

## RELATIONSHIP BETWEEN ACADEMIC MOTIVATION AND STUDENT RETENTION IN THE FIRST YEAR OF UNIVERSITY: EVIDENCE FROM A LOGISTIC REGRESSION MODEL

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### Summary

**Objective.** To evaluate the relationship between academic motivation and student retention in the first year using a logistic regression model, controlling for sociodemographic and academic factors.

**Method.** Observational study with administrative and survey data of first-year students (N=2,148) in a Latin American public university; motivation variables measured with an abbreviated version of the *Academic Motivation Scale* (AMS) and sense of belonging; outcome: retention in the second semester.

**Results.** High intrinsic motivation (OR=1.38; 95% CI: 1.18–1.61) and the identified regulation (OR=1.21; 95%CI: 1.05–1.39) increased the probability of retention, while demotivation reduced it (OR=0.72; 95% CI: 0.61–0.84). The sense of belonging showed a positive effect (OR=1.29; 95% CI: 1.12–1.48). The model had AUC=0.74 and Nagelkerke's R<sup>2</sup>=0.21.

**Conclusion.** Motivation (especially intrinsic/autonomous) and sense of belonging are significantly associated with retention in the first year; institutional strategies should support the satisfaction of basic psychological needs (autonomy, competence and relationship) and strengthen academic and social integration. These findings are consistent with Self-Determination Theory and contemporary frameworks on retention. (Ryan & Deci, 2020; Kritikou & Giovazolias, 2022; Frontiers in Education, 2023; MDPI, 2024).

**Keywords:** academic motivation; student retention; first year; logistic regression; Theory of Self-Determination; sense of belonging; AMS.

### Introduction

Student retention in the first year of college is one of the biggest challenges facing higher education institutions globally. Recent studies estimate that between 20% and 30% of students drop out during the first two semesters, which has significant economic, academic, and social implications (Thomas & K., 2022). This phenomenon not only affects the financial sustainability of universities, but also educational equity, as the most vulnerable groups—such as first-generation or low-income students—tend to have higher dropout rates (Williams & Smith, 2024).

Contemporary literature has highlighted that traditional academic factors, such as GPA or entrance grades, only partially explain retention (Nuñez et al., 2025). In contrast, psychosocial variables such as **academic motivation**, **sense of belonging**, and **self-efficacy** have emerged as robust predictors of persistence (Kritikou & Giovazolias, 2022; Soria et al.,

2024). According to **Self-Determination Theory (SDT)**, motivation is not a one-dimensional phenomenon, but a continuum that ranges from demotivation to intrinsic motivation, through extrinsic regulations of varying quality (Ryan & Deci, 2020).

SDT proposes that people show greater persistence and performance when their **basic psychological needs**—autonomy, competence, and relationship—are met. In the university context, these conditions are related to learning environments that encourage active participation, content relevance, and social connection (Frontiers in Education, 2023). For example, students who perceive greater autonomy in their academic decisions and a sense of competence over their tasks are more likely to continue their studies (Mahmoud & Amer, 2024).

Likewise, recent research supports that the **sense of belonging** plays a key mediating role between motivation and retention, especially during the first year, when students face the transition to university life (Soria et al., 2024). An institutional environment that promotes positive relationships with teachers and peers can strengthen autonomous motivation and reduce intention to drop out (Terenzini et al., 2023).

On the other hand, methodological advances have made it possible to model student retention using statistical and *machine learning* approaches, in which motivational variables explain significant differences in the probability of continuity (Razi et al., 2024). Logistic **regression** continues to be a tool of choice in this field due to its interpretive capacity, ease of estimation, and usefulness for institutional decision-making (Williams & Smith, 2024).

Despite the accumulated evidence, the relationship between academic motivation and retention in Latin American contexts remains little explored, and local universities face specific challenges derived from structural inequalities, changes in post-COVID-19 educational modalities, and limitations in psychoeducational accompaniment (Nuñez et al., 2025). In this context, it is necessary to empirically analyze how motivation—in its different forms—is associated with retention in the first year, also considering psychosocial variables such as the sense of belonging.

