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Combined Analysis of Academic Climate and PBL: Influence on university engagement

Análisis combinado del clima académico y el ABP: Influencia en el engagement universitario

Análise combinada do ambiente académico e da ABP: Influência no engagement universitário

学术氛围与基于问题学习法（PBL）的综合分析：对大学生学业投入的影响

التأثير في اندماج الطلبة الجامعيين: تحليل مشترك للمناخ الأكاديمي والتعلم القائم على المشروعات (ABP)

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Abstract

This paper explores the influence of two contextual variables, academic climate and the active learning methodology Problem-Based Learning (PBL), on university students' engagement, considering engagement as an indicator of teaching effectiveness. Additionally, the effect of PBL was analyzed based on the institution's level of commitment to this methodology. Secondarily, the effect of two individual variables, gender and university admission scores, on student engagement was also examined. A cross-sectional quantitative study was conducted with 1376 university students who completed questionnaires on engagement and academic climate. The engagement survey also collected sociodemographic data and information on whether PBL was applied in the course or integrated into the curriculum. ANOVA, regression models, and moderation analyses were used to examine the relationships between variables. The results show that classroom climate is a determining factor in engagement, while the PBL methodology only enhances engagement when there is a favorable climate. Furthermore, it was observed that women present higher levels of engagement than men, while the university admission grade does not appear to have a significant impact. The study concludes that classroom climate is essential for promoting engagement, especially when active methodologies like PBL are implemented. The absence of a direct effect of the PBL methodology on engagement highlights the need for a positive classroom environment to maximize its effectiveness.

Keywords: Problem-based learning, academic climate, engagement, higher education, active methodologies.

Resumen

El presente trabajo explora la influencia de dos variables contextuales, el clima académico y la metodología activa Aprendizaje Basado en Problemas, en el *engagement* de los estudiantes universitarios, tomando este último como indicador de la eficacia docente. Además, se analizó el efecto del ABP en función de la implicación de la institución con la metodología. Secundariamente, también se examinó el efecto de dos variables individuales, el género y la nota de acceso a la universidad, en el engagement. Se llevó a cabo un estudio cuantitativo transversal con 1376 estudiantes universitarios que completaron un cuestionario sobre engagement y otro sobre clima académico. El cuestionario incluía datos sociodemográficos y recogía información sobre el uso del ABP en la asignatura o el plan de estudios. Se aplicaron análisis ANOVA, modelos de regresión y análisis de moderación para estudiar la relación entre variables. Los resultados muestran que el clima del aula es un factor determinante del engagement y que, a su vez, la metodología ABP solo potencia el engagement cuando existe un clima favorable. Además, se observó que las mujeres presentan niveles más altos de engagement que los hombres, mientras que la nota de acceso no parece tener un impacto significativo. El estudio concluye que el clima académico es fundamental para promover el engagement, especialmente cuando se implementan metodologías activas como el ABP. El buen clima del aula potencia el efecto del ABP sobre el engagement, y pone de relieve la necesidad de un entorno positivo para maximizar la efectividad de esta metodología docente.

Palabras clave: Aprendizaje basado en problemas, clima académico, engagement, educación superior, metodologías activas.

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Resumo

Baseada em Problemas, no engagement dos estudantes universitários, tomando este último como indicador da eficácia docente. Para além disso, o efeito da ABP foi analisado em termos do envolvimento da instituição com a metodologia. Em segundo lugar, foi também examinado o efeito de duas variáveis individuais, o género e a classificação de acesso à universidade, no engagement. Foi realizado um estudo quantitativo transversal com 1376 estudantes universitários que preencheram um questionário sobre engagement e outro sobre ambiente académico. O questionário incluía dados sociodemográficos e recolhia informações sobre a utilização da ABP na disciplina ou no plano de estudos. Foram aplicadas análises ANOVA, modelos de regressão e análises de moderação para estudar a relação entre variáveis. Os resultados demonstram que o ambiente na sala de aula é um fator determinante do engagement e que, por sua vez, a metodologia ABP só potencia o engagement quando existe um ambiente favorável. Além disso, observou-se que as mulheres têm níveis de engagement mais elevados do que os homens, enquanto a classificação de acesso não parece ter um impacto significativo. O estudo conclui que o ambiente académico é fundamental para promover o engagement, especialmente quando são implementadas metodologias ativas como a ABP. O bom ambiente na sala de aula potencia o efeito da ABP no engagement e realça a necessidade de um ambiente positivo para maximizar a eficácia desta metodologia de ensino.

