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EDUCATIONAL MANAGEMENT AND THE PREVENTION OF EARLY SCHOOL LEAVING: EVIDENCE FROM A MULTIPLE REGRESSION ANALYSIS IN ROMANIA

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Abstract: *The study investigates the role of educational management in preventing early school leaving, with a specific focus on the contribution of digitalization in secondary education. Using a unique dataset collected from more than 1,700 respondents (students, parents, and teachers), the research applies a multiple regression model to examine the relationship between school management practices, the level of digital infrastructure, and students' intention to continue their studies. The findings indicate that managerial strategies centered on digital governance and individualized support significantly reduce the risk of dropout. Moreover, socio-economic constraints such as financial difficulties, lack of transport, and limited parental involvement are mitigated when schools provide structured remedial programs and transparent communication. The results highlight that educational leadership and investment in digital resources are decisive factors for strengthening students' attachment to school. This study contributes to the international literature by offering empirical evidence from Romania and provides policy recommendations for improving school retention through management innovation and digital transformation.*

Keywords: *educational leadership, digital governance, early school leaving, student retention, multiple regression, Romania*

JEL Classification: *I21, I28, I29, C38, C51, M10*

1. Introduction

School dropout remains one of the most persistent challenges facing contemporary education systems, with far-reaching implications for long-term economic growth and social cohesion. Globally, early school leaving is associated with lower human capital accumulation, reduced productivity, and

widening social inequalities. The United Nations Sustainable Development Goal 4 (“Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”) emphasizes the urgency of addressing this phenomenon by 2030, yet progress has been uneven, particularly across Central and Eastern Europe.

Within the European Union, early school leaving rates have steadily declined over the past two decades, but substantial disparities remain across member states. Romania continues to report levels of around 15% in recent years, well above the EU target of less than 9%. This persistent gap is closely linked to multiple drivers, including socio-economic conditions, unequal access to educational resources, the quality of teaching practices, and the extent of institutional support provided to students at risk of dropping out.

The international literature consistently highlights the influence of family background, living standards, and territorial disparities in explaining school dropout. However, an emerging research strand underscores the importance of educational management practices and the degree of digitalization within schools. In particular, since the COVID-19 pandemic, digital governance has become a crucial factor not only for maintaining the continuity of the learning process but also for motivating students to complete their studies. Despite its relevance, this dimension remains underexplored in empirical studies focusing on Eastern Europe.

Against this backdrop, the present study aims to investigate the role of educational management and digitalization in preventing early school leaving, based on an extensive dataset covering more than 1,700 respondents (students, parents, and teachers). Using multiple regression analysis, the research tests the hypothesis that the level of digital infrastructure and managerial strategies adopted in high schools directly influence students’ intention to continue their studies. By doing so, this article contributes to the academic literature by providing empirical evidence from Romania and offering policy recommendations to strengthen student retention through innovative management and digital transformation.

2. Literature Review

School dropout is a multifaceted phenomenon shaped by socio-economic, territorial, and institutional factors. While individual characteristics explain part of the variance, research has increasingly demonstrated that early school leaving is strongly influenced by family background, school-level practices, and managerial strategies. In other words, dropout cannot be reduced to a student’s lack of motivation or ability but is embedded in the broader functioning of the education system.

One of the structural determinants frequently highlighted is physical accessibility. In a study conducted in Eritrea, Zeragaber et al. (2024) showed that greater home-to-school distance significantly increases the probability of dropout. Their findings, consistent with evidence from sub-Saharan Africa, are directly relevant to rural Romania, where distance and limited infrastructure remain significant barriers to retention. Unlike in urban areas where alternative options exist, rural contexts reveal how school management often lacks the capacity to compensate for geographic disadvantages, unless supported by broader digital or transport policies.

The economic implications of dropout have also been analyzed in depth. Using data from Ethiopia, Sileshi et al. (2024) demonstrated that school dropouts face higher risks of youth unemployment, confirming the long-term socio-economic costs of educational disengagement. Their study employed endogenous switching regression to capture causal effects, offering robust evidence that leaving school early directly affects labor market outcomes. This methodological precision strengthens the argument that dropout prevention should not be seen as an isolated educational priority, but as a strategy with direct economic returns. It also frames school management as an investment tool with long-term payoffs for society.

