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Technology as a Tool to Reduce School Dropout Rates in Costa Rica

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Abstract: This study aimed to research the factors that cause school dropout and whether technology can positively influence the reduction of this phenomenon in adolescents. The research method was conducted using a qualitative-exploratory approach. The sample was 92 students from two schools located in two different regions in Costa Rica for the year 2021. The results show that the gender distribution and the dropout rate in the selected sample indicate that the male gender has the highest dropout rate at 65.22%. This result shows the abundance of unskilled jobs for men and the value system associated with the male gender. The findings evidence that the female gender has a higher level of dropouts in rural areas (53.12%), and one important reason is teenage pregnancy. In conclusion, students who drop out of the school system do so mainly because of a lack of interest in classes and economic problems in the family environment. Finally, it is concluded that for a virtual education process to be successful, it is not only enough to use technology as a tool, but the teacher must also establish a teaching model that is agile, flexible, and dynamic to maintain the student's interest. Among the recommendations, measures are proposed to reduce school dropout rates in institutions.

Keywords: dropout, non-school, technology, evolution, unemployment, high school

1. Introduction

School dropout in secondary education is a critical problem affecting numerous countries worldwide. This issue negatively impacts modern society, limiting its capacity for economic and social development [1]. From this perspective, technology becomes a powerful tool to address this challenge, as it not only facilitates distance communication but can also promote student motivation and commitment to staying in school [2].

The incorporation of information and communication technologies (ICT) in secondary education has transformed how students learn and teachers teach. These technologies provide access to extensive information and educational resources, foster collaboration, promote active learning, and develop critical skills such as analytical thinking and problem-solving [3]. Additionally, ICTs enable personalized learning, adapting to the needs and rhythms of each student, which can be crucial for maintaining their interest and avoiding school dropout [4].

Several studies have explored the relationship between the use of technology in the classroom and dropout reduction. Farcnik et al. [5] and Realinho et al. [6] identify that ICT integration can significantly improve student retention by making learning more engaging and accessible. Similarly, technology can help identify and support students at risk of dropping out by providing tools for monitoring and early intervention [7].

The implementation of advanced technologies in the business environment also faces several challenges and trends that can offer valuable lessons for the education sector. Herlina et al. [8] identify that the main strategic technology trends for 2025 include artificial intelligence, information security, hybrid computing, and robotics, where these technologies not only promise to improve efficiency and productivity but also raise concerns in the field of governance, ethics, and security.

Education for all ages has undergone several changes in recent years. Lately, the term *virtuality* is commonly used by students, teachers, and even in the news. While online education is a valuable tool today, it also raises questions among a significant portion of the population, including whether school dropout rates have increased since the shift from face-to-face to virtual learning. This is an alarming affair as it leads to social problems such as crime, drug addiction, and unemployment in the country [9]. Therefore, this research aims to explore the causes of school dropout, examine its historical background, and discuss how technology can help us mitigate this problem effectively.

This led to the research question that guided the present study: What are the main factors motivating school dropout in secondary education, and how can technology help reduce this phenomenon? Based on this question, the research strategy was developed. Through the bibliometric review of scientific studies, key factors, good practices, and challenges in the education sector were identified, contributing to the existing body of knowledge by introducing new paradigms that positively impact the digital strategy during the next industrial revolution. However, it is imperative to note that this study seeks to identify the contribution of technology to human development, leaving the social and ethical considerations for future research based on its findings.

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2. Literature Review

It is a fact that school dropout significantly limits a country's employability since there is a strong link between school leaving and poverty [10]. However, this is not a new issue in Costa Rica. Lorenzo-Quiles et al. [11] highlight that school dropout remains as a significant challenge in Costa Rican democracy since it requires a lot of collaboration among teachers and education authorities to address it. Despite these efforts, the expected results have not been achieved, as the population has not yet fully understood the extent of the problem at a national level. Therefore, it is crucial to raise awareness of this issue to foster greater interest in its study.

de Oliveira et al. [12] conducted a study to measure academic performance, retention, and dropout using a mixed-method approach that combined quantitative and qualitative data from questionnaires and interviews with 125 students. This research determined that due to preconceived academic ideals in the teaching system, along with numerous social, geographic, and demographic factors, school dropout occurs systematically throughout the education system, affecting both primary and secondary levels. Likewise, the study reflected distinct dropout rates among men and women.

