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Educational Alternative for Academic Improvement of Free Tuition Recipients at Two Universities in Colombia

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Abstract: This study presents an educational alternative aimed at improving the academic performance of students who benefit from Colombia's free tuition policy at two public higher education institutions: Institución Universitaria Antonio José Camacho and Universidad del Tolima. The research identifies persistent learning deficiencies in mathematics, communication, and language, which often lead to low academic achievement and increased dropout rates among first-year students. To address this issue, a pedagogical model was implemented that integrates technological and virtual tools—particularly the *Genially* platform—based on the TPACK (Technological Pedagogical Content Knowledge) framework. The study employed a non-experimental mixed-method design supported by the case study methodology. Quantitative and qualitative data were collected to analyze how interactive digital resources and gamified activities influence student motivation, participation, and learning outcomes. Preliminary results from the first phase show that students demonstrated greater engagement, improved comprehension of abstract concepts, and increased persistence in completing academic tasks. The use of virtual tools promoted a dynamic learning environment characterized by autonomy, collaboration, and critical reflection. The findings suggest that the integration of technological innovation with pedagogical practice contributes to reducing dropout rates and strengthening educational equity for economically vulnerable students. This proposal is grounded in hermeneutic and socio-critical paradigms that emphasize reflection, dialogue, and



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transformation of the teaching–learning process through praxis. The study concludes that the sustained implementation of this pedagogical model can enhance academic quality, promote inclusive learning environments, and serve as a replicable strategy for other higher education institutions in Latin America.

Keywords: Academic performance, Curriculum theory, Higher education, Pedagogical innovation, Socio-critical paradigm, Student retention, Technological tools, TPACK framework.

哥伦比亚两所大学免学费受益学生学业提升的教育替代方案

摘要：本研究提出了一种教育替代方案，旨在提升受益于哥伦比亚免学费政策的学生在两所公立高等教育机构中的学业表现：安东尼奥·何塞·卡马乔大学学院（Institución Universitaria Antonio José Camacho）和托利马大学（Universidad del Tolima）。研究识别出数学、沟通及语言方面持续存在的学习不足，这些问题往往导致一年级学生学业成绩较低以及辍学率上升。为应对这一问题，研究实施了一种教学模型，该模型基于TPACK（技术-教学-内容知识）框架，整合了技术与虚拟工具，尤其是Genially平台。

本研究采用非实验性的混合研究设计，并以案例研究方法为支撑。通过收集定量与定性数据，分析互动式数字资源与游戏化活动如何影响学生的学习动机、参与度以及学习效果。第一阶段的初步结果表明，学生的学习参与度显著提高，对抽象概念的理解得到改善，并在完成学习任务方面表现出更强的持续性。虚拟工具的使用促进了一个动态的学习环境，其特征包括自主学习、协作以及批判性反思。

研究结果表明，将技术创新与教学实践相结合，有助于降低辍学率，并增强经济弱势学生的教育公平性。本研究基于解释学与社会批判范式，强调通过实践（praxis）促进教学过程中的反思、对话与转变。研究结论认为，持续实施该教学模型能够提升教育质量，促进包容性学习环境的构建，并可作为拉丁美洲其他高等教育机构可复制的实践路径。

关键词： 学业表现；课程理论；高等教育；教学创新；社会批判范式；学生留存；技术工具；TPACK框架

1. Introduction

The educational training process for students involves a series of complex factors that can determine its success or failure, and these issues can even extend to higher education levels. It is imperative to acknowledge that these factors vary among students and are intrinsically linked to each individual's unique learning profile.

As Nivel María, Echeverría Segundo, and Morillo Roselia articulate in their article "Learning Styles in the University Context," academic performance is a global concern. The genesis of research on this topic can be traced to the 20th century, which subsequently gave rise to case studies in the early 21st century, focusing on low-performing students. These case studies sought to elucidate the underlying causes of their learning difficulties and to identify effective intervention strategies to support their educational development [1].