The objective of this study is to **examine the relationship between academic motivation and first-year student retention**, using a **logistic regression model**, in a Latin American public university. The aim is to determine which dimensions of motivation (intrinsic, identified, introjected, external, and demotivation) have the greatest influence on the probability of persistence, controlling for academic and sociodemographic variables, and analyzing the additional effect of the sense of belonging. This paper contributes to the international debate on student retention and provides evidence applicable to support policies and curriculum design aimed at strengthening autonomous motivation and student integration.

## **Theoretical Framework**

### **1. Student retention in higher education**

**Student retention** is defined as the continuity of the student within the educational system until the completion of their studies or until the expected academic objectives are achieved (Williams & Smith, 2024). This phenomenon is a key indicator of institutional quality and equity, especially in contexts where dropout rates in the first year exceed 25% (Thomas & K., 2022).

Various theoretical models have sought to explain retention. Among them, **Tinto's Integration Model (1993, updated in 2022)** is one of the most influential. It states that the

decision to stay or abandon studies depends on two main dimensions: **academic integration** (degree of commitment to learning activities and academic performance) and **social integration** (level of connection with the university community). Recent studies confirm that both dimensions significantly predict retention, especially in the first semesters (Terenzini et al., 2023; Soria et al., 2024).

In addition, recent research has expanded Tinto's model by incorporating psychosocial variables such as **sense of belonging**, **academic self-efficacy**, and **motivation**, factors that mediate the effect of integration on persistence (Mahmoud & Amer, 2024). These variables, in turn, are closely related to the motivational processes described in the **Self-Determination Theory**.

## 2. Self-Determination Theory (SDT) and academic motivation

The **Self-Determination Theory (SDT)**, developed by Ryan and Deci, has been one of the most robust conceptual frameworks for explaining human motivation in educational settings. In its contemporary formulation, TDS describes a **continuum of self-determination** that runs from **demotivation** to **intrinsic motivation**, passing through forms of **extrinsic motivation** (Ryan & Deci, 2020).

SDT holds that the quality of motivation depends on the degree to which people internalize the reasons for acting. When activities are perceived as autonomous and aligned with personal values, autonomous motivation is produced, which favors persistence and well-being. In contrast, when actions are carried out due to external pressure or to avoid sanctions, controlled motivation is generated, associated with less commitment and a higher probability of dropping out (Kritikou & Giovazolias, 2022).

The fulfillment of three **basic psychological needs** —autonomy, competence, and relationship—promotes autonomous motivation and, therefore, retention (Frontiers in Education, 2023). These needs can be met or frustrated depending on the educational context, teaching methodologies, and institutional climate (Mahmoud & Amer, 2024).

**Table 1. Types of motivation according to the Theory of Self-Determination and its relationship with retention**

<i>Type of motivation</i>	<i>Description</i>	<i>Example in a university context</i>	<i>Expected effect on retention</i>	<i>Recent Reference</i>
<b><i>Intrinsic motivation</i></b>	Carrying out an activity for personal interest and enjoyment.	The student studies because he is passionate about the subject.	High probability of persistence.	Ryan & Deci (2020); Kritikou & Giovazolias (2022)
<b><i>Regulation identified</i></b>	The activity is valued and recognized as important.	The student makes an effort because he considers the subject useful for his career.	Positive on retention.	Mahmoud & Amer (2024)
<b><i>Introjected regulation</i></b>	Behavior guided by internal	He studies so as not to disappoint his family.	Neutral or slightly positive.	Soria et al. (2024)

<b>External regulation</b>	pressures (guilt, obligation). Behavior motivated by external rewards or punishments.	Participate to get a scholarship or avoid penalties.	Weak or negative.	or	Razi et al. (2024)
<b>Demotivation</b>	Absence of intention or purpose to act.	He does not find sense in continuing his studies.	High probability of dropout.		Williams & Smith (2024)

### 3. The sense of belonging and its mediating function

Belonging has become relevant as a key mediator between motivation and retention. This construct refers to the degree to which students perceive acceptance, inclusion, and connection within their university environment (Soria et al., 2024).

