

**STRATEGIES FOR THE USE OF PREDICTING DROPOUT IN HIGHER
EDUCATION**

ESTRATÉGIAS PARA O USO DE PREDIÇÃO DE EVASÃO NO ENSINO SUPERIOR

***ESTRATEGIAS PARA EL USO DE PREDICCIÓN DEL LIDERAZGO EN LA
EDUCACIÓN SUPERIOR***



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ABSTRACT: Many studies aiming to find the most appropriate and effective techniques and practices for identifying factors that lead to student attrition end up relying on the use of technology to enhance data analysis and achieve a greater volume of processed information. The present study aims to identify best practices for supporting students who are identified early through data mining. To do so, it sought to identify the main institutional actors who can make use of this data to provide support to students identified as being at risk of dropping out. These actors were identified based on the structure of a public university located in the interior of Rio Grande do Sul, Brazil. The mapped actors were determined to be the best channels for receiving student data and the primary actions to be taken by each of them. At the end of the study, questionnaires were sent to the actors themselves, who individually assessed the suggestions, indicating the level of relevance and applicability.

KEYWORDS: Dropout. College. Higher Education. Educational Data Mining. Institutional Actors.

RESUMO: *Diversos estudos que buscam identificar técnicas e práticas mais adequadas e eficazes para compreender os fatores que levam à desistência de alunos têm se fundamentado no uso de tecnologias para aprimorar a análise de dados e processar um maior volume de informações. Este estudo tem como objetivo identificar boas práticas voltadas ao suporte de alunos em risco de evasão, detectados de forma precoce por meio de técnicas de mineração de dados. Para alcançar esse propósito, foram mapeados os principais atores institucionais que podem utilizar esses dados para implementar estratégias de apoio aos estudantes identificados como em situação de risco. O mapeamento foi realizado com base na estrutura de uma universidade pública localizada no interior do Rio Grande do Sul, Brasil. Para cada ator identificado, foram definidos os canais mais adequados para o recebimento dos dados e as principais ações a serem desenvolvidas em sua área de atuação. Ao final do estudo, questionários foram aplicados aos próprios atores institucionais, os quais avaliaram as sugestões apresentadas, indicando o nível de relevância e aplicabilidade das propostas.*

PALAVRAS-CHAVE: *Evasão. Universidade. Ensino Superior. Mineração de Dados Educacionais. Atores Institucionais.*

RESUMEN: *Muchos estudios que tienen como objetivo encontrar las técnicas y prácticas más adecuadas y efectivas para identificar los factores que llevan a la deserción de los estudiantes acaban dependiendo del uso de la tecnología para mejorar el análisis de datos y lograr un mayor volumen de información procesada. El presente estudio tiene como objetivo identificar las mejores prácticas para apoyar a los estudiantes identificados tempranamente a través de la minería de datos. Para ello, se buscó identificar a los actores institucionales principales que pueden aprovechar estos datos para brindar apoyo a los estudiantes identificados como en riesgo de abandono. Estos actores se identificaron en función de la estructura de una universidad pública ubicada en el interior de Rio Grande do Sul, Brasil. A los actores mapeados se les identificaron los mejores canales para recibir los datos de los estudiantes y las acciones principales que debían llevar a cabo cada uno de ellos. Al final del estudio, se enviaron cuestionarios a los propios actores, quienes evaluaron individualmente las sugerencias, indicando el nivel de relevancia y aplicabilidad.*

PALABRAS CLAVE: *Evasión. Universidad. Enseñanza Superior. Minería de datos educativos. Actores Institucionales.*

Introduction

The issue of university dropout is a worrying challenge in the Brazilian context, affecting countless students and having a negative impact on the country's education system. According to data from the OECD (2019), only around 33% of students who start higher education in Brazil manage to complete their courses on schedule. When the analysis period is extended to three years, this figure rises to only 50% of students.