In a similar vein, the Global Education Monitoring Report (GEM Report) [2] indicates that the

UNESCO Regional Office for Education in Latin America and the Caribbean (OREAL) and the Laboratory for Research and Innovation in Education for Latin America and the Caribbean (SUMMA) have played pivotal roles in this regard. In Latin America, 63% of adolescents and young people manage to complete their secondary education, with 20% of students from the wealthiest segment of the population being more likely to complete it than 20% of students from the least wealthy segment. A concerning finding is that only half of these students have achieved a minimum level of reading skills. According to Javier González, director of SUMMA, "the region's education systems are characterized not only by their low quality, but also by their high levels of inequality and social exclusion." [3].

In this research will identify the academic deficiencies of students in the Systems Engineering program at UNICAMACHO and the University of Tolima who benefit from the government's free tuition

policy in the areas of mathematics, communication, and language. The project will then apply the proposed pedagogical alternative. To this end, the experience of several teachers in these areas is taken into account, who report that they have found deficiencies in prior knowledge, which are caused in most cases by poor performance at the end of secondary school.

In this regard, it has been observed that students' deficiencies can lead to a decline in motivation, particularly when confronted with higher education in the form of technical, technological, and/or professional degrees. This is due to their lack of the necessary knowledge, which can result in various challenges, including failing courses, potentially leading to attrition in the initial semesters of their academic training.

Consequently, the present project offers an educational alternative for academic enhancement that utilizes technological and virtual tools with the objective of preventing student attrition, that is, the retention and subsequent graduation of all students at the institutions participating in this project.

The subsequent research question has been formulated as such: The objective of this study is to determine the efficacy of an alternative teaching method for academic improvement using technological and virtual tools. This method is designed to enable students benefiting from the national government program to remain in and subsequently graduate from the Systems Engineering degree program at UNICAMACHO and the University of Tolima. The following research objective is hereby proposed: The objective of this study is to implement an alternative teaching method for academic improvement. The implementation of this method will allow students who benefit from the national government's free tuition policy to remain in and subsequently graduate from their degree programs at the Antonio José Camacho University Institution and the University of Tolima.

2. Methods

The research design employed in this study is non-experimental. Non-experimental designs are invariably implemented in natural settings, and the groups are naturally constituted. The units of analysis are not randomly assigned to the design, as indicated by Kerlinger (1988) [4], thereby resulting in a minimal degree of control.

Concurrently, the integration of both quantitative and qualitative research methodologies is recommended, given the utilization of a holistic approach entailing the numerical analysis of data alongside the application of qualitative instruments.

The integration of quantitative and qualitative data in a complementary manner was achieved through the implementation of a mixed-method design. Quantitative data were obtained from academic records

and support session reports generated by the Academusoft platform, while qualitative data were gathered through semi-structured interviews and unstructured conversational observations with students and tutors. The quantitative analysis employed descriptive statistics to identify trends in academic support and performance. Thematic analysis was employed to systematically examine the qualitative data, facilitating the identification of recurrent patterns pertaining to student motivation, perception of the tools, and learning difficulties. The integration of both types of data enabled a comprehensive understanding of the educational phenomenon under study.

2.1. Design.

The present research endeavors to augment the curricular component, with a particular focus on the pedagogical alternative. The objective is to examine and analyze the curricular proposal of an educational institution by employing an inductive analysis of the subject under study to explore, describe, and interpret it. In light of the characteristics inherent to evaluative research, a comprehensive understanding of the events under scrutiny within the institution has been cultivated. This has enabled the delineation of priority areas where improvement actions should be implemented. In these domains, the perceptions of the study population and those of the researchers assume a pivotal role.

2.2. Area of study

Institución Universitaria Antonio José Camacho – Universidad del Tolima.

2.3. Study Sample

The project's study sample is approximately 100 first-semester Systems Engineering students in the 2024-02 period between the two public HEIs, considering that both have beneficiaries of the free tuition policy. Participation in the pedagogical activities and data collection was voluntary; students were informed of the research objectives and signed an informed consent form. The sample included 85% men and 15% women, aged between 17 and 24 years. Regarding socioeconomic background, 85% of the students belonged to strata 1 and 2 (lowest socioeconomic levels according to Colombian classification), which is consistent with the target population of the free tuition policy and HEIs.