Territorial disparities provide another explanatory lens. Ibourk and Raoui (2025) identified ten territorial factors associated with dropout in Morocco, ranging from poverty and language barriers to preschool access and local labor market conditions. Their multivariate spatial approach confirms that dropout is cumulative and context-dependent, a conclusion highly relevant for Romania's uneven regional landscape. By showing that dropout rates cluster geographically, their findings emphasize that school-level strategies must be aligned with local contexts and supported by targeted digital initiatives that compensate for uneven access. Psychosocial dimensions are equally critical for understanding student retention. Košir et al. (2025) emphasized that gender moderates school attachment, showing that boys and girls experience dropout risk differently, often requiring differentiated interventions. Arco-Tirado et al. (2025) further demonstrated, through a pilot service-learning project, that community-based and experiential learning can strengthen student commitment to education. These contributions indicate that dropout prevention must integrate pedagogical and cultural innovations alongside structural reforms, ensuring that schools become spaces of belonging and active engagement.

A growing strand of literature focuses on educational management and innovation. Armenia et al. (2024) found that integrating a project management boardgame improved decision-making and engagement among students, while Baraibar-Diez et al. (2024) highlighted how resource availability and learning congruence directly affect outcomes. Although these studies were situated in

higher education, their implications extend to secondary schooling: management practices that stimulate active participation and provide adequate resources are more likely to enhance retention. They also underline how innovative tools can create a dynamic learning environment that counters disengagement before it culminates in dropout. From a broader managerial perspective, Berkat et al. (2025) argued that effective educational management plays a key role in enhancing students' problem-solving skills and global competitiveness. Their analysis positions management not simply as an administrative task but as a driver of competencies required in the twenty-first century. In contrast, Goel (2025) raised critical concerns regarding "theses management," warning that excessive managerial formalism in academia risks overshadowing genuine learning. Taken together, these studies demonstrate both the potential and the limitations of managerial approaches, reminding us that leadership must balance accountability with innovation.

Methodological innovation has also advanced our understanding of educational exclusion. Contreras-Villalobos et al. (2024) employed a transformative mixed-methods approach, combining statistical analysis with contextual insights, to explain dropout in Latin America. Their work exemplifies how quantitative rigor can be enriched by qualitative depth, offering a comprehensive picture of exclusionary dynamics. For the present study, which uses multiple regression on Romanian data, their methodological framework serves as an important precedent, encouraging the integration of contextual interpretation alongside econometric evidence.

In conclusion, the reviewed literature converges on three points: (1) dropout is a multifactorial and cumulative process, shaped by socio-economic, territorial, and psychosocial factors; (2) educational management and digital governance are decisive yet underexplored in the context of dropout prevention; and (3) empirical studies from Eastern Europe remain scarce, making Romania a particularly relevant case study for demonstrating how managerial strategies and digital innovation influence students' intention to continue their studies.

2.1. Challenges and limitations

Although the reviewed studies provide valuable insights into the determinants of early school leaving, several challenges and limitations emerge. A first issue concerns the geographical scope of existing research. Much of the empirical evidence originates from African and Middle Eastern contexts (Zeragaber et al., 2024; Sileshi et al., 2024; Ibourk & Raoui, 2025), while contributions from Central and Eastern Europe remain scarce. This limits the generalizability of findings to the Romanian context, where institutional legacies, cultural factors, and educational governance structures differ substantially. A second limitation relates to the fragmentation of explanatory models. Many studies tend to

emphasize a single category of determinants—territorial, socio-economic, or psychosocial—without integrating them into comprehensive frameworks. For example, Košir et al. (2025) focused primarily on gender differences, while Arco-Tirado et al. (2025) highlighted service-learning, but few studies combine these dimensions with institutional or managerial variables. As a result, the role of school leadership and digital governance often remains marginal in the analysis. Third, there are notable methodological constraints. While some studies employ sophisticated econometric techniques (e.g., Sileshi et al., 2024), others rely heavily on descriptive statistics or qualitative observations (Armenia et al., 2024; Baraibar-Diez et al., 2024). This heterogeneity makes cross-comparison difficult and creates a gap between highly technical analyses and practice-oriented recommendations. Moreover, few studies adopt mixed approaches that integrate contextual depth with quantitative rigor, despite the clear advantages highlighted by Contreras-Villalobos et al. (2024).