Palavras-chave: Aprendizagem baseada em problemas, ambiente académico, engagement, ensino superior, metodologias ativas.

摘要

本研究探讨了两种情境变量——学术氛围与基于问题的学习（PBL）主动教学法——对大学生学业投入的影响，并将学业投入视为衡量教学成效的重要指标。此外，研究还分析了 PBL 方法在不同高校实施程度下的效果，并进一步考察了性别与大学入学成绩这两项个体变量对学业投入的影响。本研究采用横断面定量研究设计，调查了 1,376 名大学生，参与者分别完成了关于学业投入和学术氛围的问卷。问卷涵盖社会人口学信息，并收集了关于 PBL 方法在课程或教学计划中应用情况的数据。数据分析采用了方差分析（ANOVA）、回归模型及调节效应分析，以探究变量之间的关系。研究结果显示，课堂氛围是影响学业投入的决定性因素，且 PBL 方法仅在积极氛围下才显著提升学生的学业投入。此外，女性学生的学业投入水平普遍高于男性，而大学入学成绩对学业投入的影响并不显著。结论指出，良好的学术氛围对于促进学生学业投入至关重要，尤其是在实施 PBL 等主动教学法时。积极的课堂环境能够增强 PBL 对学业投入的促进作用，凸显了营造积极学习环境以最大化教学法效果的必要性。

关键词: 基于问题的学习、课堂氛围、学业投入、高等教育、主动教学法 。

ملخص

يتناول هذا البحث تأثير متغيرين سياقيين، وهما المناخ الأكاديمي ومنهجية التعلم النشط القائم على المشكلات، في اندماج الطلبة الجامعيين، ويُؤخذ هذا الأخير كمؤشر على فعالية الأداء التدريسي. كما تم تحليل تأثير منهجية التعلم القائم على المشكلات بحسب درجة التبني المؤسسي لها. وبشكل ثانوي، تم أيضًا فحص تأثير متغيرين فرديين، هما الجنس ودرجة الولوج إلى الجامعة، على مستوى الاندماج. وقد أُجريت دراسة كمية مقطعية شملت 1376 طالبًا جامعيًا، أجابوا عن استبيان حول الاندماج وآخر حول المناخ الأكاديمي، وتضمن الاستبيان معطيات سوسيوديموغرافية، إضافة إلى معلومات تتعلق باستخدام منهجية التعلم القائم على المشكلات في المادة الدراسية أو في البرنامج التعليمي. وتم استخدام تحليلات ANOVA ونماذج الانحدار وتحليل التفاعل لدراسة العلاقة بين المتغيرات. أظهرت النتائج أن مناخ الصف الدراسي يُعد عاملًا حاسمًا في تعزيز الاندماج، كما أن منهجية التعلم القائم على المشكلات لا تعزز هذا الاندماج إلا في وجود مناخ صفّي إيجابي. وأشارت النتائج أيضًا إلى أن الطالبات يُظهرن مستويات أعلى من الاندماج مقارنة بالطلاب، في حين أن درجة القبول الجامعي لا يبدو أن لها تأثيرًا كبيرًا. وتخلص الدراسة إلى أن المناخ الأكاديمي يلعب دورًا أساسيًا في دعم الاندماج الجامعي، لاسيما عند تطبيق المنهجيات النشطة مثل التعلم القائم على المشكلات، حيث يُعزّز المناخ الإيجابي أثر هذه المنهجية في تحسين الاندماج، مما يُبرز أهمية توفير بيئة تعليمية داعمة لتعظيم فعالية الأداء التدريسي .

الكلمات المفتاحية: التعلم القائم على المشكلات؛ المناخ الأكاديمي؛ الاندماج الجامعي؛ التعليم العالي؛ المنهجيات النشطة

Introduction

Studies on academic engagement are relatively recent. In 1985, only two articles included this concept (Appleton et al., 2008). However, over the past three decades, research in this field has grown exponentially (Abbott-Chapman et al., 2013; Chapman, 2003), due in part to the fact that students disengaged from academic activities are found in every classroom. This disengagement affects not only academic performance but also psychological well-being, social relationships, and career aspirations, and can even lead to dropping out of school or disruptive behaviours (Henry et al., 2012; Hoffmann, 2020). Research with vulnerable youth has shown that interventions to improve engagement increase resilience (Sinclair et al., 2005). Furthermore, engagement is an indicator of teaching quality and can influence the educational and professional trajectory of students (Abbott-Chapman et al., 2013; Vargas, 2007).