2.4. Technics

This approach is consistent with the TPACK (Technological Pedagogical Content Knowledge) framework, which posits that the development, implementation, and analysis of the tool must be balanced in its response to the disciplinary content, pedagogical strategies, and technological potential

involved. The process under scrutiny emphasizes critical reflection on the interaction of the three types of knowledge and uses the technological tool as an experimental space to demonstrate this integration and its impact on learning. As stated in the work of Mishra and Koehler (2006) [5].

This technique enables the investigation of how the articulation of TPACK components in the design and use of digital tools can transform educational practices, offering a systematic and well-founded framework for the development and evaluation of techno-pedagogical innovations [6].

The instruments used for data collection included: (1) institutional academic reports from the Academusoft platform, which recorded the number and topics of tutoring sessions; (2) a structured questionnaire administered to participating students to assess their perception of the Genially-based activities; and (3) field diaries kept by the researchers during the implementation, where observations on student engagement and participation were registered.

2.5. Procedures.

The development of this in-depth project is divided into two phases. The initial phase focuses on evaluating and analyzing the curriculum of higher education institutions. This will enable the most relevant aspects that are susceptible to modification or adjustment to be identified with a view to rebuilding a relevant curriculum. The second phase of the project entails the design and development of a technological and virtual tool for areas that have been identified as vulnerable.

The research method employed was the case study approach. According to Yin (1994) [7], this method is defined as a research strategy characterized by studying phenomena in their own context, using multiple sources of evidence, in order to explain the observed phenomenon comprehensively and taking into account all its complexity.

3. Theoretical Frameworks

3.1. The Theoretical Construction of the Curriculum: Concepts and Paradigms.

The study of curricular theories necessitates, above all else, the recognition of the epistemological paradigms that underpin them, as well as an understanding of the role they play in educational research. In light of this, it is imperative to consider the contributions of Thomas Kuhn, as referenced by José Sánchez (2013) [8]. According to Sánchez, paradigms can be defined as scientific accomplishments that are widely accepted by the academic community. These paradigms function as a reference point, providing a framework for identifying problems and formulating potential solutions over a specific period. From the perspective of the social sciences, this notion implies considering the social, political, and historical

frameworks in which a community develops, as these elements determine the way in which its beliefs, experiences, and values are articulated. Consequently, the paradigm functions as an interpretive framework that guides the understanding of reality and the responses that are generated in the face of it.

In this context, paradigms function as reference structures that guide the analysis, construction, and development of research processes, thereby serving as guides for the production of knowledge in various scientific domains.

Consequently, the positivist paradigm, recognized as one of the earliest to be firmly entrenched within the scientific realm, conceptualizes knowledge as the outcome of objective observation and precise measurement of phenomena. According to Flórez (2003) [9], this is achieved by taking into account the use of the experimental method and other aspects in the search for and validation of information.

This approach, which is closely linked to behaviorist trends, postulates that knowledge is generated independently of the researcher's subjectivity and social context. It prioritizes neutrality and control of variables. The technical curriculum theory, predicated on the establishment of unambiguous and quantifiable objectives, advocates an academic pedagogy centered on conventional teaching methodologies. In this pedagogical paradigm, the instructor assumes a dominant role as the transmitter of knowledge, while the student adopts a passive stance, oriented towards memorization and the replication of content.

The hermeneutic paradigm, in this sense, can be regarded as a critical response to the limitations of positivism. It underscores the significance of interpretation, understanding, and subjectivity in the process of knowledge construction. As Hernández (2023) [10] asserts, this necessity stems from the imperative to interpret, understand, and comprehend sacred texts. This paradigm seeks to explain the social sciences based on human interaction, reflection, and the meaning attributed to experiences. In this context, it is acknowledged that educational phenomena cannot be analyzed exclusively from the perspective of measurement or causality. Rather, analysis requires a profound understanding of the practices and relationships that shape them. This perspective serves as the foundation for practical curriculum theory, which is oriented toward pedagogical deliberation and the interpretation of specific educational situations.

