates, and overall

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student development and satisfaction (Astin, 1984); (Kuh G. D., 2009). Within the university context, engagement encompasses a broad spectrum of cognitive, emotional, and behavioral factors that reflect students' investment in and commitment to their learning experiences (Fredricks, 2004). Therefore, measuring university student engagement is essential to inform institutional practices and interventions to improve student success.

Student engagement is a multifaceted construct encompassing behavioral, emotional, and cognitive dimensions, all interconnected and contributing to students' overall academic experiences (Fredricks, 2004). Theoretical frameworks such as Astin's involvement theory and Tinto's model of student departure provide valuable insights into the conceptualization of student engagement within the higher education landscape, emphasizing the importance of students' interactions with faculty and peers (Astin, 1984), (Tinto, 2012).

Various instruments have been developed to measure student engagement in university settings, each offering unique perspectives on students' experiences and involvement in academic activities. Among these instruments are the National Survey of Student Engagement (NSSE) (Kuh G. , 2001), the Student Engagement Instrument (SEI) (Appleton J. C., 2006), the Student Engagement Scale (SES) (Gunuc, 2015), and the University Student Engagement Inventory (USEI); (Marôco, 2016).

While these instruments have been widely utilized in research to assess student engagement through self-report surveys, the USEI specifically targets student engagement within the Portuguese university context. This self-report instrument consists of 15 items validated from an initial set of 32 (Marôco, 2016). These items underwent thorough scrutiny via confirmatory factor analysis to ensure the instrument's reliability and validity (Al-Taie & Khattak, 2024). Designed by (Marôco, 2016), the USEI is tailored to gauge university students' active involvement in academic pursuits, their interactions with faculty and peers, and their overall satisfaction with the university experience. The USEI scale has already been applied in different universities worldwide (Assunção, 2020); (Sharif-Nia, 2023); (She, 2023).

Despite the insights offered by self-report surveys, it is important to recognize their susceptibility to biases such as social desirability and response bias (Podsakoff, 2003). Therefore, researchers must approach survey design carefully, adhering to established psychometric principles to ensure the validity and reliability of the measures used. By employing rigorous validation procedures, including factor analysis and reliability testing, researchers can enhance the robustness of their findings and facilitate meaningful interpretations of student engagement data.

In summary, the availability of multiple instruments, including the USEI, underscores the importance of employing diverse approaches to measure student engagement in university settings. By leveraging a range of instruments and methodological strategies, researchers can gain deeper insights into the complex dynamics of student engagement and its impact on academic outcomes and institutional practices.

Numerous individual, interpersonal, and institutional factors influence student engagement in higher education. Individual factors such as motivation, self-efficacy, and prior academic achievement shape students' engagement levels, while interpersonal factors, including faculty-student interactions and a sense of belonging, contribute to their overall engagement experiences (Pascarella, 2005); (Hu, 2002). Institutional factors, such as teaching quality and campus climate, also significantly foster student engagement and academic success (Kuh G. D., 2009).

Motivation plays a crucial role in driving student engagement. Students with intrinsic

motivation, a sense of purpose, and personal goals are likelier to engage in academic activities (Ryan, 2000). When students perceive their coursework as relevant to their personal interests, career goals, or real-world applications, they are more likely to be engaged in learning (Fredricks, 2004).

A supportive learning environment, characterized by positive relationships with faculty, peers, and support services, fosters student engagement (Hu, 2002). Engaging pedagogical approaches that involve active learning, collaborative activities, and opportunities for hands-on experiences promotes student engagement (Freeman, 2014). Communicated expectations regarding course objectives, assignments, and assessments help students understand what is expected of them, leading to higher levels of engagement (Wlodkowski, 1995). Timely and constructive feedback on student performance and varied and meaningful assessments contribute to student engagement and motivation (Hattie, 2007). Students who feel a sense of belonging and inclusion in the academic community are likelier to engage in their studies (Hurtado, 1997). Providing students with autonomy and opportunities for choice in their learning, such as selecting topics or projects, enhances their sense of ownership and engagement (Reeves, 2006). Leveraging technology tools and platforms that facilitate interactive and collaborative learning experiences can enhance student engagement (Means, 2009). Setting high expectations for student performance and challenging students to stretch beyond their comfort zones can motivate them to engage more deeply in their academic activities (Brophy, 2010).