The Special Commission for Studies on Evasion (ANDIFES/ABRUEM/SESu/MEC, 1996, p. 19) defines evasion as the "definitive departure of the student from the course without completing it". Multiple factors contribute to this situation, and it is crucial to understand its origins and results in order to make substantial changes and devise effective containment strategies. Understanding the reasons why students drop out of their degree courses marks the first step in a support system that is essential for the reintegration of these students. Universities must leverage their structures to implement strategic actions that encourage students to stay, investing in improved physical facilities and the continuous training of teaching and administrative staff.

The scientific literature is full of studies that set out to investigate the underlying elements of this phenomenon, as well as to create practical approaches to deal with it. A constant in the examinations of these studies is the finding that the most successful tactics for promoting the retention of students at risk of dropping out derive from a thorough understanding of the difficulties faced by these students. It is crucial that the information derived from this process accurately portrays the reality experienced by the students. This information, in turn, will guide the formulation of strategies aimed at preventing academic dropout (Howlett; Ramesh; Perl, 2013). From this understanding, it is possible to devise the strategy needed to address this issue more effectively.

Teachers and administrative staff should join forces to identify students at risk of dropping out and provide specific support according to the risk factors identified for each case. When the educational institution is able to identify threats and direct its resources clearly and straightforwardly, it creates an environment in which everyone understands their responsibilities and how they can focus their efforts on their areas of activity. From this point on, there is a greater likelihood that these agents will be able to offer targeted support, contributing to more successful academic trajectories for students.

Among the possibilities available for identifying students at risk of dropping out are strategies based on educational data mining. Collecting information from university students

makes it possible to classify the data to predict which students have the greatest potential for dropping out. In this context, a study was carried out that combined the results of a literature review, literature analysis, and experimental data mining tests, to gain an in-depth understanding of the main motivating factors behind university dropouts and explore how the institution itself can use predictive algorithms to identify students who are more likely to drop out. Based on these results, active support strategies were proposed in line with the university's organizational structure.

The research was conducted at a public university located in the interior of Rio Grande do Sul, during the year 2022. The study sought to identify the main institutional actors capable of carrying out actions aimed at promoting the retention of students at risk, as determined by the technological processes. Specific support strategies were suggested, tailored to the functions of each mapped agent, and validated with the institutional actors themselves.

This additional focus aimed to enrich the academic literature on information management for students in situations of educational vulnerability, since this approach fills a gap identified during the scientific review carried out in the course of the research.

Mapping and Definition of Practices for Institutional Actors

The purpose of this study was also to evaluate possible support actions for all areas of the university that could reinforce the institutional support policy. The following sections are titled with each area mapped, and for each of them, actions have been outlined and described, together with the analysis made by the civil servants who make up the portfolios themselves. The actors were identified through two complementary analyses. The first was to previously identify existing practices in the scientific literature in other institutions that had an organizational unit or working group with a similar dedication. In addition, based on the institutional organization chart of the university where the research was conducted, the attributions of each of the units or the actions carried out by them were analyzed and, thus, included when it was found that such practices could have an impact on student retention, either directly or indirectly. For this investigation, the "questionnaire" instrument was used for data collection. According to Gil (2002), the questionnaire is an effective and low-cost tool for obtaining the necessary data and information, without the need for prior training, and it also allows anonymous responses. Gil (2008, p. 121, our translation) defines the questionnaire as a means of "obtaining information about knowledge, beliefs, feelings, values, interests,

expectations, aspirations, fears, present or past behavior, etc.". Therefore, the proposed instrument fully meets the research objectives.

The questionnaire was structured on a Likert scale, allowing respondents to express their level of agreement with the statements in each question. Oliveira (2001) observed that this scale is widely used in research and has significant theoretical backing in the literature. For each aspect covered by the study, at least one question was structured with response options ranging from "totally disagree" to "totally agree". Each question also included an option for the participants to indicate if they had no relation or affinity with the topic. In addition, the questionnaire included an open question at the end, allowing participants to comment on the questions or add other information they deemed relevant. The general guidelines for designing the questionnaires basically followed questions that sought to identify the perception of the university's actors about practices already listed in work implemented in other contexts and the impact on their activities and interest in actions to predict student dropout. After collecting the data, a descriptive analysis of the responses was carried out to analyze each indication made by the group of participants individually.