The socio-critical paradigm is a theoretical framework that has the potential to broaden the hermeneutic vision by situating knowledge within the broader context of social transformation and the emancipation of individuals. This paradigm challenges the conventional interpretation of reality by proposing a conscious transformation through collective and

reflective action. Estrada and Rodríguez (2024) [11] emphasize that the socio-critical paradigm is based on critical theory, complex thinking, and communicative action. The objective of this approach is to promote social transformation based on situated experiences and the exchange of meanings among subjects participating in a given context. The aim is to understand the social dynamics and relationships that are configured there.

From this perspective, dialogic interaction becomes the central axis of the educational process. The socio-critical curriculum theory is based on the principles of discussion, collaboration, and the collective construction of knowledge. Carr (1995) [12] emphasizes that the relationship between theory and practice is contingent upon the participation of critical, reflective individuals who are committed to social change. In a similar vein, Popkewitz (1980) [13] contends that learning should not be confined to the mere discovery of the world but rather should encompass its active transformation.

In summary, these three paradigms—positivist, hermeneutic, and socio-critical—constitute the epistemological foundations from which the main curricular theories have been shaped: technical, practical, and critical. These trends have had a profound impact on the conceptualization, structure, and implementation of the curriculum, exerting a direct influence on pedagogical approaches and the historical evolution of contemporary educational models.

3.2. Conceptual Approach to Curriculum.

It is important to acknowledge the complexity inherent in the concept of curriculum, as its definition is not easily delineated due to the semantic diversity it encompasses. However, recent research has prompted reflection on its evolution and relevance in the comprehensive education of individuals. For instance, studies such as those conducted by Díaz, Rivadeneira, Cueva, and Cedeño (2025) [14] underscore advancements in the incorporation of research into educational programs, emphasizing the promotion of critical thinking and pedagogical innovation. Concurrently, academic reviews such as that of Márquez and Martínez [15] have explored contemporary trends, including the decolonization of the curriculum, curricular flexibility, and the competency-based approach as a response to the educational challenges of the 21st century. Research in Latin America has also examined the relationship between universities and curriculum development, as well as the role of teachers in contextualizing and enriching educational content. In order to comprehend the curriculum in contemporary pedagogical practice, it is imperative to analyze the diverse curricular conceptions that have emerged throughout history and are supported by recent research.

The curriculum can be understood as a complex

and multifaceted concept, as it has multiple interpretations according to the different educational traditions and cultural contexts in which it is implemented. The term "pedagogy" is also characterized by its varied dimensions, encompassing elements such as teaching, learning, assessment, instruction, and pedagogical planning. According to Gimeno Sacristán (2010) [16], the curriculum "names and demarcates an existing and important reality in educational systems," thereby highlighting the inherent complexity in its use and application. Furthermore, UNESCO (1958), as cited in Toro (2017) [17], defines the curriculum as the set of experiences, activities, materials, and teaching methods employed by educators to achieve educational objectives, thereby emphasizing the curriculum as an integral construct comprising various interrelated components.

3.3. Student retention and dropout rates in Colombian higher education institutions

In a state governed by the rule of law, it is important that citizens embarking on educational projects, whether basic, secondary, or higher, are able to complete them successfully. This allows education rates to rise in assessment systems. Therefore, the state must implement strategies to reduce dropout rates at all levels of education, as this contributes to a society's progress toward cultural, technological, and economic growth. Each time a group advances in their studies, they improve their quality of life, whether by starting a business or advancing in their career.

The project's goal is to make sure students from UNICAMACHO and U. Tolima stay in and finish their studies at the two public HEIs. Therefore, it is necessary to review the statistical data on student dropout rates at these two institutions during the period in which the national government's strategies were implemented, from 2020-2023. This information is obtained through SPADIES (the System for the Prevention of Dropouts in Higher Education Institutions), which "allows for the monitoring of the academic and socioeconomic conditions of students who have entered higher education in the country" [18]. SPADIES is a subsystem of SNIES (the National Higher Education Information System), which was created in 1992 through Law 30 of that same year, Article 56. This article states the following: [19].