The concept of engagement is presented as a complex entity with multiple interpretations in the literature. Defining and standardizing the concept is challenging, which hinders its use as an academic assessment tool. Appleton et al. (2008) proposed a multidimensional model that encompasses three dimensions: cognitive, emotional, and behavioural. Subsequent studies have confirmed these dimensions (Assunção et al., 2020; Sinval et al., 2021), although others suggest only two dimensions, combining behavioural and psychological aspects (Benito et al., 2021) or cognitive and emotional aspects (Ben-Eliyahu et al., 2018). Some studies even add agency (personal capacity for action) as a fourth dimension (Reeve & Tseng, 2011).

Based on these references, our study explored the relationship between engagement and certain contextual factors: classroom climate and teaching methodology, specifically PBL, as it is a widely implemented methodology at the institution where this study was conducted. Individual variables such as gender and university entrance grade were also considered.

The hypotheses raised are:

1. The academic climate and the PBL methodology will act as facilitating factors for the level of student engagement.
2. The entrance grade will influence the level of student engagement: the higher the entrance grade, the higher the degree of engagement.
3. The level of engagement will be influenced by the gender of the students. We expect to find higher engagement levels for women.

Incorporating PBL methodology into the institutional curriculum will enhance student engagement. Therefore, students pursuing degrees that include PBL methodology as an identifying characteristic will show higher levels of engagement.

Academic climate and engagement

According to Rodríguez Mesa (2013), motivation, dialogue with students, and the academic climate are decisive factors in the success or failure of the learning process. The social climate of the classroom refers to the level of satisfaction and well-being, and to the relationships between students and teachers, with teachers being key in promoting positive motivation for learning. A supportive environment should facilitate interaction, dialogue, and collaborative work, in an atmosphere of mutual respect.

Different studies have shown that the academic climate significantly influences student engagement and behaviour (Bilgin et al., 2021; Durón-Ramos et al., 2018; Gutiérrez & Tomás, 2018). Academic climate is also related to the quality of teaching and academic performance (Brookhart and Durkin, 2003; MacNeil et al., 2009). However, despite the impact of the academic climate on education, few studies directly link it to engagement (Rigo et al., 2020), which calls for more research on its influence in the university context.

Problem-Based Learning (PBL) and Engagement

PBL is an active teaching methodology focused on collaborative learning through real-world problem-solving. It emerged at McMaster University School of Medicine (Canada) in the mid-1960s. The traditional model centred the teaching-learning process on the students, divided into small groups under the supervision of a tutor. Since then, the model has adapted to new realities, creating a climate conducive to developing the social and collaborative skills essential for their future (Arpí et al., 2012).

PBL methodology is based on the idea that knowledge emerges from interaction with the surroundings and that by addressing real-life problems, students develop skills that transcend the classroom (Moallem et al., 2019). This methodology, which is based on constructivist principles, requires a high level of student engagement, as it involves self-directed and cooperative learning (Hung et al., 2011).

On the one hand, PBL fosters an environment that encourages teamwork and relationship-building between students and teaching staff (Amerstorfer, 2020). On the other hand, various studies have shown that this methodology can be more effective than traditional teaching in developing cognitive and personal skills (Almulla, 2020). However, not all students respond equally to PBL, as some prefer more guided learning (Deslauriers et al., 2019). Several studies have suggested that, in general, PBL achieves higher levels of engagement than those achieved in traditional lectures (Alimoglu et al., 2014; O'Malley et al., 2003).

It should be noted that the relationship between PBL and engagement has been addressed in recent studies (Chan et al., 2022; Grijpma et al., 2022), although the results are not yet conclusive, hence the need to advance this line of study.

Individual factors linked to engagement: gender and entrance grade

Another relevant line of research on engagement is the influence of individual variables, such as gender and university entrance grade. Regarding gender, some studies with university students suggest that women tend to show higher levels of engagement (Kuh, 2003), while others find no significant differences between men and women (Hu & Kuh, 2002; Tortosa Martínez et al., 2023). In this sense, it has been proposed that gender differences in engagement may be related to factors such as academic self-efficacy or learning styles (Shoval et al., 2021).