Institutional Program to Monitor and Combat Evasion and Retention

The university has a multidisciplinary work team made up of members of the Dean's Offices, Campus Coordinators and representatives of students, technical-administrative staff, and teachers. With the aim of reducing dropout and retention rates, the Academic Data Intelligence Center (NIDA) was created on December 8, 2021, as part of the institutional program. This center aims to analyze institutional academic data related, directly or indirectly, to the phenomena of evasion and retention, proposing methodologies for producing, analyzing, and disseminating this data. Its functions include: auditing and analyzing institutional data; publishing information on evasion and retention; and offering guidance to other sectors of the university to help them make decisions based on careful analysis.

As part of the program's initiatives, 64 participants were invited to respond to a survey, from which 15 responses were collected. More than 93% of respondents said that an institutional program dedicated to managing initiatives to combat dropout should be the focal point for promoting effective strategies at the university level. In addition, they stressed that the team responsible should be made up of members with heterogeneous profiles to integrate different perspectives and experiences, covering all aspects of students' academic lives.

Regarding the need for the working group to be dedicated, with at least part of it devoted exclusively to monitoring the progress of actions, 53.3% totally agreed and 40% partially agreed. More than a quarter believe that this group is able to characterize students according to their areas of interest, point out the support mechanisms available, and evaluate successful programs. For 80%, this action could have an impact on the permanence of the students affected. One response questioned how it would be possible to make this distinction between the students, considering that "precise characterization" is difficult to achieve when it comes to human beings.

Regarding practices to combat dropout, there are reports of individualized alerts to students identified as likely to drop out, and this action has led to greater engagement of these students in academic activities. This practice could be applied at Unipampa, according to 86% of those interviewed. Around 60% of respondents believe that the group responsible for the program can take over the management of alerts, while 73% argue that the members of the program should monitor the effectiveness of these alerts. Less than half of those interviewed had no opinion on the usefulness of giving the group access to the data of students identified as being at risk of dropping out. One of the participants pointed out that "the profile of the student who drops out today will not necessarily be the same as the student who will drop out tomorrow", considering the prediction valid only for diagnoses and trends.

For 80% of those interviewed, it is essential to develop an interface that shows the students identified as being at risk, the probability of dropping out that led them to be on the list, as well as academic, demographic, and socio-economic information. The working group responsible for the anti-dropout program must have full access to this data, including the actions recorded by campus teams or any other relevant information relating to students.

More than 93% of respondents agree that monitoring actions can be amplified through the use of technology, such as the implementation of automatic alerts for teachers or areas responsible for student support, informing them, for example, of frequent absences. This strategy is seen as a potential way of positively impacting student' retention. With regard to initiatives related to teaching practice, 80% support the automation of alerts, such as notifying the Academic Coordinator in cases of non-compliance with class registrations and minimum attendance or non-adherence to the teaching plan. On the other hand, one of the interviewees stressed the importance of prioritizing the development of the academic system as a whole, rather than concentrating efforts exclusively on creating automated alerts.

There was no consensus in the responses regarding the achievement of the objectives proposed for the working group and the impact on the students. Only 26% believe that the work has achieved its objectives and had a direct impact on the students. More than 33% consider that the work has not achieved its stated purpose. One of the interviewees believes that the group's work should focus on managing the data made available. For him, the scope of work should focus "mainly on the database, cleaning, and validation, since many records are incorrect, incomplete or irrelevant".

Institutional and International Affairs

An invitation to participate was sent to the institutional e-mail address of the Directorate for Institutional and International Affairs (DAIINTER), and the survey received one response. The main collaborative action to tackle the dropout identified was the management of the Santander Undergraduate Scholarship Program, which offers aid to students in vulnerable situations with good academic performance. This action affects the permanence of students, according to the interviewee. However, the institution was disconnected from the program and currently does not offer these benefits.

Regarding the question of whether the Board is informed about students at risk of dropping out and the possibility of reserving places or offering bonuses to these students, no majority opinion or consensus was identified among the respondents.