"Article 56: The National Higher Education Information System is hereby established. Its primary objective is to disseminate information that will guide the community in understanding the quality, quantity, and characteristics of the institutions and programs within the System."

The following table (Table 1) is based on the SPADIES platform and shows student dropout rates at the two HEIs and the aforementioned periods. Please note that information is only available up to 2023-02.

Table 1. Dropout rates at UNICAMACHO and U. Tolima (SPADIES)

Academic Period	U. Tolima	UNICAMACHO
2020-1	7.87%	9.95%
2020-2	9.2%	10.23%
2021-1	4.72%	8.21%
2021-2	7.03%	4.99%
2022-1	11.38%	6.34%
2022-2	12.67%	8.23%
2023-1	12.9%	6.59%
2023-2	7.28%	6.37%

Similarly, students in the Systems Engineering program at both HEIs will be reviewed in the same way until the 2023-02 period. This review will take into account the measurement date on the SPADIES platform, as shown in Table 2.

Table 2. Dropout rate for Systems Engineering for both (SPADIES)

Academic Period	U. Tolima	UNICAMACHO
2020-1	5.88%	11.8%
2020-2	3.53%	13.14%
2021-1	1.63%	11.47%
2021-2	1.76%	7.39%
2022-1	3.8%	8.19%
2022-2	6.29%	9.22%
2023-1	14.32%	7.15%
2023-2	9.3%	6.02%

Taking the above information into account, it can be seen that the University of Tolima and UNICAMACHO have average dropout rates of 9.1% and 7.6%, respectively. At the academic program level, these rates are 5.8% and 9.3%, respectively.

3.4. Technological and virtual tools for teaching and learning.

Based on the above data, the implementation of a pedagogical alternative that includes technological and virtual tools could reduce the dropout rate in the aforementioned academic program and, consequently, in higher education institutions. This alternative could benefit students by improving their academics due to its flexibility, accessibility, and usefulness in teaching and learning fundamental topics in subjects such as mathematics and communication and language.

Thus, this project proposes a pedagogical approach that utilizes technological and virtual tools, such as the Genially platform and its Escape Room templates. These tools allow students to learn through play, facilitating the internalization of basic and advanced concepts. This has been observed in various research and project development studies like Jiménez & Cuenca (2021) [20].

As mentioned by Leon, Vargas, and Garcia (2025) [21], the use of technological tools in the teaching and learning process is widespread in HEIs today.

That is why the Genially platform is a useful technological tool for creating interactive resources that can be adapted to various disciplines, as shown in Figure 1. This figure is an example of a template for using escape rooms with the gamification method, which is based on the TPACK methodology.

**Figure 1. Escape Room Example Template (Genially)**

According to Estupiñan, Cruz & Pérez (2024) [22], the Genially tool has stood out in educational settings for being innovative and appealing to teachers and students. He also conducted a study on how teachers use the platform and found that most of them are familiar with it. However, he concluded that there is a need to develop a strategy to encourage the implementation of this type of practice in the classroom.

Similarly, Torres's (2024) research [23] highlights the favorable perception of the tool's application among teachers who frequently use and experiment with it. This was demonstrated through a structured survey with closed questions and a Likert scale.

That is why, in this research, the Genially tool is linked to the pedagogical alternative. This alternative encourages and motivates students in the educational process. It also diversifies traditional teaching and learning methods.

4. Results

As a result of the research on implementing an alternative teaching method, several technological resources were designed using the Genially tool. These resources focus on topics that present the greatest

difficulty in mathematics and communication and language classes.

In order to ascertain whether the aforementioned areas demand a differentiated teaching approach, a comparative analysis was conducted of the three previous academic periods, supplemented by the last period of the study. The present analysis focused on the number of support sessions provided in the areas consulted. The results of this analysis are presented in the Figure 2.