However, the evolution and acceleration of ICT in the last decade have significantly boosted all processes across all educational fields, paving the way for virtual education [13]. Although it is considered a relatively new phenomenon, virtual education is not new, since distance education dates back to the beginning of the 19th century. Realinho et al. [6] highlight that the first studies on virtual education appeared between 1970 and 1980, where reference is made to distance education as a teaching process in which the educator and the learner are separated.

Addressing the knowledge gap regarding technology as a tool to reduce school dropout in Costa Rica is vital. Many schools, teachers, and the education system were not prepared for the unexpected transition from traditional to virtual education. This knowledge gap has been bridged over time through different training programs offered in schools and universities via virtual platforms. This shift has not only forced changes in the traditional working methods in business and school settings but has also strengthened the dynamics of the learning system as all stakeholders, including educators and students, are now prepared to engage in both physical and virtual learning models.

We must question if the educational system is truly efficient, as it serves its purpose when it achieves its teaching objectives within an appropriate period and without wasting human and financial resources. However, two major obstacles that hinder the efficiency of the educational system are grade repetition and dropout. A student entering the system faces three outcomes: passing, retaking the school year, or dropping out. Repetition and dropout imply a waste of economic and human resources that affects the efficiency levels of the system. Therefore, the three phenomena are closely interrelated [14].

School dropout has been a priority issue in Latin America [15]. Likewise, adolescent pregnancy has a direct correlation with school dropout [16]. Additionally, Perchinunno et al. [17] point out that there are psychological factors that contribute to low performance, failure, and school dropout. While each family is different and so faces its own challenges, there are more general and broader social, economic, and environmental conditions and factors that are likely to lead children to leave school.

Amir-ud-Din et al. [18] found that the primary cause of school dropout included lack of interest, with key factors such as economic status, an unstable nuclear family, urban residency, marriage, and living in a family setting where the head of the family was over 40 years old or female. However, the impact of wealth, gender, and family emigration on school dropout differed depending on the context. Nurmalitasari et al. [19] reveal that personal economic conditions, academic satisfaction, academic performance, and family economics are the most significant factors contributing to school dropout, making it a serious problem in the education system in many countries.

Tsolou et al. [20] highlight four historical events that contributed to the evolution and advancement of virtual education. The first was the development of the railroad, which resulted in a more reliable and faster postal service, allowing students to submit their assignments and send them by mail. The second was the establishment of the British Open University, which introduced a multimedia approach by using printed materials along with radio and television broadcasts. The third was the advancement of technological networks and satellite technologies in the early 1980s, which enhanced direct communication between teacher and student. Finally, the extensive use of the Internet has triggered the evolution of teaching processes through email, videoconferencing platforms, and instant messaging exchange systems.

In 2020, the COVID-19 pandemic accelerated the adoption of virtual education. Several authors agree that the impact of this global event led to increased virtual interactions between the teacher and the students, transitioning from a limited interaction with a small number of learners to a more massive, dynamic, and simultaneous interaction with larger groups, regardless of the distance. In addition, virtual education has turned into a key factor in reducing the operating costs of educational institutions and a valuable mechanism to keep both teachers and students connected and updated.

However, in Costa Rica, social inequality among different geographical areas and sectors of society limits students' access to virtual education. Consequently, the Ministerio de Educación Pública (MEP) has implemented strategies to facilitate their access to this new teaching modality, including cooperation agreements with the private sector. One of these initiatives was *Aprendo en Casa* (I Learn at Home), which aimed to provide students with nationwide access to virtual education through personal computers and tablets supplied by MEP so they could continue their studies from home in times of pandemic. Due to its impact and scope, this program gained significant attention and collaboration from the business sector, which contributed through the donation of necessary technological equipment [21].

3. Research Methodology

This research followed a qualitative-exploratory approach to examine the object of study, identifying regularities and relationships among its components [22]. Similarly, a subcategory was established within the descriptive approach to identify and analyze the properties and characteristics of school dropout, recognizing its main causes and the potential use of technology as a tool to mitigate this problem and understanding trends within the population under study [23]. To model the factors that generate school dropout in Costa Rica, an exploratory type research design was employed, concentrating on the most influential factors – how they emerged, their characteristics, and how they manifested themselves – from an epistemological perspective of constructionism [24]. Additionally, the study assumed that ICTs could contribute positively to the reduction of school dropout through the promotion and acceleration of virtual education.