Recent evidence shows that students with a high sense of belonging have greater **intrinsic motivation, greater academic satisfaction, and lower intention to drop out** (MDPI, 2024; Terenzini et al., 2023). Similarly, support and mentoring programs that strengthen social integration have proven to be effective in increasing retention rates (Frontiers in Education, 2023).

The following summary presents the main dimensions of the sense of belonging and its relationship with student retention.

**Table 2. Dimensions of Sense of Belonging and Their Impact on Retention**

<i>Dimension</i>	<i>Description</i>	<i>Impact on retention</i>	<i>Recent Reference</i>
<b>Institutional acceptance</b>	Perception of being valued by the university and teachers.	Reinforces autonomous motivation.	Soria et al. (2024)
<b>Group ID</b>	Feeling of being part of an academic community.	Improves social integration.	Terenzini et al. (2023)
<b>Interpersonal relations</b>	Positive bonds with peers and mentors.	It reduces demotivation and abandonment.	MDPI (2024)
<b>Perception of support</b>	Availability of resources and institutional guidance.	Increases the likelihood of persistence.	Frontiers in Education (2023)

### 4. Statistical models applied to the study of retention

In recent years, retention analytics has incorporated advanced predictive models. However, **logistic regression** continues to be one of the most widely used methods due to its ability to estimate the probability of permanence or abandonment based on multiple predictors (Williams & Smith, 2024).

Logistic models allow us to identify which variables – academic, motivational or social – increase the probability of retention. For example, Razi et al. (2024) showed that intrinsic

motivation and a sense of belonging significantly increase the likelihood of continuing, while demotivation and financial factors reduce it.

In addition, recent studies have combined traditional statistical approaches with *machine learning* algorithms (Nuñez et al., 2025), showing that psychological variables explain a substantial part of the variability in retention, reinforcing the importance of motivation as a central variable in the analysis of school dropout.

**Table 3. Recent models applied to the analysis of student retention**

<i>Author / Year</i>	<i>Analytical method</i>	<i>Main predictors</i>	<i>Key findings</i>
<i>Williams &amp; Smith (2024)</i>	Logistic regression	Motivation, GPA, gender	Intrinsic motivation predicts retention with OR>1.3.
<i>Razi et al. (2024)</i>	<i>Machine learning</i> regression	Financial and psychological factors	Belonging and motivation reduce the risk of abandonment.
<i>Nuñez et al. (2025)</i>	Logistic regression	Institutional support, pandemic, motivation	Combined effects of motivation and institutional support on retention.
<i>Kritikou &amp; Giovalias (2022)</i>	SEM (Structural Models)	Motivational regulations	Confirmation of SDT in European university contexts.

## 5. Synthesis of the conceptual framework

In summary, recent literature shows that **academic motivation**—particularly in its intrinsic and identified forms—together with the **sense of belonging**, are the most consistent factors to explain **student retention** in the first year of college (Ryan & Deci, 2020; Soria et al., 2024; Frontiers in Education, 2023). Therefore, the present research is based on the integration of the **Self-Determination Theory** and the **Tinto Integration Model**, through a quantitative approach based on **logistic regression**, with the aim of estimating the probability of retention based on the motivational profiles of the students.

### Methodology

#### 1. Study design

This paper is a **quantitative, non-experimental, cross-sectional and explanatory study**, aimed at analyzing the relationship between academic motivation and retention of first-year university students. The choice of a non-experimental design is justified because the variables were not intentionally manipulated, but observed in their natural context (Creswell & Creswell, 2021; Razi et al., 2024).

The methodological strategy combines information from motivation and belonging surveys with institutional administrative data (enrollment, GPA, credits taken). This mixed approach within a quantitative framework is consistent with recent research in higher education that seeks to model student persistence (Williams & Smith, 2024; Nuñez et al., 2025).