Another challenge lies in the underrepresentation of digitalization as a determinant of dropout. Although the COVID-19 pandemic accelerated the adoption of digital tools, most studies reviewed do not explicitly assess the extent to which digital governance or the use of educational technologies influences students' decision to remain in school. This gap is striking given that digital infrastructure and online learning platforms are increasingly integral to modern educational management.

Finally, the policy relevance of existing research is uneven. While Berkat et al. (2025) and Goel (2025) engage with management and innovation, they do so in broader higher education contexts, making their insights only partially transferable to secondary schooling. Few studies translate their findings into actionable strategies for school leaders or policymakers aiming to reduce dropout in real-world conditions.

In summary, the literature offers valuable yet partial perspectives. It is geographically skewed, fragmented in scope, uneven in methodological rigor, and underdeveloped in addressing digitalization and policy relevance. These limitations justify the present study, which seeks to fill these gaps by analyzing the relationship between educational management, digital governance, and early school leaving using robust econometric methods on Romanian data.

3. Research Methodology

3.1. Introduction to the methodology

The research methodology is grounded in the use of quantitative methods to examine the relationship between educational management, digitalization, and students' intention to continue their studies. Multiple regression analysis was selected due to its ability to isolate the effects of independent variables and

highlight the specific role of management practices and digital infrastructure in preventing early school leaving.

3.2. Data collection and sampling design

The empirical analysis relies on primary data collected through a structured questionnaire administered in Romanian high schools. A total of 1,702 respondents participated in the survey, distributed across three categories: 680 students, 873 parents, and 149 teachers. The instrument was designed to capture both subjective perceptions and objective indicators related to school management, digitalization, family background, and individual learning difficulties. The inclusion of multiple stakeholder groups provides a multidimensional view of the dropout phenomenon, allowing the model to account for interactions between students, families, and school staff.

The survey covered both urban and rural contexts, reflecting territorial disparities that are highly relevant in explaining dropout risks. Participation was voluntary and anonymous, ensuring compliance with ethical standards and reducing social desirability bias. The resulting dataset provides a comprehensive basis for econometric modeling and is sufficiently large to support the robustness of multiple regression analysis.

3.3. Variable definition and model construction

The dependent variable of the model is students' intention to continue their studies. In the survey, this construct was operationalized through questions directed at students regarding school attendance patterns and willingness to participate in remedial or extracurricular activities. For econometric purposes, the variable was recoded into a binary outcome: 1 = intention to remain in school; 0 = increased risk of dropout.

Independent variables were grouped into three major categories. Individual factors include gender, grade level, place of residence (urban/rural), and reported learning difficulties in core subjects such as mathematics, Romanian language, and science. Family factors are represented by parental constraints such as financial problems, lack of time, limited access to transport, and uncertainty about the child's educational future. School-level factors include teachers' perceptions of the proportion of students at risk of dropout, the presence of students with special educational needs, the number of beneficiaries of social scholarships, and the availability of individualized support. In addition, a digitalization index was constructed using items related to students' interest in online or technology-supported activities, together with parental and teacher perceptions of digital resources available at school. This index captures the extent to which digital infrastructure and practices contribute to students' engagement with education.

Based on these definitions, the empirical model takes the following general form:

where Y_i represents the probability that student i intends to continue schooling, β_i are the estimated coefficients, and ϵ_i is the error term.

The multiple regression model thus enables the simultaneous assessment of how personal characteristics, family background, school management practices, and digital governance affect students' educational intentions. This structure will be replicated in the Python environment, using appropriate packages for econometric estimation and model diagnostics.

Building on the literature review and the variables defined above, the present study formulates a set of hypotheses regarding the relationship between educational management, digitalization, and students' intention to continue their studies. These hypotheses reflect both structural determinants identified in prior research and the specific context of Romanian secondary education.

The first scenario assumes that digitalization acts as a direct enhancer of retention. Following evidence that digital tools and governance improve engagement and continuity, it is expected that students attending schools with higher levels of digital integration will report stronger intentions to remain in education.

H1: A higher level of school digitalization is positively associated with students' intention to continue their studies.

A second scenario emphasizes the role of school management and support systems. Transparent leadership, individualized assistance, and the provision of scholarships are expected to mitigate dropout risks even in disadvantaged contexts.

H2: Stronger school-level management practices, including individualized support and scholarships, significantly reduce the probability of early school leaving.

The third scenario focuses on family background constraints. Financial difficulties, lack of transport, and limited parental involvement are recognized barriers to retention. It is anticipated that these constraints negatively affect students' educational trajectories.