Figure 2. Subjects with the most support (Acadmusoft Report)

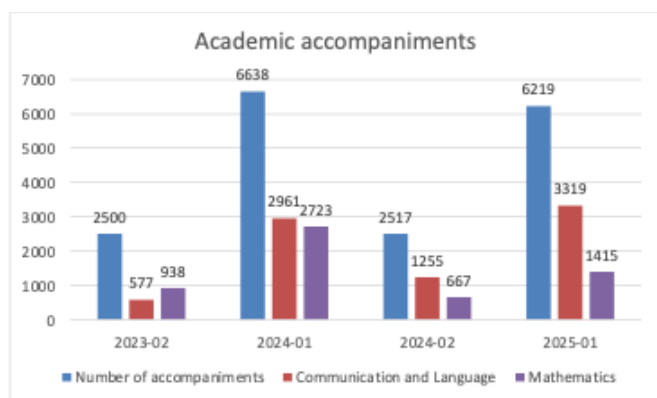


Table 3 presents a comprehensive overview of the most prevalent topics in mathematics for which students seek assistance. These were identified through conversations with teachers and academic tutors at one of the HEIs.

Table 3. Mathematics Frequently Topics (Academusoft Report)

Topic	2023-02	2024-01	2024-02	2025-01
Algebra and arithmetic (Operations with Real Numbers, Factorization)	165	231	62	288
Applications and tools	30	18	2	7
Equations and inequalities	305	329	134	283
Factorization and notable products	155	207	37	137
Functions and graphs	114	71	53	131
Geometry and trigonometry	79	26	34	55
Exponents, roots, and rationalization	32	66	58	101
Reasoning and mathematical foundations	50	1763	287	214
Ratios, proportions, and percentages	8	12	0	199

A close examination of the data reveals that, among the mathematical fundamentals, Algebra and Arithmetic have the highest number of queries in each of the periods analyzed, with percentages of 23%, 73%, 52%, and 35%, respectively.

Concurrently, recurring themes in the domain of Communication and Language are subjected to analysis. This analysis is demonstrated in the following Table 4.

Table 4. Communication and Language Frequently Topics (Academusoft Report)

Topic	2023-02	2024-01	2024-02	2025-01
Reading comprehension	32	100	109	624
Oral communication and expression	8	2	18	46
Paragraph construction and writing	58	46	85	308
Academic essays	22	92	30	110
Fact sheets and reports	0	0	0	53
APA standards	111	721	675	984
Graphic organizers	8	42	0	30
Spelling	338	1958	335	1149

An analysis of Table 4 indicates that APA Standards and Spelling are the most frequently consulted topics in the specified time frame, with average percentages of 32% and 47%, respectively.

Consequently, a range of technological resources is designed and implemented using the Genially tool in the aforementioned areas, incorporating multiple-choice questions, sorting, fill-in-the-blank, assigning the corresponding value, and other options provided by the platform, as illustrated in Figure 3. This figure utilizes a template and is adapted to the relevant topic and/or situation. In a similar vein, the inquiries that were formulated are situated within a quotidian milieu.



Figure 3. Fractional Numbers Escape Room (Genially)

As illustrated in Figure 4, the Genially tool can be a valuable educational resource. It employs a basic math exercise on fractions that presents students with different scenarios and challenges, utilizing engaging games to facilitate learning.



Figure 4. Types of questions in the Escape Room (Genially)

A similar functionality is exhibited by the tool's capacity to establish challenges, which facilitate students' progression through the Escape Room by requiring them to ascertain a secret code to access additional sections and ultimately reach the culminating point. This process is illustrated in Figures 5 and 6.

In Figure 5, the student's acquisition of the access code is evident on the left side.



Figure 5. Access code to a new section of the Escape Room (Genially)

Therefore, as demonstrated in Figure 6, the student is required to enter the code obtained during their participation in the Escape Room.