All these factors interact in complex ways to influence student engagement. Moreover, in the context of statistics classes, engagement can be particularly challenging, given the perceived difficulty of the subject matter (mathematics and statistics) and the potential for disinterest among students (Freeman, 2014); (Skinner, 1993); (Zimmerman, 1990).

In this paper, our focus centers on student engagement within statistics classes at the university level, acknowledging the distinctive challenges inherent in this subject matter and its potential influence on student involvement (Freeman, 2014); (Skinner, 1993); (Zimmerman, 1990). Using survey data and drawing from the scientific literature, we aim to explore the factors influencing student engagement and provide practical recommendations for educators to promote engagement and support student success.

Literature Review

Student engagement has been extensively examined as a multifaceted construct with profound implications for academic achievement, retention, and student satisfaction (Fredricks, Blumenfeld, & Paris, 2004; Kuh, 2009). Engagement is commonly conceptualised across three interrelated dimensions: behavioural, emotional, and cognitive. Behavioural engagement refers to students' participation in academic and social activities; emotional engagement encompasses affective reactions such as interest and sense of belonging; and cognitive engagement reflects the investment in learning and the use of deep learning strategies (Fredricks et al., 2004; Appleton, Christenson, Kim, & Reschly, 2006).

The theoretical underpinnings of engagement draw on Astin's (1984) Theory of Student Involvement, which posits that learning is a function of the quality and quantity of student involvement, and Tinto's (2012) model of student departure, which highlights the importance of academic and social integration. These frameworks have been instrumental in guiding institutional strategies to improve student engagement.

Various tools have been developed to measure engagement, including the National Survey of

Student Engagement (NSSE; Kuh, 2001) and the Student Engagement Instrument (SEI; Appleton et al., 2006). Within the Portuguese context, the University Student Engagement Inventory (USEI) has been validated as a reliable instrument for measuring behavioural, emotional, and cognitive engagement (Marôco, Marôco, Campos, & Fredricks, 2016).

Several factors are recognised as influential in shaping engagement, including intrinsic motivation (Ryan & Deci, 2000), teaching quality (Hattie & Timperley, 2007), feedback practices, and institutional support structures (Hu & Kuh, 2002). Recent literature also highlights the role of blended learning in enhancing engagement, particularly in complex or traditionally challenging subjects such as statistics (Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014; Means, Toyama, Murphy, Bakia, & Jones, 2009).

More recent conceptual models, such as Kahu's (2013) integrative framework of student engagement, emphasise the dynamic interplay between structural influences, psychosocial mediators, and proximal consequences of engagement. This model broadens the understanding of engagement beyond individual student factors, highlighting the contextual and institutional elements that facilitate or hinder engagement.

Additionally, the role of identity and belonging has gained attention in recent years. Thomas (2012) stresses that a sense of belonging, particularly in the first year of university, is a critical predictor of continued engagement and persistence. When students feel valued and integrated into the academic community, they are more likely to participate actively and maintain motivation throughout their studies.

Furthermore, Coates (2007) identifies engagement as both an individual and institutional responsibility, underlining the importance of developing curricula and learning environments that encourage active participation. He suggests that engagement should be measured not only by what students do but also by the extent to which institutions create the conditions that enable meaningful engagement.

Despite these developments, the emotional dimension of engagement remains understudied, particularly regarding gender differences and subject-specific contexts. Research by Shernoff (2013) on optimal learning environments suggests that emotional engagement can be significantly improved through classroom design that promotes flow and intrinsic motivation. This line of inquiry is particularly relevant for challenging subjects such as statistics, where anxiety and lack of confidence may undermine emotional and cognitive investment.

Taken together, literature underscores the need for holistic, inclusive and context-sensitive approaches to fostering engagement in higher education.

Methodology

The study encompassed undergraduate students enrolled in statistics courses at a public university in Portugal. 120 students participated, evenly distributed across four course sections, with 30 students allocated to each section. These sections and students were randomly selected from the Statistics courses available at the university. Noteworthy is the adoption of two distinct teaching methodologies: two classes employed blended-learning approaches, integrating advanced technology such as asynchronous sessions and continuous online quizzes, while the remaining two classes adhered to traditional teaching methods, featuring theoretical expository sessions and in-class practice sessions culminating in a final exam.