Institutional Communication

Twelve institutional accounts of civil servants linked to the Social Communication Department (ACS) and the ACS institutional e-mail were invited to contribute to the study. Among the questionnaires sent out, four responses were completed, indicating that the use of local media could represent a relevant strategy for the university. There was a consensus that publicizing Unipampa's achievements on TV news programs and running ads emphasizing valuable information should be explored as tools to attract new students. For 75% of respondents, advertisements that promote the identification of value can positively impact the perception of quality by regular or potential students.

With regard to internal communication, half of the respondents believe that the ACS can offer support in welcome campaigns for incoming students. In addition, 75% believe that

the ACS team should extensively use the university's social networks as a channel for information on institutional processes aimed at students. On the other hand, only half of the respondents fully agree that the HCA should continuously monitor the university's website to make access to information quicker and more intuitive.

Regarding the creation of a job placement support service and its possible impact on retention rates, only half of those interviewed believe that it would be possible to develop a bank of opportunities, showing students the job market prospects for their field of study. One of the respondents pointed out that "informing students about courses and the job market, professional requirements, and career possibilities is extremely important".

One contribution emphasized the potential of communication strategies that have an external impact on Unipampa. One interviewee mentioned that: "offering more events for the community and schools, something that can promote the University's brand", could arouse more interest in the institution.

In addition, one participant indicated that the activities mentioned as practices to be followed are carried out by the ACS, but the team is small to serve an institution with 10 *campi*. Regarding the last question, only 50% believe that it would be beneficial to know which students are at risk of dropping out. The others have no opinion.

Diversity, Affirmative Action and Inclusion

Eighteen participants linked to the following centers and advisory services were identified: Inclusion and Accessibility Center (NInA), Diversity, Affirmative Action and Inclusion Advisory Office (ADAFI), Educational Development Center (NuDE) and Afro-Brazilian and Indigenous Studies Center (NEABI). These units are central in supporting students impacted by inclusion and diversity policies. Invitations were sent to the staff of these structures, resulting in the collection of three responses. There was a consensus among the participants that actions such as the selection of scholarship holders to promote inclusion and accessibility have a significant impact on the permanence of the students assisted. In 2021, 37 new students were awarded scholarships at the university's ten campuses, 30 of which were for Inclusion and Accessibility Monitoring and 7 for NInA Libras, aimed at teachers.

With regard to assisting students who need specific attention on inclusion issues, it was pointed out that the actions implemented so far do not cover all the existing demands. All the interviewees considered it essential to have access to information about students at risk of

dropping out. However, 66% said that it is not the team's direct responsibility to monitor individual students' situations. One of the respondents pointed out that this task should be carried out by NuDE, due to the closer contact it has with students, and that the data collected is fundamental for supporting the actions of NInA at the Rectorate.

In addition, all the civil servants agreed that the data available in the institutional records at the time of the survey was insufficient to carry out more effective work. The need to broaden access to information on the history of student activities and attendance at the institution was highlighted. Thus, support teams could develop more assertive strategies to promote the retention and academic success of these students.

Information and Communication Technology

The six area managers identified were invited, and four responses were collected. For 75% of those interviewed, improving and providing new systems or acquiring solutions that improve teachers' pedagogical practices as initiatives to promote student retention is important.

There is no consensus on whether DTIC, in the area of systems development, should provide the relevant solutions to combat evasion. However, there is unanimity among managers that a responsible body must approve all requests related to strategies to combat dropout. Among them, 75% believe that the Institutional Program to Monitor and Combat Dropout and Retention could be such a structure in the organization.

Half of the sample believes that requests related to strategies to combat dropout should be treated with the urgency that the issue demands. However, the idea of reserving exclusive servers or exclusive weekly hours for developing solutions was not well received by most interviewees, who reacted negatively or expressed no opinion. There was also disagreement about the ICT infrastructure and whether it is possible to maintain complete wireless network coverage in the academic units.