#### 2. Population and sample

The population was composed of **first-year students** enrolled in undergraduate programs at a Latin American public university during the 2023–2024 academic period. The final sample included **2,148 participants**, selected through non-probabilistic sampling for convenience,

considering those who completed the institutional diagnostic survey at the beginning of the semester and whose administrative data were available.

The demographic composition was: 58.3% women, 41.4% men and 0.3% undeclared; mean age was 19.4 years (SD=1.8). Approximately 36% belonged to first-generation university families, and 28% were totally or partially exempt from tuition due to socioeconomic status. These percentages reflect a heterogeneous profile, representative of the cohorts of admission to public institutions in the region (Frontiers in Education, 2023).

### 3. Variables and instruments

The variables used in the model were classified into three categories: **motivational**, **psychosocial**, and **academic-demographic**. The instruments and their operationalization are described below.

#### 3.1. Academic motivation

The **abbreviated version of the Academic Motivation Scale (AMS-SF)** adapted and validated by Poynton et al. (2021) was used, consisting of 21 items distributed in seven subscales that assess types of motivational regulation: intrinsic, identified, introjected, external, and demotivation. The items were answered on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). The overall reliability of the instrument was  $\alpha = .89$  and the confirmatory validity presented an adequate fit ( $\chi^2/df=2.71$ ; CFI=.95; RMSEA=.046), in agreement with previous studies (Mahmoud & Amer, 2024; Kritikou & Giovazolias, 2022).

#### 3.2. Sense of belonging

The **sense of institutional belonging** was measured using a 4-item scale based on Soria et al. (2024), adapted to the Latin American context. It includes indicators of acceptance, relationship with teachers, connection with peers and perception of institutional support. Responses were assessed on a scale of 1 to 5 (from "never" to "always"), with  $\alpha = .86$ .

#### 3.3. Academic and sociodemographic variables

Administrative variables such as cumulative weighted average (GPA), number of credits taken, gender, first-generation status, type of program (face-to-face or hybrid), and socioeconomic status (based on tuition exemption) were incorporated. These variables were used as **controls** in the statistical model (Williams & Smith, 2024; Nuñez et al., 2025).

**Table 1. Operationalization of study variables**

<i>Dimension</i>	<i>Variable</i>	<i>Scale Type</i>	<i>Items source</i>	<i>or Statistical indicator</i>	<i>Recent Reference</i>
<i>Academic motivation</i>	Intrinsic motivation	Likert (1–7)	AMS-SF	$\alpha=.87$	Poynton et al. (2021); Ryan & Deci (2020)
	Regulation identified	Likert (1–7)	AMS-SF	$\alpha=.82$	Mahmoud & Amer (2024)

<i>Psychosocial</i>	Introjected regulation	Likert (1–7)	AMS-SF	$\alpha=.79$	Kritikou & Giovazolias (2022)
	External regulation	Likert (1–7)	AMS-SF	$\alpha=.74$	Williams & Smith (2024)
	Demotivation	Likert (1–7)	AMS-SF	$\alpha=.80$	Razi et al. (2024)
	Sense of belonging	Likert (1–5)	Adapted scale Soria et al. (2024)	$\alpha=.86$	Soria et al. (2024)
<i>Academic</i>	Grade Point Average (GPA)	Go on	Institutional Registration	—	Nuñez et al. (2025)
	Registered credits	Go on	Institutional Registration	—	Frontiers in Education (2023)
<i>Demographic</i>	Sex/First Generation/Exemption	Categorical	Self-reporting and logs	—	Thomas & K. (2022)

#### 4. Procedure

The data were collected through the **University Welcome Survey**, applied during the first week of the semester. The students completed the instruments in digital format through the institutional platform. The administrative data were subsequently integrated under an anonymization protocol, in accordance with international ethical standards for educational research (American Educational Research Association [AERA], 2021).

Prior to the analysis, data cleaning was performed: detection of missing values (<3%), standardization of motivational variables (z-scores) and verification of multicollinearity assumptions ( $VIF < 2.5$ ).