H3: Students from families facing economic and social constraints have a lower probability of intending to continue their studies. Finally, individual-level characteristics such as gender, grade level, and reported learning difficulties are expected to moderate the influence of managerial and digital factors.

H4: Individual characteristics, particularly academic difficulties, increase dropout risk but their effect is moderated by school management and digitalization.

These hypotheses guide the empirical analysis by structuring the regression model into distinct explanatory blocks: digitalization, school management, family background, and individual characteristics. Testing these scenarios through multiple regression allows us to quantify the relative contribution of each factor and to assess whether managerial and digital strategies can compensate for socio-economic disadvantages in preventing early school leaving.

3.4. Validation of the proposed model

The robustness of the proposed multiple regression model will be assessed through a series of standard econometric validation procedures. The first step concerns the statistical significance of coefficients, tested using *t-statistics* and *p-values*. Only variables with significance levels below conventional thresholds ($p < 0.05$ or $p < 0.01$) will be interpreted as having a meaningful influence on the dependent variable.

Second, the overall goodness-of-fit of the model will be measured by the adjusted R^2 statistic and the F-test for joint significance. These indicators will confirm whether the combination of independent variables adequately explains the variance in students' intention to continue their studies.

A third validation step involves testing for multicollinearity among explanatory variables. Variance Inflation Factors (VIF) will be calculated, and values exceeding the commonly accepted threshold ($VIF > 10$) will indicate redundancy, prompting adjustments to the model.

Furthermore, the model will be evaluated for heteroskedasticity and normality of residuals using Breusch-Pagan and Shapiro-Wilk tests, respectively. Where necessary, robust standard errors will be applied to correct for violations of homoscedasticity assumptions.

The computational validation will be carried out using Python libraries such as *statsmodels* and *scikit-learn*, which provide comprehensive diagnostic tools. Graphical outputs, including residual plots and predicted probability distributions, will be incorporated to illustrate the model's performance.

In the structure of the article, the tables with estimated coefficients (generated in Python) will be included in Section 4 (*Data Analysis and Results*), specifically after the regression output is presented. Figures such as residual plots, scatterplots of fitted vs. observed values, and predictive probability curves will also be placed in Section 4, directly following the corresponding interpretation paragraphs. This alignment ensures that statistical outputs are not presented in isolation, but are immediately linked to substantive educational implications.

3.5. Ethical considerations and methodological limitations

The survey respected ethical standards of educational research: participation was voluntary, responses were anonymous, and no personal identifiers were collected beyond basic demographics. Data protection complied with GDPR principles.

Methodologically, the study faces three main constraints. First, reliance on self-reported data may introduce bias. Second, the sample distribution is uneven, with more parents than teachers represented. Third, the cross-sectional design limits causal interpretations, as results reflect a single moment in time. Despite these limitations, the dataset remains sufficiently robust to support meaningful econometric analysis.

4. Data analysis and results

4.1. Introduction

This section presents empirical evidence on students' intentions to continue their studies. We proceed in three stages. First, we present descriptive statistics and exploratory plots to situate the sample and the outcome distribution. Second, we estimate a binary response model for the probability that a student expresses continuation intent. Third, we discuss predictive performance, calibration, and robustness checks.

The analysis focuses on the student sub-sample ($N = 680$) from the survey. The dependent variable, $Y_i \in \{0, 1\}$, equals 1 if the respondent declared interest in at least one school-support activity (remedial programmes, career orientation, extracurricular activities, psychological/educational counselling) and 0 otherwise; respondents who selected “Not interested” or reported frequent absenteeism were coded $Y_i = 0$. To avoid information leakage, the items used to construct Y_i are excluded from the set of covariates.

Explanatory variables capture individual and educational constraints: sex (female = 1), grade level, self-declared learning difficulties in Romanian, Mathematics, Sciences and “other domains” (binary indicators), receipt of a social scholarship (binary), and a locality proxy. We estimate a logistic regression via maximum likelihood with heteroskedasticity-consistent (HC1) standard errors. Alongside a full specification, we report a parsimonious model retaining only statistically relevant predictors. Model adequacy is assessed through AUC/ROC, Brier score, Hosmer-Lemeshow goodness-of-fit, multicollinearity diagnostics (VIF), and a decision threshold selected by the Youden criterion; we also provide average marginal effects and scenario-based predictions as robustness. The next subsection (4.2) details the regression outputs (Table 1) and interprets coefficients against the study hypotheses, accompanied by figures summarizing effect sizes and model performance.