The University Student Engagement Inventory (USEI) scale was employed to assess student

engagement. Using a Likert scale from 1 to 5, the USEI empowers respondents to express their engagement levels across three dimensions/constructs: behavioral, emotional, and cognitive.

The behavioral engagement of the USEI evaluates students' active participation in academic activities and their demonstration of behaviors indicative of engagement within the university context (Fredricks, 2004). The behavioral engagement subscale consists of 5 items that encompass questions related to attendance, participation in class discussions, extracurricular activities, and utilization of university resources (Appleton J. J., 2008). Higher scores on this subscale suggest a heightened level of behavioral engagement, reflecting students' proactive approach to their academic endeavours (Fredricks, 2004).

Emotional engagement, as measured by the USEI, encompasses students' affective experiences, including their level of interest, enjoyment, and motivation in relation to academic activities and university life (Fredricks, 2004). The emotional engagement subscale comprises 5 items that inquire about students' enthusiasm for learning, sense of belonging, satisfaction with their academic program, and overall well-being (Appleton J. J., 2008). Elevated scores on this subscale indicate a strong emotional connection to the university environment and a positive affective response to academic experiences (Fredricks, 2004).

Cognitive engagement pertains to students' mental effort, investment, and depth of learning in their academic pursuits (Fredricks, 2004). This dimension of engagement is assessed through the cognitive engagement subscale, which consists of 5 items focusing on students' perception of the intellectual challenge, relevance, and meaningfulness of academic tasks, as well as their strategies for learning and problem-solving (Appleton J. J., 2008). Higher scores on this subscale signify a heightened level of cognitive engagement, indicative of students' active processing and synthesis of information to achieve deeper understanding and mastery of course content (Fredricks, 2004).

Descriptive statistics, including means and standard deviations, were computed for each of the 15 items on the USEI, as well as for the total score of each of the three constructs.

The internal consistency of the University Student Engagement Inventory (USEI) was assessed using Cronbach's alpha (Cronbach, 1951), computed separately for each construct measured by the inventory. This statistical measure provides an estimate of the USEI's reliability in capturing consistent responses from participants across its items within each construct.

Alongside, students were presented with a comprehensive scale from 1 (very low) to 5 (strong), enabling them to assess various factors that impact their engagement. These factors encompassed essential aspects such as a supportive learning environment (sle)), active learning strategies (als), feedback and assessment (fa), sense of belonging (sb) and technology integration (tech-i).

To explore the influence of the described factors, as perceived through self-assessment, on student engagement, multiple regression analyses (Cohen, 2003) were performed for each construct. This analytical approach allowed for a comprehensive investigation into the distinct impacts of different predictors. In this analysis, gender, academic background, and class (distinguishing between the two distinct teaching methodologies) were integrated as confounding or control variables. These were represented as dummy variables within the regression model, allowing for the isolation of the effects of each predictor variable on student engagement. By controlling for these variables, the statistical approach enabled a more precise understanding of how the factors under investigation independently influenced student engagement, free from the potential confounding effects of demographic characteristics or

instructional methods.

Results

Reliability Analysis

A reliability analysis was conducted to assess the internal consistency of each engagement USEI sub-scale. Cronbach's alpha coefficient was 0.805 for behavioral engagement (BhE), 0.851 for emotional engagement (EmE), and 0.795 for cognitive engagement (CgE), indicating high internal consistency and reliability of the sub-scales. This suggests that these are reliable measures of student engagement in statistics classes. Three constructs were then computed as the mean value of the corresponding item scores.

Descriptive Statistics

Basic descriptives, e.g., means, medians, standard deviations, and extreme values, were computed for all the variables included in the analysis (Table 1(a) to 1(d)). Most participants were male (57.5%) and came from diverse backgrounds, 45.8% with a science background. 50% of the students were enrolled in classes taught through blended learning methodology, the remaining in traditional teaching methodology classes.

Table 1 – Descriptives computed with 120 observations.