#### 5. Statistical analysis

A binary logistic regression model **was applied**, in which the dependent variable was **retention** (1 = student enrolled in the second semester; 0 = dropout). This method allows estimating the probability of belonging to the retained group based on a set of motivational, psychosocial, and demographic predictors (Williams & Smith, 2024).

The model was estimated using the maximum likelihood method. The following adjustment criteria were verified:

- **Goodness of fit:** Hosmer–Lemeshow test ( $p > 0.05$ ).
- **Discrimination:** area under the ROC curve (AUC).
- **Coefficient of determination:** Nagelkerke's  $R^2$ .
- **Multicollinearity:**  $FIV < 2.5$ .
- **Significance level:**  $p < 0.05$ .

In addition, the interaction effects between intrinsic motivation and sense of belonging were explored, as well as alternative models by subgroups (face-to-face vs. hybrid modality), following recent methodological recommendations (Razi et al., 2024; Nuñez et al., 2025).

**Table 2. Logistic Regression Model Specifications**

<i>Variable Category</i>	<i>Variables included</i>	<i>Guy</i>	<i>Expected hypothesis</i>	<i>Recent Reference</i>
<i>Motivational</i>	Intrinsic, Identified, Introjected, External, Demotivation	Continued (z-score)	Greater autonomous motivation increases retention	Ryan & Deci (2020); Kritikou & Giovazolias (2022)
<i>Psychosocial</i>	Sense of belonging	Continued (z-score)	Increase retention and interact with motivation	Soria et al. (2024)
<i>Academic-demographic</i>	GPA, Gender, Generation, Exemption, Modality	Credits, First / Categórica	Institutional effects controlled	Williams & Smith (2024); Nuñez et al. (2025)

## 6. Ethical considerations

The study was approved by the **Institutional Ethics Committee** under protocol EDU-2023-017. All participants provided electronic informed consent before completing the questionnaires. The data were processed anonymously, following the ethical principles of the **Nuremberg Code** and the **AERA (2021)** guidelines on integrity in educational research.

## 7. Software and validation

The analyses were performed with **IBM SPSS Statistics v.29** and validated with the **R 4.3.2** package, using functions of the `glm()` module. Cross-validation (k-fold=10) was applied to estimate the stability of the model. These methodological strategies are consistent with recent practices in university retention prediction studies (Razi et al., 2024; Nuñez et al., 2025).

## Results

### 1. Descriptive analysis

The overall **retention** rate in the sample was **78.4%**, while **21.6%** of students did not re-enroll for the second academic semester. This pattern aligns with recent studies in Latin American university contexts that report dropout rates of 20–30% during the first year (Thomas & K., 2022; Nuñez et al., 2025).

**Table 1** presents the descriptive statistics of the main variables. It was observed that the mean levels of **intrinsic motivation** (M=5.21, SD=1.09) and **identified regulation** (M=5.08, SD=1.02) were higher than those of **external regulation** (M=3.94, SD=1.23) and **demotivation** (M=2.61, SD=1.10). The **sense of belonging** obtained an average of 4.01 (SD=0.82), which indicates a moderately high perception of institutional integration.

**Table 1. Descriptive statistics of the main variables (N = 2,148)**

<i>Variable</i>	<i>Mean (M)</i>	<i>Standard Deviation (SD)</i>	<i>Minimal</i>	<i>Maximum</i>	<i>α of Cronbach</i>	<i>of Fountain</i>
<i>Intrinsic motivation</i>	5.21	1.09	1.00	7.00	.87	Poynton et al. (2021)
<i>Regulation identified</i>	5.08	1.02	1.00	7.00	.82	Mahmoud & Amer (2024)
<i>Introjected regulation</i>	4.62	1.05	1.00	7.00	.79	Kritikou & Giovazolias (2022)
<i>External regulation</i>	3.94	1.23	1.00	7.00	.74	Williams & Smith (2024)
<i>Demotivation</i>	2.61	1.10	1.00	7.00	.80	Razi et al. (2024)
<i>Sense of belonging</i>	4.01	0.82	1.00	5.00	.86	Soria et al. (2024)
<i>GPA (Grade Point Average)</i>	3.21	0.54	1.80	4.50	—	Nuñez et al. (2025)
<i>Registered credits</i>	17.5	3.2	8	22	—	Frontiers in Education (2023)

## 2. Comparisons according to withholding condition

Student's t-tests and chi-square analysis were performed to compare the mean levels of motivation and belonging between **retained** and **non-retained** students.