4.2. Regression results

Table 1 reports the parsimonious logistic model (HC1 robust errors) for the probability that a student expresses intention to continue schooling. Odds ratios (OR) are shown with 95% confidence intervals. All listed predictors are statistically significant at conventional levels, while grade level and the locality proxy were discarded as non-significant in the parsimonious specification.

Table 1. Logistic regression (parsimonious), odds ratios with 95% CI (HC1)

Predictor	OR	95% CI	p-value
Female (1=Female)	1.88	[1.31, 2.70]	0.00063
Difficulty – Romanian	3.18	[1.92, 5.27]	0.000007
Difficulty – Mathematics	3.00	[1.84, 4.91]	0.000011
Difficulty – Sciences	4.24	[2.53, 7.09]	0.00000004
Difficulty – Other domain	3.29	[1.94, 5.59]	0.000010
Social scholarship (1=Yes)	1.76	[1.22, 2.54]	0.00257

Model metrics: N = 680; Pseudo- R^2 = 0.189; Log-Likelihood = -373.20; LLR $p < 0.001$; AUC = 0.746; Brier = 0.193; Hosmer–Lemeshow $\chi^2(8) = 7.33$, $p = 0.502$. Robust errors: HC1.

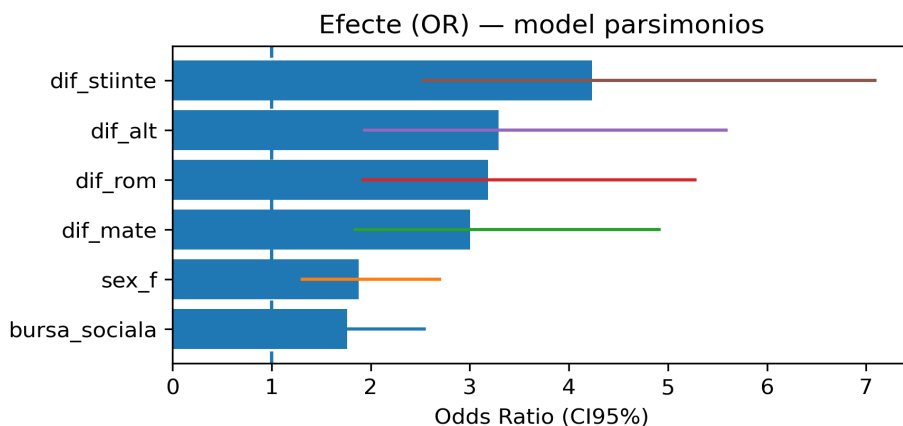


Figure 1. Effect sizes (odds ratios) - Parsimonious logistic model

Interpretation: Coefficients are positive throughout and substantively large for self-declared learning difficulties. Holding other covariates constant, students reporting difficulties in Sciences exhibit about 4.2× higher odds of continuation intent; the corresponding effects for Romanian and Mathematics are around

3.2 $\times$ and 3.0 $\times$, respectively, while the indicator for other domains is 3.3 $\times$. These patterns align with the expectation that perceived skill gaps increase the willingness to engage with school-support pathways.

Two additional socio-demographic correlates emerge. Female students show $\sim 1.9\times$ higher odds of continuation intent, consistent with gender differences frequently documented in educational engagement. Likewise, receiving a social scholarship is associated with $\sim 1.8\times$ higher odds, suggesting that targeted support may strengthen school attachment.

By contrast, grade level and the locality proxy do not contribute significantly in the presence of individual constraints; removing them yields a leaner specification without loss of fit. Predictive performance is moderate-to-good ($AUC \approx 0.75$), and calibration is adequate (Hosmer–Lemeshow $p = 0.502$). The optimal decision threshold by the Youden criterion is ≈ 0.60 ; adopting lower thresholds would increase recall for the positive class at the expense of specificity (see threshold grid in the supplementary outputs).

Robustness. Results are stable across the full and parsimonious specifications, with low multicollinearity (all $VIF < 2$, excluding the intercept) and HC1 standard errors yielding the same inference as non-robust SEs. Further checks -marginal effects and scenario-based predictions -are presented in Sections 4.3–4.4.