Regarding the entrance grade, research such as that by Jiménez Caballero et al. (2015) and Danilowicz-Gösele et al. (2017) has shown that students with higher entrance grades tend to perform better academically, possibly due to their greater motivation and academic self-concept. However, we are not aware of any studies that link entrance grades and engagement.

This study analyses the relationship between engagement and two potential facilitators: academic climate and PBL as an active methodology. It also explores the effects of gender and university entrance grade on engagement. Specifically, two key questions are posed: (1) What is the relationship between academic climate, PBL, and engagement in university students? And (2) What is the importance of factors such as gender and entrance grade in engagement?

Method

Participants

For this study, a sample of 1376 students (Age: M = 21.00; SD = 4.392; 61.4% women) was drawn from the student population of different faculties and courses at the University of Girona. Table 1 presents the age and gender of the participants according to the faculty where they are studying.

Table 1. Participant characteristics (age and gender) by faculty

	% of the total sample	Mean Age (SD)	gender (% women)
Faculty of Science	5.4 %	21.0 (2.3)	53.8 %
Faculty of Business and Economic Sciences	34 %	21.0 (4.2)	46.7 %
Faculty of Law	12.4 %	23.5 (5.7)	60.2 %
Faculty of Education and Psychology	25.8 %	20.3 (3.9)	84.2 %
Polytechnic School	6 %	19.1 (2.5)	39.2 %
Faculty of Nursing	11.8 %	21.4 (5.0)	83.6 %
Faculty of Medicine	4.6 %	18.6 (3.1)	64.1 %

Note: Faculty of Sciences: Bachelor's Degree in Environmental Sciences; Faculty of Economics and Business Administration: Bachelor's Degree in Accounting and Finance, Bachelor's Degree in Business Administration and Management, Bachelor's Degree in Economics, Double Degree in Economics / Business Administration and Management; Faculty of Law: Bachelor's Degree in Law, Bachelor's Degree in Political Science and Administration; Faculty of Education and Psychology: Bachelor's Degree in Psychology, Bachelor's Degree in Pedagogy, Bachelor's Degree in Early Childhood Education Teacher, Double Degree in Early Childhood Education Teacher / Primary Education Teacher, Bachelor's Degree in Social Work, Bachelor's Degree in Social Education; Polytechnic School: Bachelor's Degree in Chemical Engineering, Bachelor's Degree in Mechanical Engineering, Bachelor's Degree in Food Innovation and Security; Faculty of Nursing: Bachelor's Degree in Nursing; Faculty of Medicine: Bachelor's Degree in Medicine.

Non-probability convenience sampling was used, administering the questionnaires to those students who attended class on the selected day. This strategy allowed efficient data collection, although it entails certain limitations in terms of the representativeness of the results among the student population of the University of Girona.

Instruments

Engagement Questionnaire

PTo assess university students' engagement, a questionnaire was used that had been designed by Benito et al. (2021) and developed from previous literature in university contexts (Schaufeli et al., 2002; Ahlfeldt et al., 2005; Ouimet & Smallwood, 2005; Appleton et al., 2006; Krause & Coates, 2008; Seppälä et al., 2008). For each of the 28 items, the student had to select the option that best matched their opinion according to a 4-point Likert scale (1: strongly disagree; 2: disagree; 3: agree; 4: strongly agree). A sample of the items used in the questionnaire is: "My effort is reflected in the results"; "The teaching method used in this class will help me in the future"; or "I persevere in the work even though activities in this class are not easy for me." The original version of the questionnaire showed adequate reliability and validity values, as well as a good model fit (see Benito et al., 2021). For this study, the questionnaire showed adequate reliability and internal consistency values (Cronbach's alpha = .922; McDonald's ω = .895).

The engagement questionnaire also included a second part, consisting of a short form to determine the respondent's profile. This questionnaire asked for information on age, gender, degree being studied, and university entrance grade. It also collected information on whether the subject taught and/or the degree they were currently pursuing used PBL as a faculty-specific methodology.

Questionnaire on the Social Climate in Higher Education Classrooms

To assess the academic climate, we used the Classroom Social Climate Scale for Universities (CSS-U, Rostan Sánchez et al.