According to Lim [25], in a qualitative study, factors should be established through categories of analysis, which are defined based on the abstraction of one or several common characteristics

of a group of objects or situations to be classified. In the present study, categories were built throughout the research process, starting with broad themes and the research question, which was intended to identify the main causes of school dropout in Costa Rica. Data were collected through an in-depth interview using a questionnaire for subsequent analysis, taking as a basis the theory developed by Taherdoost [26] as a scientific guideline in the area.

The unit of analysis, from which the observable consequences were derived [27–29], comprised the factors that influence school dropout in Costa Rica in 2021. The research sample included 92 students aged 11–17 from two schools located in different regions of Costa Rica.

Data collection took place from January to March 2021, involving 92 students from the participating schools. This process was carried out synchronously and asynchronously and included informed consent from the representatives of the participating students. For data analysis, NVivo was used to analyze open-ended responses, while IBM SPSS was employed to generate frequency tables of the closed-ended surveys.

The in-depth interview used a semi-open questionnaire to analyze the absolute frequency distribution, which allowed to identify the most recurrent factors contributing to dropout. This included counting the most common words and phrases that indicate the reasons for school leaving, as well as requirements to continue their educational process. It is important to note that the scope of the study did not include the collection and analysis of social and ethical issues.

4. Results and Discussions

The results presented in this section focus on the findings of the in-depth interviews conducted using a questionnaire with 92 students from two schools in Costa Rica. First, an analysis of the closed questions was carried out using absolute frequency distribution. Then, the most common words and phrases were analyzed, disclosing the primary causes of school dropout.

Table 1 presents the results obtained to determine the gender distribution and the dropout rate in the selected sample.

Table 1
Gender with the highest dropout rate

Gender	People	(%)
Female	32	34.78%
Male	60	65.22%

The results indicate that male students have the highest dropout rate at 65.22%. This reflects that, in both institutions, regardless of their geographical location, male students are more likely to drop out of school. These results align with current scientific studies, such as the one conducted here, which indicate that the primary factors contributing to this issue are the availability of unskilled jobs for men and the value system associated with male gender roles.

Table 2 shows the results obtained about dropout by gender, evaluating the impact of the geographic location of the educational center.

An interesting aspect highlighted in Table 2 is that the number of dropouts is very similar between both regions (Limón and San José), with a difference of 4.4% (equivalent to four students). This may be attributed to the number of students in each campus (1980 in Escazú and 120 in Limón) according to MEP records [30].

Table 2
Location of the defective gender

Location by gender	Male	(%)	Female	(%)
Centro Educativo San Carlos (Limón)	29	47.8 %	17	53.12%
Centro Educativo Liceo Escazú (San José)	31	52.2 %	15	46.88%

Correspondingly, the dropout rate among female students is higher in rural areas (53.12%), suggesting that women in such regions face more challenges to complete their education compared to those in urban areas. Zulaika et al. [31] point out that family issues emerge as the main cause of the problem, which is often linked to teenage pregnancy.

Table 3 presents the results related to the grade level of students who dropped out at the Centro Educativo San Carlos in Limón. In this view, 28 students left school during their secondary education (seventh to eleventh grade), while 16 students dropped out in the primary education cycle (first to sixth grade).

Table 3
Level of schooling at Centro Educativo San Carlos (Limón)

Grade of schooling	People	(%)
Secondary	28	63.63%
Primary	16	36.37%

Table 4 shows similar results regarding the level of schooling linked to dropouts at the Centro Educativo Liceo de Escazú in San José, where 81.25% of the students left school during the secondary education cycle.

Table 4
Level of schooling at Centro Educativo Liceo de Escazú (San José)

Grade of schooling	People	(%)
Secondary	39	81.25%
Primary	9	18.75%

Tables 3 and 4 reveal a common behavior pattern, indicating that the level of school dropout increases as students reach higher levels of the education system. Atat and Majid [32] obtained a similar result in a study conducted in Sinaloa, Mexico, during the COVID-19 pandemic, identifying the main cause of this phenomenon as the lack of contact between students and teachers due to the absence of digital platforms that facilitate communication.

Table 5 highlights the lack of interest in the education process and the economic problems (38.63% each) as the primary causes of school dropout as identified by the students at the Centro Educativo San Carlos in Limón.

Finally, Table 6 identifies the lack of interest in class-related activities (50%), economic problems (31.25%), and family issues (18.25%) as the underlying factors contributing to school dropout at the Centro Educativo Liceo de Escazú.