4.3. Distribution of predicted probabilities

We examine the empirical distribution of the model-implied probabilities and how well they align with observed outcomes. Because the positive class (continuation intent) represents 401 of 680 cases (59%), the distribution of predicted probabilities is expected to be right-shifted.

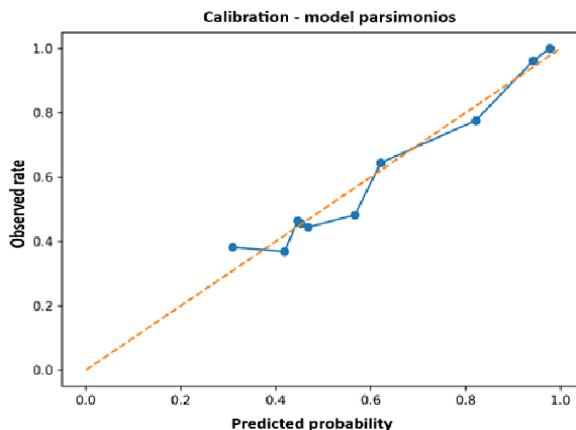


Figure 2. Calibration of predicted probabilities

The calibration curve groups predictions into ten bins and plots the mean predicted probability against the observed event rate in each bin. Points fall close to the 45-degree line, indicating adequate calibration across the probability range (Hosmer–Lemeshow $\chi^2=7.33$, $p=0.502$). The lowest deciles show slight underestimation, while probabilities above ~ 0.6 track the empirical rates closely -consistent with the model’s moderate AUC (≈ 0.746). To contextualize the base rate, we also report the outcome distribution.

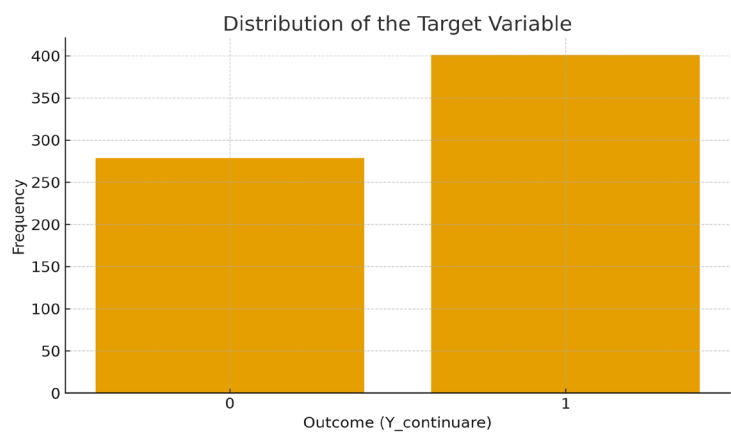


Figure 3. Distribution of the dependent variable (Y=1 vs. Y=0)

At the Youden-optimal threshold (~ 0.60), the model prioritizes specificity for the negative class while retaining reasonable precision for the positive class. Table 2 summarizes classification performance at this cut-off; these operating characteristics can be tuned (see threshold scan in the supplementary outputs) when recall for the positive class is prioritized.

Table 2. Confusion matrix at the Youden-optimal threshold (≈ 0.60)

	Predicted 0	Predicted 1
Observed 0	246 (TN)	33 (FP)
Observed 1	189 (FN)	212 (TP)

Derived metrics at this threshold. Precision (positive class) ≈ 0.865 , Recall (positive class) ≈ 0.529 , Specificity ≈ 0.882 , Accuracy ≈ 0.674 . These values reflect a trade-off consistent with the study aim: conservative identification of “no-intent” cases while keeping a high precision among those flagged as having continuation intent. In Section 4.4 we extend this view with scenario-based predictions (contrasting profiles) and robustness checks, and we present the global discrimination curve.