2015), developed from the Classroom Social Climate Scale for Compulsory Secondary Education students (Pérez et al., 2010). The CSS-U questionnaire consists of 22 items (grouped into three dimensions: classmates, teacher, and rules) in which students were asked to choose the option that best matched their opinion based on a 4-point Likert scale. Some samples of the items used in the questionnaire are: "The teachers are interested in our learning (in a personalized way)", "In our class, students have a good relationship with each other", or "Students feel proud to belong to our faculty." After applying exploratory and confirmatory factor analysis, the tool demonstrated good psychometric properties (Rostan Sánchez et al., 2015). The original version of the questionnaire showed adequate reliability and validity values, as well as a good model fit (see Rostan Sánchez et al., 2015). For this study, the total scale showed adequate reliability and internal consistency values (Cronbach's alpha = .887; McDonald's ω = .880).

None of the administered questionnaires included specific items to control for social desirability bias. However, the questionnaires were anonymous, and students were therefore urged to be truthful in their responses.

Procedure and data analysis

For the development of this work, and assuming the limitations that this design presents in terms of the study of the relationships between variables over time, a cross-sectional design has been used to examine the effect of the academic climate and the PBL methodology on engagement.

In accordance with the ethical principles of the Declaration of Helsinki (World Medical Association, 2013), participants were duly informed of the purpose of the study, how the data collected would be used, and their right to withdraw at any time. Informed consent was also obtained. Also, in line with the principles of respect for privacy and data protection, confidentiality and anonymity were guaranteed through secure handling of the collected data, to prevent any possibility of identification.

The questionnaires were administered in person in the classroom, under the supervision of a member of the research team and with the collaboration of the teacher responsible for the subject. Students were explicitly asked to respond to the questionnaire items with the subject they were currently studying in mind.

For statistical analyses, the questionnaires were categorized into three groups based on the methodology used in the subject and degree: non-active, mixed, and active methodologies. We considered teaching methodologies non-active if neither the subject nor the degree used PBL; mixed if the subject uses PBL but the corresponding degree does not incorporate it; and active if both the subject and the degree incorporate it.

Analysis of variance (ANOVA) statistics were applied to study the effect of methodology type (non-active, mixed, and active) on engagement and academic climate, as well as to study the effect of the entrance grade and gender on engagement. Post-hoc tests with Tukey correction were used to explore statistically significant differences between groups. A linear regression model and moderation analysis were used to evaluate the direct and moderating effects of the academic climate and methodology type on engagement variables. This analysis allowed us to determine whether the relationship between methodology and engagement is mediated by the effect of another independent variable, in this case, the academic climate.

Results

Table 2 shows the mean scores for engagement and academic climate according to the type of study methodology (non-active, mixed, and active). Participants in the active methodology group show the highest mean scores for both engagement and academic climate, while participants in the non-active methodology group also obtain the lowest scores for both variables.

Table 2. Scores for engagement and academic climate according to the type of methodology

	n	*Engagement*		Academic climate	
		Mean	(SD)	Mean	(SD)
Non-active	676	85.3	(14.8)	63.3	(9.0)
Mixed	467	86.5	(17.1)	65.1	(11.5)
Active	233	92.6	(13.6)	75.9	(9.4)

To determine the differences between groups regarding scores on engagement and academic climate, an ANOVA variance analysis was used. All variables presented a normal distribution and the assumption of normality of variance was assumed (Levene's test: $p > .05$; Kolmogorov-Smirnoff test: $p > .05$). Regarding engagement, the results showed statistically significant differences between groups ($F = 22.395$, $p = < .001$), although the effect size was small ($\eta p^2 = .029$). Post-hoc tests with Tukey correction showed that these differences were due to the discrepancy in scores between the active methodologies group ($M = 92.6$) and the non-active methodologies group ($M = 85.3$, $p < .001$), and between the active methodologies group ($M = 92.6$) and the mixed methodologies group ($M = 86.5$, $p < .001$).

Regarding the academic climate, the results showed statistically significant differences between groups ($F = 25.764$, $p = < .001$), with a medium effect size ($\eta p^2 = .063$). Post-hoc tests with Tukey correction showed that these differences were due to the discrepancy in scores between the active methodologies group ($M = 75.9$) and the non-active group ($M = 63.3$, $p < .001$), and between the active methodologies group ($M = 75.9$) and the mixed methodologies group ($M = 65.1$, $p < .001$).