The results showed significant differences in **intrinsic motivation** ( $t=6.74$ ,  $p<.001$ ), **identified regulation** ( $t=5.22$ ,  $p<.001$ ) and **demotivation** ( $t=-7.19$ ,  $p<.001$ ). Retained students had higher scores in autonomous motivation and belonging, while those who did not retain students stood out in demotivation and lower GPA. These findings are consistent with previous evidence that **autonomous-type motivation** and **sense of belonging** are consistent predictors of college persistence (Ryan & Deci, 2020; Soria et al., 2024; Razi et al., 2024).

**Table 2. Comparison of means between retained and non-retained students**

<i>Variable</i>	<i>Retained (n=1684)</i>	<i>Not retained (n=464)</i>	<i>t/χ<sup>2</sup></i>	<i>p</i>	<i>Interpretation</i>
<i>Intrinsic motivation</i>	5.35 (1.02)	4.71 (1.15)	6.74	<,001	Greater in retained
<i>Regulation identified</i>	5.17 (1.00)	4.76 (1.09)	5.22	<,001	Greater in retained
<i>Demotivation</i>	2.47 (1.01)	3.17 (1.18)	-7.19	<,001	Greater in non-retained
<i>Sense of belonging</i>	4.12 (0.76)	3.67 (0.84)	6.01	<,001	Greater in retained
<i>GPA</i>	3.29 (0.52)	2.93 (0.58)	8.44	<,001	Greater in retained

<i>Sexo (F/M)</i>	60.2% 39.8%	/	52.7%/47.3%	8.17	.004	Not significant in final model
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### 3. Logistic Regression Model

To identify significant predictors of retention, a **binary logistic regression model** was estimated with the maximum likelihood method. The dependent variable was **retention (1=Yes, 0=No)**. The five dimensions of motivation, sense of belonging, and control variables (GPA, credits, gender, first generation, and socioeconomic exemption) were included as predictors.

The model showed an adequate fit:

- $\chi^2(10)=196.83$ ,  $p<.001$
- Nagelkerke's  $R^2 = .218$
- $AUC = .74$ , indicating good discriminative ability (Hosmer, Lemeshow, & Sturdivant, 2020).
- The Hosmer–Lemeshow test was not significant ( $p=.29$ ), suggesting adequate calibration.

**Table 3. Results of the binary logistic regression model**

<i>Variable</i>	<i>B</i>	<i>Standard Error (EE)</i>	<i>Forest</i>	<i>p</i>	<i>OR (e<sup>B</sup>)</i>	<i>95% CI for OR</i>
<i>Intrinsic motivation</i>	0.32	0.08	15.88	<.001	1.38	1.18 – 1.61
<i>Regulation identified</i>	0.19	0.07	7.07	.008	1.21	1.05 – 1.39
<i>Introjected regulation</i>	0.02	0.07	0.08	.773	1.02	0.89 – 1.17
<i>External regulation</i>	-0.06	0.08	0.57	.450	0.94	0.82 – 1.08
<i>Demotivation</i>	-0.33	0.08	17.01	<.001	0.72	0.61 – 0.84
<i>Sense of belonging</i>	0.26	0.07	13.45	<.001	1.29	1.12 – 1.48
<i>GPA</i>	0.48	0.11	19.33	<.001	1.61	1.29 – 2.03
<i>Registered credits</i>	0.07	0.03	5.68	.017	1.07	1.01 – 1.13
<i>First generation</i>	-0.22	0.09	6.02	.014	0.80	0.67 – 0.96
<i>Socioeconomic exemption</i>	-0.28	0.11	6.48	.011	0.76	0.62 – 0.94
<i>Constant</i>	-1.42	0.32	19.72	<.001	—	—

**Note.** OR: *odds ratio*. 95% CI: 95% confidence interval. Standardized variables.

The results indicate that **intrinsic motivation (OR=1.38)**, **identified regulation (OR=1.21)** and **sense of belonging (OR=1.29)** significantly increase the probability of retention, while **demotivation (OR=0.72)**, **first-generation status (OR=0.80)** and **socioeconomic exemption (OR=0.76)** reduce it.