Table 5
Causes of abandonment in the Centro Educativo San Carlos (Limón)

Causes of abandonment	People	(%)
Lack of interest in classes	17	38.63%
Financial problems	17	38.63%
Family problems	10	22.74%

Table 6
Causes of abandonment in the Centro Educativo Liceo de Escazú (San José)

Causes of abandonment	People	(%)
Lack of interest in classes	24	50%
Financial problems	15	31.25%
Family problems	9	18.75%

The results previously presented point out that the lack of interest in classes is the main cause of school leaving in both institutions. Hence, this factor turns into a key element when designing a retention strategy to reduce dropout rates. Getenet et al. [33] propose that one of the mechanisms to solve this problem is the integration of technology in the teaching process, which can enhance students' motivation levels and help reduce the costs involved in the learning process, this being another key factor identified in the findings.

Additionally, responses to the open-ended questions reflect that the most frequently used words and phrases related to school dropout are economic difficulties, commuting challenges, and lack of interest in classes. Haleem et al. [34] emphasize that technology is an input that helps institutions to reduce school dropout since it allows streamlining the educational process through the incorporation of the virtual education model, which comprises self-directed learning; time and space management; virtual learning techniques – active participation; feedback and self-evaluation; use of resources; and mind maps and pomodoro technique, using technological tools such as videoconferencing, learning management system, email, and instant messaging, among others. These tools help students avoid commuting to educational centers while streamlining communication between teacher and student through agile and user-friendly communication platforms, thus allowing teachers to offer more dynamic and simple classes according to the participant's needs.

5. Conclusions

The present study aimed to identify the main factors that drive students to leave school in Costa Rica and to recognize the role of technology to reduce the impact of school dropout through the incorporation of a teaching model based on virtual education.

The results obtained from a group of former students reveal that school dropout is a widespread issue affecting both urban and rural areas in Costa Rica.

It is important to recognize that school dropout is a complex psychosocial problem, which comprises social and political aspects. Its causes are strongly linked to economic factors, leading students to leave their studies to work and contribute to their families due to financial difficulties, family problems, or lack of interest in the education process. However, with the aid of technological advances, many students around the country will have the opportunity to continue their studies. Thanks to virtual learning, thousands of people, especially in rural areas, will be able to connect to classes anytime, anywhere. Technology will also provide these students with agile, dynamic, and flexible teaching methodologies that can boost their learning.

Regarding the lack of interest in classes, as stated throughout the research, teachers could adopt a technology-based approach that sparks students' motivation to advance in their educational process. At the same time, classes could be more dynamic by focusing on developing the technological skills of the students.

Finally, it is vital for institutions to take a series of steps to reduce school dropout rates. Therefore, the following recommendations are proposed:

1) Understand the functionality of the online modality: Virtual learning requires a lot of motivation, discipline, and self-direction to succeed. Similarly, students should be prepared to navigate through the large amount of information they find online.
2) Appropriate use of technology: Students should fully leverage the tools that virtual learning offers, such as apps, to make summaries, plan time properly, and learn new skills. Likewise, recorded classes allow learners to review the target topics at their own pace.
3) Create a suitable study environment: Students should have a quiet, organized, and distraction-free space to carry out their school duties.
4) Set clear goals and objectives: Students can improve their memory retention by reviewing the course notes and key concepts.
5) Plan time effectively: Developing consistent study habits is crucial as this helps students concentrate and absorb information. The flexibility offered by virtual classes, in many cases, can lead to procrastination; hence, it is advisable to remain organized and focused.
6) Maintain a positive attitude and take breaks: Students should be motivated to fully participate in class and collaborate with classmates.

Future Research Lines

The beginning of the digital era and the rapid emergence of new technological innovations have changed the way education occurs in today's globalized world, where there is no doubt that the future of the individual will be immersed in the development of competencies associated with the use of technology.

The practical implications of the results obtained propose a shift in the approach to teaching in school. In this view, virtual learning emerges as a robust tool to ensure global competitiveness.

The results of this study will guide interested institutions in the promotion and implementation of virtual teaching/learning.

The implications from the theoretical perspective contemplate the development of research works in the academy, including additional elements regarding the relationship between the teaching processes in school education and the use of technology to increase the performance, learning, and competitiveness of the learners. Future studies could aim to explore the role of teacher training in promoting effective virtual learning. Similarly, it would be beneficial to develop further studies on the impact of technology on social and ethical issues of human development and learning.

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Conflicts of Interest

The author declares that he has no conflict of interest to this work.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Author Contribution Statement

Gabriel Silva-Atencio: Conceptualization, Methodology, Validation, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration.

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