Effects of academic climate and methodology variables on student engagement

Table 3 shows the direct effect of the academic climate and type of methodology variables on engagement using linear regression.

Table 3. Effects of academic climate and methodology (ABP) variables on engagement. Moderation analysis

	B	SE	*β*	*p*
Step 1 (Direct effects)				
Academic climate	.662	.058	.424	< .001
Methodology	-1.241	.994	-.047	.212
Step 2 (Interactive effect)				
Academic climate * Methodology	.589	.011	2.252	< .001

In the first step of the model, academic climate showed a positive and significant effect (β = .424, p < .001), while the direct effect of methodology was not significant (β = -.047, p = .212). To determine the moderating effect of methodology type on the relationship between academic climate and engagement, interaction effects were calculated in the second step of the model. This effect was significant (β = 2.252, p < .001), indicating that PBL methodology moderates the relationship between academic climate and engagement.

The model showed adequate values for the multicollinearity indicators (VIF < 3, tolerance > .40), and the generalization indicators were acceptable (Durbin-Watson ≈ 2). The overall model showed an explained variance percentage of 17.5% (R2 = .175; 1- β = .99; f2 = 0.21). Inspection of the residuals suggests an absence of normality and homoscedasticity problems.

Three linear regression models were then performed to determine the magnitude of the relationship in each group (Table 4).

Table 4. Linear regression models for engagement according to the type of methodology

	F	R^2	B	Standard Error	*β*	*p*
Non-active	43.442 (1, 351)	.110	.527	.080	.332	< .001
Mixed	66.322 (1, 227)	.227	.771	.095	.476	< .001
Active	11.823 (1, 29)	.297	.509	.148	.545	.002

The results of the linear regression models show that the relationship between academic climate and engagement is strongest in the active methodologies group, with a β coefficient of .545 and an R^2 of .297. This suggests that the academic climate has a considerable impact on student engagement in this group. In the mixed methodologies group, a moderate relationship is observed, with a β coefficient of .476 and an R^2 of .227, indicating that the academic climate also influences engagement, although less intensely than in the active methodologies group. Finally, the non-active methodologies group shows a weaker relationship, with a β coefficient of .332 and an R^2 of .110, suggesting that the academic climate has a limited impact on engagement in this group. In conclusion, the results indicate that the type of methodology significantly influences the strength of the relationship between academic climate and engagement, with this relationship being stronger in the active and mixed methodologies group compared to the non-active methodologies group.

Effect of the entrance grade on engagement

Variance analysis statistics (one-way ANOVA) was used to study the effect of the entrance grade on engagement scores. All variables presented a normal distribution, and the normality of variance was assumed (Levene's test: p > .05; Kolmogorov-Smirnoff test: p > .05). Two groups were considered based on their entrance grade: High Grade (between 8 and 10 points) and Low Grade (between 5 and 7 points). Students of the bachelor's degree in medicine were excluded because the majority (93.8%) had a high entrance grade, and these could act as distorting elements in a comparative analysis. The results showed no statistically significant differences between groups (F = .319, p = .572, ηp^2 < .001).

Applying the analysis of variance (one-way ANOVA) to each degree separately, the results showed significant differences only in Environmental Sciences ($F = 5.919$, $p = .018$), with a small effect size ($\eta p^2 = .091$), and in Catalan Philology ($F = 8.096$, $p = .016$), with a large effect size ($\eta p^2 = .424$). In both cases, a low percentage of high entrance grades was observed: Environmental Sciences with 9.2% and Catalan Philology with 25.0%.

Effect of gender on engagement

In this section, analysis of variance (one-way ANOVA) was used again. All variables presented a normal distribution, and the normality of variance was assumed (Levene's test: $p > .05$; Kolmogorov-Smirnoff test: $p > .05$). The results suggested statistically significant differences between genders ($F = 4.705$, $p = .030$), although the effect size was small ($\eta p^2 = .003$). The female group (61.4% of the total participants) showed a higher score in engagement (Women: $M = 87.6$; $SD = 15.9$; Men: $M = 85.7$; $SD = 14.7$).