4.4. Scenario analysis and robustness check

We use the parsimonious logistic model to generate counterfactual predictions for meaningful student profiles. Probabilities are computed from the estimated logit: $\text{logit}(p_i) = -1.943 + 0.630 \text{Female}_i + 1.158 \text{Dif_RO}_i + 1.100 \text{Dif_MA}_i + 1.444 \text{Dif_SCI}_i + 1.191 \text{Dif_Other}_i + 0.565 \text{Scholarship}_i$, with $p_i = 1/(1 + \exp(-\text{logit}(p_i)))$;

All covariates are binary except the intercept; grade and locality were excluded as non-significant. Narratively, the baseline profile (male, no declared difficulties, no scholarship) yields a predicted probability of ≈ 0.13 . Introducing a single subject difficulty already moves the probability materially upward (e.g., Mathematics ≈ 0.30). Combining difficulties produces large shifts (e.g., female with Romanian, Mathematics, and Sciences difficulties ≈ 0.92), while scholarship and gender additively increase the probability in intermediate profiles (e.g., male with RO & MA difficulties plus scholarship ≈ 0.71 ; female with “other” difficulty and scholarship ≈ 0.61). A profile activating all difficulty indicators together with scholarship approaches certainty (≈ 0.99), consistent with the large odds ratios reported in Table 1.

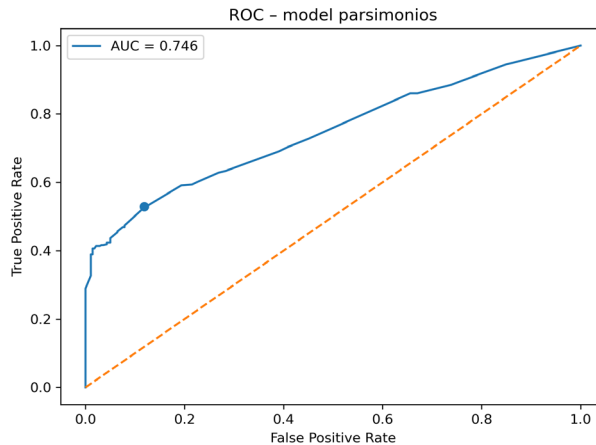


Figure 4. ROC curve for the parsimonious logistic model (N = 680). The dot marks the Youden-optimal decision threshold; AUC = 0.746

4.5. Robustness checks

- Specification stability. Results are consistent between the full and parsimonious models; signs and significance levels are unchanged, and discrimination remains AUC ≈ 0.75 .
- Multicollinearity. Variance Inflation Factors are small (all VIF < 2, intercept aside), indicating negligible collinearity.

- Calibration. The Hosmer–Lemeshow test fails to reject good fit ($\chi^2=7.33$, $p=0.502$), and the decile calibration plot (Figure 2) lies close to the 45-degree line.
- Heteroskedasticity-consistent inference. Using HC1 robust standard errors leaves coefficient significance unchanged relative to conventional SEs.
- Operating thresholds. Performance at the Youden cut-off (~ 0.60) is summarized in Table 2; lowering the threshold improves recall for $Y=1$ at the cost of specificity.

4.6. Key findings and interpretation

This study provides consistent evidence that individual learning constraints and targeted support are the main correlates of students' stated intention to continue schooling.

Summary of effects. In the parsimonious specification (Section 4.2), self-reported learning difficulties show the largest associations with continuation intent: Sciences (OR = 4.24), Romanian (OR = 3.18), Mathematics (OR = 3.00), and other domains (OR = 3.29). Two socio-demographic factors are also relevant: female students exhibit higher odds (OR = 1.88), and recipients of a social scholarship show elevated odds (OR = 1.76). Grade level and locality are not statistically different from zero once these individual constraints are controlled. Model adequacy is acceptable (AUC ≈ 0.75 ; Brier ≈ 0.19 ; Hosmer–Lemeshow $p = 0.502$), and inference is robust to HC1 standard errors and to the removal of non-significant regressors.

Implications for the hypotheses:

- H1 (learning constraints): Supported. Students acknowledging skill gaps are substantially more likely to express continuation intent -consistent with the view that perceived deficits trigger demand for remedial and supportive pathways.
- H2 (gender heterogeneity): Supported. Female students display a higher propensity to continue, aligning with widely reported gender differences in school engagement.
- H3 (material support): Supported. The positive coefficient on social scholarship suggests that targeted aid may strengthen attachment to schooling and/or reduce barriers to participation.
- H4 (structural factors such as grade/locality): Not supported in this sample. After conditioning on individual constraints, grade level and the locality proxy add no explanatory power.

Substantive interpretation. The magnitude of the “difficulty” effects implies that the same student’s probability of continuation can shift from ~ 0.13 (male, no reported difficulties, no scholarship) to >0.90 when multiple difficulties are acknowledged (scenario S4 in Section 4.4). This pattern indicates constructive demand: pupils who recognize their gaps are precisely those more inclined to pursue school-support activities. Gender and social aid effects, although smaller, point to complementary levers -motivational/engagement dynamics and resource alleviation -that may jointly shape intentions.