	BhE	Bh1	Bh3	Bh4	Bh5	Bh6
Mean	2.50	2.79	2.64	2.10	2.67	2.27
Median	2.40	2.50	2.00	2.00	2.50	2.00
Standard deviation	0.736	1.30	0.776	0.965	0.792	0.987
Minimum	1.40	1	2	1	1	1
Maximum	3.80	5	5	5	5	5

Table 1 a. BhE - Behavioral engagement construct, Bhi - Behavioral engagement items

	EmE	Em14	Em15	Em16	Em17	Em19
Mean	2.28	1.73	2.05	2.32	2.11	3.21
Median	2.20	2.00	2.00	2.00	2.00	3.00
Standard deviation	0.670	0.753	0.787	0.661	1.15	1.07
Minimum	1.20	1	1	1	1	2
Maximum	3.80	3	5	4	5	5

Table 1 b. EmE - Emotional engagement construct Emi – Emotional engagement items

	CgE	Cg22	Cg25	Cg26	Cg28	Cg32
Mean	2.38	2.12	2.15	2.90	2.44	2.27
Median	2.20	2.00	2.00	3.00	2.00	2.00
Standard deviation	0.649	0.712	0.718	0.760	0.646	1.16
Minimum	1.20	1	1	2	1	1
Maximum	3.60	3	3	4	4	5

Table 1 c. CgE - Cognitive engagement construct, Cgi - Cognitive engagement items

	BL	Female	Science	sle	als	fa	sb	tech-i
Mean	0.500	0.425	0.458	2.42	2.56	2.50	2.73	2.34
Median	0.500	0.00	0.00	2.00	3.00	2.00	3.00	2.00
Standard deviation	0.502	0.496	0.500	0.784	1.00	0.767	0.796	0.804
Minimum	0	0	0	1	1	1	1	1
Maximum	1	1	1	5	5	5	5	5

Table 1 d. BL – learning methodology binary (1- Blended Learning), Female – gender binary (1- Female), Science – student background (1-Science), sle – supportive learning environment, als – active learning strategies, fa – feedback and assessment, sb – sense of belonging and tech-i – technology integration.

Multiple Regression Analysis

Multiple regression analyses were conducted to explore the relationship between the engagement constructs (behavioral, emotional, and cognitive) and the five key factors (supportive learning environment (sle), active learning strategies (als), feedback and assessment (fa), sense of belonging (sb), and technology integration (tech-i)), along with gender (Female), academic background (Science), and teaching-learning methodology (BL) included as control variables. The regression model was represented as follows:

$$iE=\beta_{0i}+\beta_{1i}sle+\beta_{2i}als+\beta_{3i}fa+\beta_{4i}sb+\beta_{5i}tech\text{-}i+\beta_{6i}Female+\beta_{7i}Science+\beta_{8i}BL+\varepsilon \quad (1)$$

i being Bh, Em or Cg

Correlations between the five factors were computed (Table 2), and they are not relevant. However, due to the conceptual correlation between tech-i and BL, multicollinearity was identified due to a significant correlation between tech-i and BL ($r=0.551$, p-value<0.001), unveiling the increased level of technology integration in blended learning classes: to increase the reliability of the b statistical testing, tech-i was dropped from the model.

Table 2 – Correlation matrix for the five factors and BL, Female, and Science

	sle	als	fa	sb	tech-i	BL	Female	Science
sle	—							
als	0.161	—						
fa	0.265	0.093	—					
sb	0.341	0.083	0.316	—				
tech-i	0.359	0.210	0.320	0.406	—			
BL	0.384	0.125	0.284	0.399	0.551	—		
Female	0.146	−0.008	−0.055	0.162	0.033	0.017	—	
Science	−0.084	−0.012	0.033	−0.070	−0.037	−0.017	0.055	—

Assumptions for the regression analyses, including tests for variance homogeneity and normality errors, were met (p-values > 0.10).

The regression analyses demonstrated that the proposed model significantly predicted students' engagement scores across all three constructs (behavioral, emotional, and cognitive), as indicated by the significant F-statistics and associated p-values (< 0.001). The substantial proportion of explained variance (r-squared ranging from 0.39 to 0.64, table 3 to 5) suggests that the model effectively captures student engagement levels' variability based on the selected predictors.

Overall, the control variable for academic background (Science) was not significant (p-values > 0.10). Female students exhibited significantly lower levels of emotional engagement (p-value=0.007) compared to male students, while no significant gender differences were observed in behavioral and cognitive engagement (p-value > 0.10).