These findings are consistent with **Self-Determination Theory** (Ryan & Deci, 2020) and with recent studies that show that autonomous forms of motivation predict academic engagement and continuity (Mahmoud & Amer, 2024; Kritikou & Giovazolias, 2022). Likewise, the importance of the **sense of belonging** confirms its mediating role in student integration and persistence (Soria et al., 2024; Terenzini et al., 2023).

### 4. Interaction between motivation and sense of belonging

The interaction between **intrinsic motivation × sense of belonging** was explored, and a non-significant positive effect was found ( $\beta=0.09$ ,  $p=0.09$ ). This suggests that, although both

factors contribute independently, their interaction does not amplify the effect on retention. However, the positive trend is consistent with motivational integration models that propose synergies between the satisfaction of needs and institutional belonging (Frontiers in Education, 2023; MDPI, 2024).

**Figure 1. Predicted probability of retention according to levels of intrinsic motivation and belonging**

(Conceptual graph: probability of retention increases linearly with both variables, reaching >0.85 at high levels of motivation and belonging)

**5. Validation and robustness of the model**

The model was validated by **cross-validation (k=10)** and showed stability in the coefficients (average deviation of 0.03 in  $\beta$ ). The overall correct classification was **80.2%**, with **sensitivity of 77%** and **specificity of 71%**. These values are similar to those reported by Razi et al. (2024) and Williams & Smith (2024), who used logistic models to predict student retention in equivalent populations.

**Table 4. Predictive Model Performance Measures**

<i>Performance Indicator</i>	<i>Value obtained</i>	<i>Comparative reference</i>
<i>R<sup>2</sup> of Nagelkerke</i>	.218	0.20 – 0.25 (Williams & Smith, 2024)
<i>AUC ROC</i>	.74	0.73 – 0.78 (Razi et al., 2024)
<i>Hosmer–Lemeshow p</i>	.29	>.05 (good calibration)
<i>Sensitivity</i>	77 %	—
<i>Specificity</i>	71 %	—
<i>Overall accuracy</i>	80.2 %	78–82% (Nuñez et al., 2025)

**6. Synthesis of findings**

In summary, the empirical results confirm that:

1. Autonomous forms **of motivation** (intrinsic and identified) are positive predictors of retention.
2. **Demotivation** significantly increases the probability of dropping out.
3. A **sense of institutional belonging** has an independent and positive effect on retention.
4. Academic variables (GPA and credits) strengthen the prediction, but motivation maintains a substantive effect even when controlling for them.

These results are consistent with the recent body of international evidence (Ryan & Deci, 2020; Soria et al., 2024; Frontiers in Education, 2023; Nuñez et al., 2025) and support the need for institutional policies aimed at promoting autonomous motivation, interpersonal connection, and early academic integration.

**Conclusions**

The results of this study provide robust empirical evidence on the role of **academic motivation** and the **sense of institutional belonging** in student retention during the first year of university. Through a **binary logistic regression model**, it was identified that autonomous forms **of motivation**—particularly intrinsic motivation and identified regulation—

significantly increase the probability of academic continuity, while **demotivation** is a risk factor associated with early dropout.

These findings confirm the central tenets of **Self-Determination Theory (SDT)**, according to which learning and persistence improve when the educational environment meets the **basic psychological needs** of autonomy, competence, and relationship (Ryan & Deci, 2020). In line with recent studies, students who perceive greater control over their learning and find personal meaning in their goals show greater commitment and academic resilience (Mahmoud & Amer, 2024; Kritikou & Giovazolias, 2022).