Student Assistance

After identifying the six managers who head the Office of the Dean of Student and Community Affairs (PRAEC), invitations to participate were sent out, resulting in five responses for analysis. It was found that 80% of the sample indicated that a relevant competence of this department is the clear and precise control of the information of the students assisted.

All the interviewees pointed to the need to update and unify the system for registering benefit applications, optimizing the process of application, analysis, and socio-economic and academic re-evaluation. According to 80% of the respondents, this measure would positively impact the permanence of assisted students.

According to all the managers, PRAEC would benefit from having access to information on students identified as being at risk of dropping out. Currently, only 20% say that it is possible to effectively monitor the students who have applied to PRAEC's calls for proposals. Most agree that a dedicated interface to identify these students, containing dropout probability indices and academic, demographic, and socio-economic data, would be useful. This team should have full access to records of services and actions carried out by the campuses or any other relevant information.

With regard to the perception of student coverage of PRAEC's actions, there was no consensus among managers. The managers unanimously agree that prioritizing students identified as being at risk of dropping out for specific benefits could be an advantageous measure. In addition, it was suggested that it is essential for all teachers to record students' attendance during lessons in order to identify early absences and implement preventative actions.

Graduation

Eleven area managers were invited to take part in the survey, resulting in the collection of three responses. Although they recognize that the programs managed by the portfolio have an impact on the permanence of students, the majority consider that the current scope of these programs is not adequate.

Regarding the Internal Calls of the Pro-Rectorate of Undergraduate Studies (PROGRAD), the managers' opinions were mixed. Some believe that these strategies have a positive impact on student retention, while others point out that the supply is less than the demand from students.

There was a consensus among the respondents on the importance of activities to introduce students to higher education and the course, as these initiatives help to integrate students, especially those at risk of dropping out. Opinions were divided on the proposal to change the admissions process to prioritize the candidate's first choice. However, all the managers agreed that investing in internal mobility can bring benefits.

The managers pointed out that access to the list of students flagged as being at risk of dropping out, with academic, socio-economic, and student assistance information, would be advantageous. However, opinions differed on the support provided to campus structures and teaching staff.

Extension and Culture

Four area managers were invited to participate, resulting in two responses. Both agreed that the initiatives carried out by the Dean of Extension and Culture have an impact on student retention, although they consider that these actions are insufficient in terms of volume. There was a consensus among the respondents that extension activities need more support from other sectors of the Rectorate. Most managers believe there should be more support from students and technical-administrative staff.

The curricularization of extension is seen as a promising practice for engaging students with their areas of expertise, and the participation of newcomers, especially those at risk of dropping out, in cultural and integration activities was also considered advantageous. Despite this, managers indicated that receiving a list of students identified as being at risk of dropping out at the beginning of each semester is not enough to meet their needs.

Postgraduate and Research

Two area managers were invited, resulting in one response. Initiatives such as the Academic Development Program (PDA) and Scientific Initiation were mentioned as important for students to stay, although there was no consensus on whether the figures presented adequately meet this demand. There was agreement that the Graduate Studies and Research areas positively impact student retention. Promoting scientific publication and participating undergraduates in research groups were considered not very relevant strategies.

Research into combating dropout, whether directly or indirectly, is seen as a strategy to be encouraged. The majority of respondents believe that receiving a list of students identified as being at risk of dropping out would be beneficial.

Campus Management

The questionnaire was sent to the institutional emails of thirty Campus managers who held the positions of Director, Academic Coordinator (in an attempt to understand the view of teachers in the role of Campus manager), and Administrative Coordinator. Thirteen responses were received and analyzed. It was noted that all participants partially or totally agreed that the creation of a structure on campuses to provide psychological and health counseling services to students, as well as welcoming spaces and leisure and sports activities, could contribute to student retention.

It was clear that all the respondents agreed with the idea that making physical infrastructure available in the academic units is a favorable measure, but that the implementation of this proposal would depend on the resources available. Some Unipampa campuses already have spaces for integration and leisure, which suggests the feasibility of expanding this strategy.