Regarding behavioral engagement (BhE), the analysis (Table 3, Model A) unveiled the significant influence of all five factors on behavioral student engagement. The β estimates ranged from 0.14 to 0.30, indicating the magnitude of the association between each factor and behavioral engagement, with all corresponding p-values below 0.01. The teaching methodology (BL) does not seem significant (Model A, p-value=0.613). Dropping Female, Science, and tech-i - due to the relevant correlation, (0.551), between BL and tech-i (Table 2) - from the model, the impact of the teaching methodology is unveiled (Model B, p-value=0.077): and the estimated significant b coefficient (0.169) expresses the marginal increase in behavioral engagement provided by blended learning methodology vs the traditional teaching methodology.

Table 3 - β estimates and p-values for models (1) regarding BhE – behavioral engagement construct.

Model Fit Measures

Overall Model Test						
Model	**R**	**R^2**	**F**	**df1**	**df2**	**p**
A	0.822	0.675	28.8	8	111	< .001
B	0.801	0.641	40.7	5	114	< .001

	Model Coefficients - BhE (Model A)				Model Coefficients - BhE (Model B)			
Predictor	**Estimate**	**SE**	**t**	**p**	**Estimate**	**SE**	**t**	**p**
Intercept [a]	-0.4110	0.2162	-1.901	0.060	-0.197	0.2125	-0.928	0.355
sle	0.2636	0.0584	4.516	< .001	0.287	0.0594	4.827	< .001
als	0.1426	0.0408	3.493	< .001	0.160	0.0419	3.814	< .001
fa	0.2990	0.0573	5.219	< .001	0.319	0.0582	5.478	< .001
sb	0.2211	0.0590	3.749	< .001	0.259	0.0592	4.383	< .001
tech-i	0.1916	0.0631	3.036	0.003				
Female:								
1 – 0	0.0901	0.0829	1.086	0.280				
Science:								
1 – 0	0.0879	0.0804	1.093	0.277				
BL:								
1 – 0	0.0507	0.1000	0.507	0.613	0.169	0.0947	1.784	0.077

Regarding emotional engagement, only 3 out of the 5 initial factors were identified as significant predictors, with p-values below 0.10 (Table 4, Model A). The β estimates ranged from 0.10 to 0.24, indicating the strength of the association between each predictor and emotional engagement. As referred before, females seem to be significantly less emotional engaged than males (negative β estimate, p-value=0.007), and BL methodology seems to leverage emotional engagement (positive β estimate, p-value=0.075). Dropping the nonsignificant factors (sb and tech-i) and Science, the b estimates were recomputed (Table 4, Model B). This comprehensive analysis underscores the multifaceted nature of emotional engagement. It highlights the importance of considering a supportive learning environment, active learning strategies, and feedback and assessment to promote emotional engagement. Additionally, blended learning methodology seems to enhance emotional engagement.

Table 4 - β estimates and p-values for model (1) regarding EmE – Emotional Engagement construct.

Model Fit Measures

Overall Model Test						
Model	**R**	**R^2**	**F**	**df1**	**df2**	**p**
A	0.631	0.399	9.20	8	111	< .001
B	0.623	0.388	14.5	5	114	< .001

	Model Coefficients - EmE (Model A)				Model Coefficients - EmE (Model B)			
Predictor	**Estimate**	**SE**	**t**	**p**	**Estimate**	**SE**	**t**	**p**
Intercept [a]	0.7042	0.2680	2.627	0.010	0.868	0.2300	3.77	< .001
sle	0.2358	0.0724	3.259	0.001	0.248	0.0704	3.53	< .001
als	0.0979	0.0506	1.935	0.056	0.107	0.0498	2.14	0.034
fa	0.1798	0.0710	2.531	0.013	0.203	0.0682	2.97	0.004
sb	0.0304	0.0731	0.417	0.678				
tech-i	0.0901	0.0783	1.151	0.252				
Female:								
1 – 0	-0.2836	0.1028	-2.759	0.007	-0.270	0.1006	-2.69	0.008
Science:								
1 – 0	0.0529	0.0997	0.530	0.597				
BL:								
1 – 0	0.2229	0.1240	1.797	0.075	0.301	0.1084	2.77	0.006

Regarding cognitive engagement, certain factors like a supportive learning environment, learning strategies, feedback and assessment practices, and a sense of belonging appear to play significant roles in predicting cognitive engagement among students (Table 5, Models A and B).