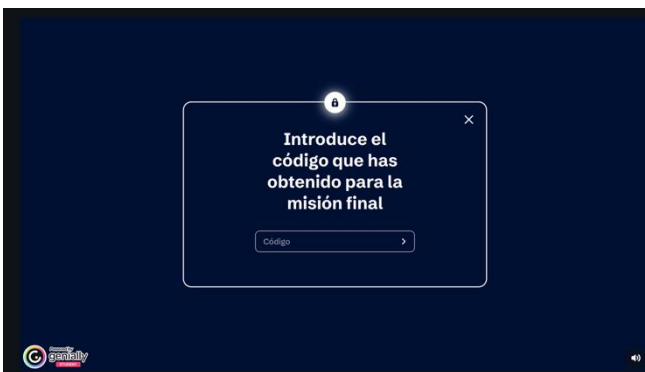


Figure 6. Section for entering the code in the Escape Room (Genially)

These instruments and methodologies have been demonstrated to facilitate the establishment of educational environments in a variety of disciplines, including Communication and Language, where autonomous learning can be cultivated see Figure 7.



Figure 7. Communication and Language in the Escape Room (Genially)

Consequently, a variety of subjects can be addressed within a single resource, thereby enhancing student learning, as illustrated in Figure 8.

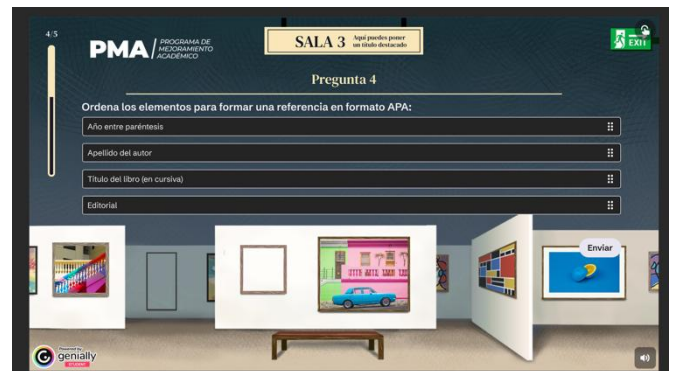


Figure 8. Diversification in the questions in the Escape Room (Genially)

Despite the fact that the implementation is still underway, preliminary data suggest a positive impact on student engagement. As demonstrated in Table 5, 100% of students actively engaged in the proposed activities, and 95% of them reported that the Escape Room format enhanced their comprehension of complex subjects. These findings are consistent with the research objective of enhancing academic performance and mitigating the risk of attrition by leveraging technological tools.

Table 5. Preliminary indicators of students engagement and perception (questionnaire)

Indicator	Measurement	Result
Student participation rate	% of students who completed at least one Escape Room activity	100% (100/100)

Average time spent on activities	Minutes per session (self-reported)	30 min
Perceived usefulness of the tool	% of students who agreed or strongly agreed that Genially helped them understand the topic	90%
Intention to reuse the tool	% interested in using similar resources in other subjects	95%

5. Discussion.

The ensuing discourse will center on the preliminary analysis of the progress observed during the implementation of the pedagogical alternative aimed at improving the academic performance of students benefiting from the free education policy. It is imperative to acknowledge that the implementation of technological and virtual resources is currently underway; consequently, the results presented herein correspond to an inaugural phase of the process. Nonetheless, the preliminary findings indicate encouraging trends in the enhancement of fundamental knowledge and in fostering student motivation in the domains of mathematics and communication and language. These advances, albeit limited in scope, indicate that the proposal is exerting a progressive influence on learning processes. A more comprehensive evaluation of these effects is scheduled to take place at the conclusion of the current academic cycle.

In accordance with the findings of this study, it can be concluded that the integration of interactive technological tools has contributed to enhancing the dynamism of the instructional environment and fostering active student engagement. This approach aligns with the tenets of the socio-critical paradigm, which advocates for interaction, dialogue, and collective knowledge construction as the foundation for meaningful learning. Consequently, the hermeneutic approach is evident in the constant reflection of teachers and students on their own learning process. This allows for the adjustment of pedagogical strategies according to the needs detected in the classroom and the activities carried out independently.