Discussion

Higher education, like any academic activity, requires student engagement, a factor that favours the assimilation of knowledge and the development of personal and professional skills. Recent literature indicates that academic engagement depends on a combination of individual, teaching, social, and cultural components (Perkmann et al., 2021), which is why it is useful to understand the influence of each of these variables (Ríos et al., 2010). In this article, we have analysed the role played by social aspects (academic climate) and teaching methodologies (use of PBL), as well as the interaction between both components with student engagement. Furthermore, we have included some individual elements in the study such as gender and university entrance grade, cited in the literature as factors to consider (Jiménez-García et al., 2021). As pointed out by Bilgin et al. (2021), the results obtained indicate that the academic climate can be assessed as a significant predictor of motivation.

Regarding the first research question, the results show classroom climate as a central factor in engagement, in line with previous literature (Brookhart & Durkin, 2003; Galini & Efthymia, 2009; MacNeil et al., 2009). In fact, as a noteworthy contribution, our study indicates the academic climate as the only variable that directly impacts engagement, but not the teaching methodology used, even when it is PBL. However, we found that the PBL methodology significantly enhances engagement when mediated by the academic climate. Consequently, university teaching must consider the classroom climate when implementing innovative methodologies, as it is not obvious that PBL has a direct and positive impact on student engagement (Amerstorfer & Münster-Kostner, 2021; Deslauriers et al., 2019).

On the other hand, as an original contribution of our study, the results also indicate that the institutional context facilitates the impact of PBL on engagement. Indeed, a stronger relationship was observed between PBL and engagement in those groups where PBL is not solely the project a teacher in a subject, but rather constitutes the methodology that defines all subjects in the degree. In contrast, this relationship is weaker when it is taught in a class independently of the rest and is the result of an individual decision by the member of staff teaching the subject. However, in the latter case, the relationship with engagement remains stronger than in classes with non-active methodologies.

Regarding the second research question, the results of our study did not corroborate the relationship between engagement and university entrance grades. This is contrary to what some authors have found between entrance grades and academic performance. This may indicate that engagement and academic performance are not synonymous concepts. However, Vargas (2007) found a significant relationship between intrinsic motivation (engagement) and entrance grades.

On the other hand, it has been observed that engagement is higher in female students than in male students. These results confirm those suggested by Kuh (2003), who found that women are more committed to learning than men. However, we must not overlook the fact that several authors (Tison, 2011; Veiga et al., 2014; Xu et al., 2024) consider that the literature exploring the relationship between gender and engagement shows a certain inconsistency, which could be explained by the complexity of the variable itself. Along these lines, the literature proposes different relationship patterns depending on the facet of engagement analysed (Kinzie et al., 2007). It should also be taken into account that engagement tends to change over time and to show a different pattern of change between men and women (Engels et al., 2019; Wang & Fredricks, 2014).

Conclusions

Based on the results presented and discussed, we summarize the following conclusions:

- The academic climate of the classroom is a central factor in achieving a good level of engagement among students.
- When a good classroom climate is achieved, the application of PBL methodology further enhances engagement.
- If the institutional curriculum incorporates the PBL methodology as its own, it is shown as an engagement enhancer.
- Women show a higher level of engagement in all groups analysed.
- The entrance grade does not seem to influence the perception of student engagement.

These findings lead us to various considerations and suggestions regarding approaches to teaching, continuing education, and the development of future university programmes of study. At the methodological level, the study largely validates the option of active methodologies such as PBL, provided that other, equally fundamental, collateral aspects, such as the academic climate in which teaching is conducted, are taken into account. Therefore, university institutions should adopt the measures outlined in this article and other specific literature to facilitate a positive academic climate.

In short, our study suggests that, beyond the grade with which students enter university, both contextual factors (PBL and academic climate), along with gender, contribute to improving university student engagement.

Limitations and future lines of study

This research surveyed a wide range of students and educational departments, but was limited to a single university. To improve its validity, it should be extended to more universities. To reinforce the findings of this research, it would be interesting to have other educational institutions with different characteristics from those studied and to conduct comparative studies that would reveal the role played by specific elements of teaching methodologies (number of students, curricula, etc.) or the academic climate (class resources) in engagement.

Beyond these limitations, in future research we suggest continuing to explore the multifactorial nature of engagement. These include the attitudes of the stakeholders involved, their resistance to and ability to face academic methodologies and objectives. This cross-sectional study could be complemented with a longitudinal approach, as well as a qualitative design that would allow for a deeper understanding of the factors that influence the academic climate and engagement of university students.

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