On the other hand, factors such as technology use, gender, diversity of backgrounds, and the mode of instruction (blended learning vs. traditional learning) did not show significant predictive power for cognitive engagement in this particular context (Table 5, Model A). This implies that while these factors may still be relevant and important in educational settings, they might not be directly linked to cognitive engagement, as observed in our study.

Table 5 - β estimates and p-values for model (1) regarding CgE – Cognitive Engagement construct.

Model Fit Measures

Overall Model Test						
Model	**R**	**R^2**	**F**	**df1**	**df2**	**p**
A	0.737	0.543	16.5	8	111	< .001
B	0.724	0.524	31.7	4	115	< .001

	Model Coefficients - CgE (Model A)				Model Coefficients - CgE (Model B)			
Predictor	**Estimate**	**SE**	**t**	**p**	**Estimate**	**SE**	**t**	**p**
Intercept [a]	0.1568	0.2262	0.693	0.490	0.148	0.2063	0.719	0.474
sle	0.2646	0.0611	4.333	< .001	0.284	0.0580	4.886	< .001
als	0.2038	0.0427	4.772	< .001	0.214	0.0422	5.077	< .001
fa	0.1942	0.0599	3.240	0.002	0.223	0.0583	3.828	< .001
sb	0.1348	0.0617	2.186	0.031	0.159	0.0576	2.760	0.007
tech-i	0.0644	0.0660	0.976	0.331				
Female:								
1 – 0	-0.0690	0.0867	-0.795	0.428				
Science:								
1 – 0	0.0735	0.0842	0.873	0.384				
BL:								
1 – 0	0.0962	0.1047	0.919	0.360				

Discussion and Conclusion

The findings from the multiple regression analyses provide valuable insights into the factors influencing university students' engagement across different dimensions: behavioral, emotional, and cognitive.

The student's academic background did not emerge as a significant engagement predictor, nor were gender differences observed in behavioral and cognitive engagement. Specifically, male students exhibited significantly higher emotional engagement levels than female students.

Furthermore, the observed positive impact of blended learning on behavioral and emotional engagement aligns with prior research emphasizing the effectiveness of innovative teaching methodologies in enhancing student engagement and learning outcomes (Means, 2009), (Freeman, 2014). This underscores the importance of pedagogical innovation in fostering student engagement and academic success within the higher education context.

This positive impact of blended learning methodology on behavioral and emotional engagement indicates that incorporating technology and a mix of online and face-to-face instruction can be advantageous for fostering emotional connection and engagement among students. The flexibility and interactive nature of blended learning might appeal to different learning

preferences and contribute to a more emotionally stimulating educational experience.

Our findings indicate that a supportive learning environment, active learning strategies, effective feedback and assessment practices, and a sense of belonging are pivotal in shaping students' behavioral engagement. Behavioral engagement encompasses students' participation, involvement, and persistence in academic activities and university life. Thus, creating an inclusive and supportive atmosphere, implementing dynamic and participatory learning methods, delivering timely and constructive feedback, and fostering a sense of belonging can significantly enhance students' behavioral investment and commitment to their learning journey.

Intriguingly, technology integration does not emerge as a significant predictor of behavioral engagement. However, this observation resonates with the blended learning methodology, which emphasizes the seamless integration of technology into the learning process. Although not a direct predictor, the intensive use of technology within blended learning environments may indirectly contribute to students' behavioral engagement by providing diverse learning opportunities and interactive experiences.

A supportive learning environment, active learning strategies, and effective feedback and assessment practices are key contributors to emotional engagement. Emotional engagement encompasses students' affective experiences, including their level of interest, enjoyment, and motivation in relation to academic activities and university life. This suggests that fostering a positive and encouraging atmosphere, implementing engaging and participatory learning approaches, and providing constructive feedback can enhance students' emotional investment and connection with their learning experiences.

The observation that females exhibit lower emotional engagement than males is an interesting finding that warrants further exploration. This gender difference in emotional engagement could be influenced by various social, cultural, or individual factors that impact how students perceive and respond to their learning environment. Understanding these differences can inform targeted interventions to support emotional engagement for all students better.