Concurrently, preliminary findings indicate a steady decline in rates of motivation and enhanced persistence in academic pursuits. This finding aligns with the findings of previous studies emphasizing the pivotal role of teacher support facilitated by digital resources in fostering student retention [20]. However, given that the process is still under development, quantitative data related to academic performance will

need to be compared with subsequent measurements to consolidate evidence of the proposal's impact.

It is important to acknowledge that the progressive nature of the implementation results in a temporary limitation of the study, as the long-term effects can only be observed once the students' educational process has been fully completed. Notwithstanding, the extant results provide a solid basis for the continuation of monitoring and validation of the pedagogical model. The model is aimed at the strengthening of basic skills and the improvement of the quality of education in the participating institutions.

The sustained implementation of this pedagogical approach will facilitate the development of a replicable pathway for enhancement, which can be adopted by other higher education institutions serving populations with analogous socioeconomic circumstances. Therefore, it is anticipated that the initiative will contribute to two key outcomes: first, a reduction in academic dropout rates, and second, the consolidation of a culture of autonomous, inclusive, and sustained learning through the pedagogical use of digital technologies.

6. Conclusion

The conclusions that follow synthesize the primary contributions and findings of the study, taking into account that the implementation of the pedagogical alternative is still underway within the academic process of the students who benefit from the free tuition policy. In this regard, the preliminary results obtained, and the projections derived from the analysis carried out are highlighted, with the aim of guiding future phases of validation and consolidation of the model. The conclusions integrate the theoretical, methodological, and practical aspects of the research, emphasizing the relevance of the use of technological and virtual tools as a strategy to strengthen learning and retention in public higher education.

In light of these findings, it can be concluded that the implementation of a pedagogical alternative, underpinned by the integration of technological and virtual tools, particularly through the utilization of the Genially platform, has yielded commendable advancements in the motivation and active engagement of students who benefit from the free tuition policy in the universities examined within the domains of Mathematics and Communication and Language.

In a similar vein, students' perceptions when participating in unstructured conversation indicate that the incorporation of interactive technological resources fosters the development of dynamic, flexible, and meaningful learning environments. These findings are consistent with the tenets of hermeneutic and socio-critical paradigms, which advocate for reflection, engagement, and the transformation of the educational process through praxis.

The implementation experience underscored the significance of supplementing training with innovative teaching strategies that address the genuine needs of students, particularly those from disadvantaged backgrounds. In this regard, the pedagogical use of technology is regarded as a fundamental tool, albeit one that is challenging for all students to access. The objective is to strengthen retention and reduce dropout rates in higher education.

It is imperative that further research be conducted to ensure the ongoing monitoring of the process, thereby facilitating the validation of long-term results and the in-depth analysis of the quantitative impact of the alternative on academic performance. This analysis should be facilitated by strategies developed by an Academic Improvement Office. It is further recommended that the model be expanded to encompass other areas of knowledge and diverse public institutions, with the objective of establishing a replicable and sustainable educational strategy.

The proposal emphasizes the significance of educational innovation as a conduit for inclusive excellence and enhancing academic quality in higher education, thereby reaffirming the institution's commitment to equity, student retention, and academic distinction.

This research makes a significant contribution through the development of a pedagogical model that integrates gamification and interactive digital tools—specifically the Genially platform—within the TPACK framework. The model's implementation and preliminary validation serve to address fundamental learning deficiencies in mathematics and communication among vulnerable students. In contradistinction to conventional remedial strategies, this model fosters autonomous, motivated, and contextually meaningful learning, a critical factor in ensuring student retention in public higher education. Moreover, its capacity to be adapted to different academic disciplines and institutional contexts renders it a replicable strategy for other universities in Colombia and Latin America grappling with analogous challenges related to educational equity and the prevention of student attrition. Future research should concentrate on longitudinal tracking of participants to measure the sustained impact on academic performance and graduation rates, as well as on the transferability of the model to other knowledge areas.

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Author Contributions

All authors contributed to structuring the article. All authors have read and agreed to the published version of the manuscript

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Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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