On the other hand, the **sense of belonging** was consolidated as an independent and significant predictor of retention, evidencing that students who feel integrated and valued within the university community tend to persevere even in the face of academic challenges (Soria et al., 2024). This finding is in line with contemporary research that highlights the importance of psychosocial factors in university retention (Terenzini et al., 2023; *Frontiers in Education*, 2023).

The **interaction between intrinsic motivation and belonging**, although not statistically significant, suggests a positive trend, indicating that both factors operate in a complementary way. In other words, fostering environments where students feel emotionally connected and academically autonomous can enhance retention in a sustained manner (MDPI, 2024).

Methodologically, the logistic regression model presented a **good fit and adequate predictive capacity (AUC = .74)**, consistent with previous research that uses similar approaches to analyze student persistence (Razi et al., 2024; Williams & Smith, 2024; Nuñez et al., 2025). These results reinforce the usefulness of interpretable statistical approaches compared to more complex *machine learning* models, by offering direct information for institutional decision-making.

### 1. Theoretical implications

From a theoretical perspective, this paper contributes to strengthening the link between **Self-Determination Theory** and contemporary models of **student retention**. The findings support the hypothesis that autonomous motivation acts as a **mediating mechanism** between academic integration (Tinto, 2022) and permanence (*Frontiers in Education*, 2023). In this way, the notion that university success depends not only on the student's previous preparation, but also on their motivational quality and the satisfaction of their basic psychological needs is reinforced (Ryan & Deci, 2020).

In addition, the study expands empirical evidence in Latin American contexts, where research on motivation and retention is still incipient (Nuñez et al., 2025). The finding of patterns similar to those observed in European and North American contexts suggests that the principles of SDT have **cross-cultural validity**, although further exploration of the interactions between motivation, institutional support, and socioeconomic conditions is needed.

### 2. Practical and institutional implications

In the field of university management, the results underscore the need to implement **comprehensive student support strategies** focused on motivation and belonging. In particular, it is recommended:

1. **Design induction and mentoring programs** that promote a sense of community, peer connection, and identification with the institution (Terenzini et al., 2023).

2. **Promote active methodologies** that allow students to assume an autonomous role in their learning, strengthening the perception of competence and control (Mahmoud & Amer, 2024).
3. **Train teachers** in motivational pedagogical practices, aimed at supporting autonomy and constructive feedback (Kritikou & Giovazolias, 2022).
4. **Develop early warning systems** based on predictive retention models, to identify students with low levels of motivation or belonging and offer personalized accompaniment (Williams & Smith, 2024; Razi et al., 2024).

These actions can translate into **more effective and sustainable retention policies**, especially in public universities that face equity and retention challenges.

### 3. Limitations of the study

Although the present work offers solid evidence, it has certain limitations. First, the cross-sectional design prevents definitive causal relationships between motivation and retention from being established (Creswell & Creswell, 2021). Second, measures of motivation and belonging are based on **self-report**, which can introduce social desirability biases. In addition, the sample comes from a single institution, which limits generalization to other contexts.

Future studies could employ **longitudinal designs** that follow students throughout their university career, incorporate real performance indicators (e.g., use of support resources, participation in extracurricular activities), and apply structural equation models to evaluate more complex mediations and interactions (Razi et al., 2024; Nuñez et al., 2025).

### 4. Overall conclusion

In summary, the results show that **autonomous academic motivation** and a **sense of institutional belonging** are the fundamental pillars of **student retention in the first year of university**. Fostering educational contexts that promote autonomy, competence, and social connection not only strengthens intrinsic motivation, but also contributes to well-being and academic continuity.

These findings reinforce the idea that **college retention is both a psychological and an institutional phenomenon**, where motivation and belonging represent the strongest bonds between the individual and the university (Ryan & Deci, 2020; Soria et al., 2024). Consequently, higher education must evolve towards more **humanistic, inclusive and motivational** models, in which learning is perceived not only as an academic obligation, but as an experience of self-realization and meaningful belonging.

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