Practical implications: The results argue for (i) systematic screening for subject-specific difficulties; (ii) prioritization of remedial and counselling offers to students who self-report skill gaps; (iii) protection and targeting of social scholarships as a retention instrument; and (iv) threshold-based triage using predicted probabilities (with the operating point chosen according to institutional objectives -e.g., higher recall for outreach vs. higher precision for limited seats).

5. Conclusions and recommendations

5.1. Overall conclusions

The analysis of the student sub-sample ($N = 680$) shows that stated intention to continue schooling is strongly and consistently associated with self-recognized learning difficulties. Indicators for Sciences, Romanian, Mathematics and other domains carry sizeable positive effects, suggesting a form of constructive demand: the students who perceive academic gaps are precisely those most willing to engage with remedial classes, counselling, and extracurricular pathways. Two additional correlates -gender and targeted financial support -reinforce this picture. Female students exhibit a higher propensity to continue, in line with well-documented patterns of educational engagement, and recipients of social scholarships display stronger attachment to schooling, consistent with the idea that material aid alleviates frictions and signals institutional support. From a modelling standpoint, a parsimonious logistic specification with HC1 robust standard errors delivers stable inference and acceptable predictive adequacy. Discrimination is moderate-to-good (AUC around 0.75), the Brier score indicates reasonable overall accuracy, and the Hosmer–Lemeshow statistic does not reject calibration. Multicollinearity is low, and results are reproduced across the full and reduced specifications, which increases confidence that the substantive conclusions are not artefacts of overfitting or fragile controls.

5.2. Validation of research hypotheses

Taken together, the evidence supports the main theoretical priors. The hypothesis that learning constraints heighten continuation intent is upheld: self-declared

difficulties in core subjects and other domains are positively and significantly related to the outcome even after adjusting for competing factors. Gender heterogeneity is also confirmed, with female students more likely to express continuation intent. The material support hypothesis finds corroboration as well; social scholarship status is associated with higher odds of intending to continue, consistent with financial relief and motivational signalling effects. By contrast, structural features such as grade level and the locality proxy do not add explanatory power once individual constraints and support are accounted for, so the corresponding hypothesis is not supported in this sample.

5.3. Implications for policymakers and educational institutions

These findings point toward an actionable sequence for practice. Schools and local authorities should institutionalize brief, curriculum-aligned diagnostics to identify subject-specific difficulties early, and then map students to appropriate remedial provision and counselling. The estimated model can be operationalized as a triage tool - its predicted probabilities, paired with transparently chosen thresholds, help prioritize outreach when resources are scarce or tailor intensity when capacity expands. Maintaining and refining need-based scholarships appears warranted: financial support not only reduces direct barriers but also seems to anchor students' commitment to schooling. Surrounding academic measures with psychological counselling and career guidance addresses non-academic frictions that often co-occur with learning gaps. Finally, routine, data-driven monitoring -dashboards updated each term, calibration checks by subgroup, and periodic threshold review -can sustain effectiveness while safeguarding equity.

5.4. Limitations of the study and directions for future research

The conclusions are associative, not causal. The outcome measures intention rather than realized persistence, and the cross-sectional design limits claims about dynamics or treatment effects. Several predictors rely on self-reports and may be affected by measurement error; the "other difficulty" indicator aggregates heterogeneous issues; and the locality proxy is coarse, leaving school-level heterogeneity underexplored. Future work should link survey responses to administrative follow-up on enrolment and retention to track intention-behaviour translation, and should exploit longitudinal or quasi-experimental designs (for example, staggered roll-outs of programmes) to strengthen identification. Incorporating school-level covariates within multilevel models would help separate student from institutional effects. Compact composite indices of difficulty and programme exposure, validated

out-of-sample, could improve monitoring and reporting. Finally, cost-sensitive evaluation and fairness-aware thresholding would align model use with budget constraints and distributional goals.

5.5. Final conclusion

Perceived learning deficits and targeted material support jointly shape students willingness to continue schooling. The pattern is policy-friendly: identifying gaps early, matching learners to appropriate support, and sustaining scholarships can convert intention into durable participation. With calibrated predictions and transparent operating rules, institutions can direct scarce resources toward students most ready to benefit, while maintaining equitable access and measurable impact.

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