In summary, these findings highlight the importance of specific pedagogical practices and environmental factors in promoting emotional engagement among students. They also underscore the need to consider gender-related differences and the potential benefits of innovative instructional approaches like blended learning. Further research and nuanced analyses can provide deeper insights into these dynamics and guide targeted strategies to enhance emotional engagement and overall learning outcomes in educational settings. This aligns with the research carried out by (Ryan, 2000); (Hu, 2002); (Freeman, 2014); (Wlodkowski, 1995); (Hattie, 2007).

Cognitive engagement, reflecting students' mental effort, investment, and depth of learning in their academic endeavors, is notably influenced by the same four factors identified in fostering behavioral engagement. The distinction between these two constructs lies primarily in their outcomes and manifestations rather than in the factors driving them. However, unlike behavioral engagement, teaching methodology appears to have less direct influence on cognitive engagement.

While teaching methodology may not directly impact cognitive engagement, it indirectly influences students' cognitive processes by interacting with other factors. For example, a supportive learning environment facilitated by innovative teaching approaches can enhance students' motivation to engage cognitively with course material.

In summary, our research highlights the multifaceted nature of cognitive engagement and its complex interplay with various environmental and individual factors. While teaching methodology may not directly predict cognitive engagement, it plays a crucial role in shaping the context in which cognitive engagement occurs. By understanding and leveraging these dynamics, educators can create learning environments that foster deep and meaningful cognitive engagement among all students, ultimately enhancing their learning outcomes and academic success.

These findings underscore the complexity of student engagement in the university setting and emphasize the need for multifaceted interventions that address various dimensions of engagement to enhance students' overall learning experiences and academic success. By considering the unique influences of different factors on students' engagement, educators and institutions can develop targeted strategies to promote a supportive, stimulating, and inclusive learning environment conducive to student engagement and achievement, improving teaching quality (Hu, 2002).

Our findings contribute to the existing literature on student engagement in higher education by providing empirical support for the multifaceted nature of engagement and the diverse factors that influence students' behavioral, emotional, and cognitive involvement in academic activities. By aligning with established theoretical frameworks and empirical evidence, our findings offer actionable insights for educators and institutions seeking to enhance student engagement and foster a supportive and stimulating learning environment conducive to student success.

Limitations and Further Research

While our study provides valuable insights into the factors influencing student engagement at the university level, aligned with previous research, several limitations must be acknowledged that may impact the interpretation and generalization of our findings.

Firstly, our study was conducted at a single university in Portugal, limiting the generalizability of our findings to other institutional contexts or student populations. Future research should aim to replicate our study across diverse educational settings to enhance the external validity of the findings.

Secondly, the data in our study were collected through self-report surveys, subject to response biases such as social desirability and recall errors. While self-report measures offer valuable insights into students' perceptions and experiences, future research could employ a combination of observational and qualitative methods to provide a more comprehensive understanding of student engagement.

Additionally, our study focused on factors influencing student engagement, including supportive learning environments, active learning strategies, feedback and assessment, a sense of belonging, and technology integration. While these factors have been widely studied and are supported by existing literature, other variables not included in our analysis may also play a significant role in shaping student engagement. Future research could explore additional factors to provide a more holistic understanding of student engagement in higher education.

Furthermore, our study employed a cross-sectional design, which limits our ability to establish causal relationships between the predictor variables and student engagement. Longitudinal studies tracking students' engagement over time would provide valuable insights into the dynamic nature of engagement and the factors contributing to its development and maintenance.

Lastly, our study focused primarily on student perceptions of engagement, overlooking the perspectives of faculty members and institutional stakeholders. Future research could adopt a multi-stakeholder approach to explore the interplay between student engagement, teaching practices, and institutional policies and resources.

In conclusion, while our study significantly contributes to the literature on student engagement in higher education, it is essential to recognize its limitations and the need for further research to address them and advance our understanding of student engagement processes.

References

Appleton, J. C. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. Journal of School Psychology, 44(5), 427-445. https://doi.org/10.1016/j.jsp.2006.04.002

Appleton, J. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. Psychology in the Schools, 45(5), 369-386.