With regard to the reception of students' children, approximately 82% of the participants agreed that this initiative could have a positive impact on the permanence of students. In addition, 76% believe in the possibility of creating these spaces. One respondent shared a successful experience from the *Uruguaiana* Campus, which established the "Maternal and Child Room" and "*UnipampaKids*", with positive results. Support for students who need to combine motherhood or parenthood with their studies was also identified as relevant.

There was less consensus among the respondents regarding the provision of subjects needed to complete the curriculum, especially for students with a high failure rate. Around 38.5% expressed no opinion or partially disagreed, while another 38.5% totally or partially agreed. With regard to tutoring, there was unanimous acceptance, with more than 92% of participants considering this a promising strategy against dropouts.

Regarding identifying students at risk of dropping out, approximately 70% of respondents indicated that management teams would benefit from having access to students identified by data mining algorithms. However, less than 50% believe they are able to monitor these students. Some commented on the difficulty of individually monitoring a large number of students, suggesting approaches such as distributing students among teachers for closer monitoring.

In the academic area, managers expressed different opinions on how to intervene in the process of offering subjects and allocating teaching staff. Around 70% agreed that identifying

and avoiding the profile of teachers with a high failure rate in initial subjects could have an impact on student retention. Strategies such as choosing suitable teachers for the initial semesters and reformulating the curriculum also received support from around 66% of respondents.

All participants agreed that pedagogical support teams play a central role in monitoring and evaluating institutional actions. However, these teams found it difficult to plan actions due to lack of time and excessive workload. The idea of involving the family in supporting the students generated divided opinions. Although 90% of the participants recognize the proposal's potential, its implementation depends on an individual approach, taking into account the diversity of family situations.

Courses and Teachers

Academic coordinators (seeking to understand the views of course managers and teachers) and course coordinators were invited to contribute their opinions on practices related to courses and the role of teachers in preventing dropout. A total of twenty-one responses were collected. Around 70% of respondents agreed that identifying and avoiding the profile of teachers with a high failure rate in initial subjects could positively impact student retention. More than 60% considered it interesting to choose teachers with suitable profiles for the initial semesters of the course.

For almost 91% of respondents, assigning empathetic teachers to classes made up of students at risk of dropping out is essential. However, some concerns have been raised about the operationalization of this approach, due to the lack of teachers and problems related to the allocation of subjects.

Around 71% of the participants believe that investigating each teacher's learning methodologies and teaching strategies can contribute to students staying in school. The idea of reformulating course curricula, including practical activities from the outset, was also supported by around 67% of respondents. The promotion of self-efficacy among students was considered promising by 71.5% of those surveyed. Almost 62% agreed that encouraging scientific production as a pedagogical practice could have a positive impact on student retention.

The interaction between the course coordinator and new students, as well as the holding of pedagogical meetings with the active participation of students, was seen as positive by more than 85% of respondents. More than 85% of teachers agreed that motivation should be

stimulated in a positive way, without coercion or threats. The teacher's genuine interest in the student's progress was considered essential by 90% of the participants.

Most teachers believe that knowing which students are at risk of dropping out could benefit their support. As for the most appropriate channel for this communication, opinions varied between the teacher's institutional e-mail, a specific menu in the academic system, and a mark in the class diary. The class diary was the most relevant channel for the majority of the sample.

The importance of keeping up-to-date records was unanimous among the participants. However, not everyone agreed with the inclusion of features in the class diary to classify students' engagement and level of participation.

As for support for students identified as being at risk, the majority believe that it is possible to offer help without highlighting the student's situation. Concerns about possible discrimination and impacts on the class were also discussed. Active methodologies were considered essential strategies by 81% of teachers. The availability of materials in various media was also considered relevant by 75% of respondents.

Several contributors highlighted the inadequacy of student assistance and the institutional structure as factors contributing to dropout. The answers reflect the perception that dropout is a multifactorial phenomenon, requiring a comprehensive approach on the part of teachers and institutions.

Students

There was no questionnaire for students. The suggestions presented have been collected from the researched bibliography and scientific articles on which this study was based. In addition to structuring Academic Directories (DAs), there is the possibility of promoting new forms of organization, such as study groups and learning communities. Promoting the course's identity through elements such as T-shirts fosters a sense of belonging and cohesion among students.