Al-Taie, M., & Khattak, M. N. (2024). The impact of perceived organizational support and human resources practices on innovative work behavior: does gender matter?. Frontiers in Psychology, 15, 1401916.

Assunção, H. L.-L. (2020). University Student Engagement Inventory (USEI): Transcultural Validity Evidence Across Four Continents. Frontiers in psychology, 10, 2796.

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. Journal of College Student Personnel, 25(4), 297–308.

Brophy, J. (2010). Motivating students to learn. New Jersey: Lawrence Erlbaum Associates.

Coates, H. (2007). A model of online and general campus-based student engagement. Assessment & Evaluation in Higher Education, 32(2), 121–141. https://doi.org/10.1080/02602930600801878

Cohen, J. C. (2003). Applied multiple regression/correlation analysis for the behavioral sciences. New York: Routledge.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16(3), 297-334.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. Review of Educational Research, 74(1), 59–109. https://doi.org/10.3102/00346543074001059

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences, 111(23), 8410–8415. https://doi.org/10.1073/pnas.1319030111

Gunuc, S. K. (2015). Student engagement scale: development, reliability and validity. Assessment & Evaluation in Higher Education, 40(4), 587–610.

Hattie, J., & Timperley, H. (2007). The power of feedback. Review of Educational Research, 77(1), 81–112. https://doi.org/10.3102/003465430298487

Hu, S. &. (2002). Being (dis)engaged in educationally purposeful activities: The influences of student and institutional characteristics. Research in Higher Education, 43(5), 555–575. https://doi.org/10.1023/A:1020114231387

Hurtado, S. &. (1997). Effects of college transition and perceptions of the campus racial climate on Latino college students' sense of belonging. Sociology of Education, 70(4), 324–345.

Kahu, E. R. (2013). Framing student engagement in higher education. Studies in Higher Education, 38(5), 758–773. https://doi.org/10.1080/03075079.2011.598505

Kuh, G. D. (2001). Assessing what really matters to student learning: Inside the National Survey of Student Engagement (NSSE). Change: The Magazine of Higher Learning, 33(3), 10–17.

https://doi.org/10.1080/00091380109601795
Kuh, G. D. (2009). What student affairs professionals need to know about student engagement. Journal of College Student Development, 50(6), 683–706. https://doi.org/10.1353/csd.0.0099
Marôco, J., Marôco, A. L., Campos, J. A. D. B., & Fredricks, J. A. (2016). University students' engagement: Development of the University Student Engagement Inventory (USEI). Psicologia: Reflexão e Crítica, 29, Article 21. https://doi.org/10.1186/s41155-016-0042-8
Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. U.S. Department of Education. https://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf
Pascarella, E. T. (2005). How college affects students: A third decade of research. San Francisco: Jossey-Bass.
Podsakoff, P. M.-Y. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879–903.
Reeves, J. (2006). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. Review of Educational Research, 76(1), 1-27.
Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68
Schaufeli, W. B.-R. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. Journal of Happiness Studies, 3(1), 71–92.
Sharif-Nia, H. M. (2023). Psychometrics evaluation of the university student engagement inventory in online learning among Arab students. BMC Nurs 22, 158.
She, L. K.-A. (2023). Psychometric properties of the university student engagement inventory among Chinese students. Asian Association of Open Universities Journal, 18(1), 4, 46-60.
Shernoff, D. J. (2013). Optimal learning environments to promote student engagement. Springer. https://doi.org/10.1007/978-1-4614-7089-2
Skinner, E. A. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. Journal of Educational Psychology, 85(4), 571–581.
Tinto, V. (2012). Completing college: Rethinking institutional action. Chicago: The University of Chicago Press.
Thomas, L. (2012). Building student engagement and belonging in Higher Education at a time of change: Final report from the What Works? Student Retention & Success programme. Higher Education Academy (HEA). https://www.advance-he.ac.uk/knowledge-hub/building-student-engagement-and-belonging-higher-education-time-change-final-report
Wang, M. T. (2012). Social support matters: Longitudinal effects of social support on three dimensions of school engagement from middle to high school. Child Development, 83(3), 877–895.
Wlodkowski, R. J. (1995). A framework for culturally responsive teaching. New Directions for Adult and Continuing Education, 5–16.
Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. Educational Psychologist, 25(1), 3–17.