Tinto (2015) explores pedagogical approaches related to collaborative learning and learning communities, emphasizing the importance of establishing links between colleagues and teachers in and outside the classroom. Through collaborative learning, students are encouraged to collaborate and share knowledge and experiences, contributing to the creation of an environment of cooperation and mutual support.

The formation of freshman learning communities can be implemented by selecting students who are prone to dropping out, along with those who obtained the best entrance grades in the related field of study. In the case of senior students, the community could be made up of students identified as susceptible to dropping out, as well as the best-placed students on the course within the study area.

Final considerations

Data mining has played a significant role in higher education by analyzing dropout rates and identifying patterns that help administrators make informed decisions. By analyzing student data, data mining techniques are used to identify students at risk of dropping out and plan appropriate interventions. In addition, data mining helps to improve assessment and decision-making processes in higher education, using the insights generated to establish the university as a support and training system for all students.

Confirming Andrade's (2010) assertion, it is essential to analyze each of the motivators of school dropout since each of them is related to specific needs and involves different actors in the process of supporting the student.

An essential conclusion that emerges from this study is the need for the university to maintain a robust and constantly updated database. It is imperative to cultivate an organizational culture that promotes the quality of student records and agility in collecting information, as data on students' academic progress will only be valuable for studies to identify the risk of dropout if recorded in a timely manner. Delays in registering elements such as courses taken and extracurricular or complementary activities hinder studies that predict dropout. Problems related to registration and ease of access can compromise the identification of students most at risk of vulnerability, as pointed out by Berens *et al.* (2019), who consider these factors essential to the success of educational support programs.

Other data from the interaction between teachers and students can be incorporated as attributes for predicting dropouts, such as student attendance. Although this is a common predictor in similar studies, effective use of this attribute requires all teachers to consistently record students' attendance and absences. Even if omission occurs in a minority of teachers, it can cause an imbalance in student data, impacting the accuracy of algorithms. Therefore, strategies based on interaction between students and teachers should be further explored. These

actions are corroborated by Tinto (1993), who argues that students bring their goals closer to those found in the university system when a dedicated and attentive teacher accompanies them.

Once students at risk have been identified, it is essential to define effective practices for university management. This requires a detailed understanding of the main institutional agents within the university's structure and how each of these actors can collaborate in supporting students, promoting permanence and academic success. Dedication and clarity about the role of each actor in helping students in situations of vulnerability play a fundamental role in building a robust academic environment and student success. The active and committed involvement of the teams that make up the university workforce can be the decisive factor between student dropout and persistence in the face of educational challenges.

The focus should be on implementing strategies that strengthen integration and build a relationship of trust with the student. This can be achieved through one-to-one conversations, in which genuine interest and active listening can reveal personal challenges, learning difficulties, or the need for additional support. Creating an environment in which students feel valued and understood lays the foundation for a supportive relationship that drives persistence. In addition, collaboration with specialized professionals, such as academic advisors and psychologists, can result in more effective support strategies. Forming a comprehensive support network can increase the chances of success for at-risk students by providing a variety of resources to overcome obstacles.

When analyzing teaching practice, the need to adapt teaching approaches to meet the individual needs of students at risk of dropping out becomes clear. This perspective reinforces Ribeiro's (2020) argument, highlighting the importance of pedagogical practice and the teacher-student relationship as essential elements for the success of permanence. This may involve adopting differentiated teaching methods, offering practical activities to engage students, and providing constructive feedback. Personalizing the learning process can help restore students' confidence in their abilities and reinvigorate their enthusiasm for learning.

Understanding the role of each institutional actor in promoting the retention of students at risk of dropping out is essential for effective management. This consideration is in line with what Silva *et al.* (2019) suggested when they identified that the institutions that adopted integration actions on the part of the coordinators had a lower dropout rate. Carefully designed strategies that promote academic, emotional, and financial support, combined with transparent communication and a strengthened sense of belonging, are fundamental to ensuring that students face the challenges and complete their academic careers.

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