



## RESEARCH ARTICLE

## Influence of information and communication technologies on the personalization of learning in the university context

Sonia Rivera-Valderrama\*<sup>1</sup>, Nestor Tipula-Quispe<sup>2</sup>, Rubén Wilfredo Jilapa-Humpiri<sup>3</sup>, Danner Anderson Figueroa Guerra<sup>4</sup>

<sup>1</sup>Universidad César Vallejo, Trujillo-Perú

<sup>2,3</sup> Universidad Nacional de Juliaca, Juliaca-Perú

<sup>4</sup> Universidad Técnica Estatal de Quevedo

ARTICLE INFO	ABSTRACT
Received: Jun 16, 2024	<p>Nowadays, the ICTS have played a fundamental role in the development of the activities that humanity carries out on a daily basis. Due to the devastation caused by the recent events of recent years; pandemics, armed conflicts, etc., The ICTS have become increasingly important in higher education institutions. The ICTs have been introduced with greater impetus in higher education institutions, making them dynamic and adapting to the needs of students. However, when analyzing the influence that ICTS have on the personalization of university students' learning, positive and negative points stand out, which were addressed in several previous studies. It is for this reason that the present bibliographic article was carried out, in order to analyze the previously presented approaches and to discern with greater concentration, the positive and negative points that the influence of ICTs on the personalization of Learning in university students brings with it. In addition to contemplate the challenges that are foreseen in the future in the educational context, in relation to the learning and permanence of students. This work contemplates a broad spectrum panorama, involving teachers and students of the third level, who figure as continuous participants of the digital and modern era.</p>
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<b>*Corresponding Authors:</b> sriveraval@gmail.com	

### INTRODUCTION

Information and Communication Technologies (ICT) revolutionize various aspects of human life, including education. In the university context, these technologies enable the implementation of more flexible learning approaches tailored to individual student needs, a process known as personalized learning. Personalized learning refers to the ability to adapt the educational process to each student's characteristics, interests, and pace, allowing for greater engagement and improved academic performance.

Since the origin of humanity, curiosity has been an innate characteristic of people, one that has allowed for significant strides on the path of evolution. This quality has led humanity to continually improve over the years, designing tools that simplify and ease their work. Human evolution is nothing more than an immense compilation of all the events that have shaped the society in which we develop, with significant and consequential changes that have contributed to our survival and adaptability to constant changes.

Historians argue that humanity has managed to navigate adverse situations, leading to the improvement of the quality of life we see today. However, generating a major change involves an

adaptation period, which, depending on the ease offered by the new tool or methodology, can either extend or shorten. Currently, the integration of information and communication technologies in university-level education has generated substantial expectations. While it offers ease, it also involves an adaptation process, distinguishing those who can adapt. As the technological spectrum grows exponentially and integrates into all human activities—from study to work to home—the only way to cope is by adapting to the changes it introduces.

In recent times, due to global events, information and communication technologies have turned the tide in their favor. People who previously operated within a routine model found themselves obligated to conduct their work and studies through technological tools. Based on the aforementioned, this article presents various epistemological approaches from different authors who have addressed the influence of information and communication technologies, specifically within the context of education, with a functional focus on the university environment.

Personalized learning through ICT is based on using digital tools that facilitate the creation of interactive, accessible, and collaborative learning environments. This includes online learning platforms, educational apps, simulations, social networks, and other technologies that allow students to access personalized educational resources, participate in interactive activities, and receive instant feedback.

However, implementing ICT in personalized learning also presents significant challenges, such as the need for adequate technological infrastructure, teacher training, and equity in access to these technologies. These aspects must be carefully considered to maximize the positive impact of ICT on university education.

The objective of this study is to analyze the influence of Information and Communication Technologies (ICT) on personalized learning in the university context, identifying the opportunities, challenges, and strategies that can enhance educational development tailored to individual student needs. The question guiding our research is: How do Information and Communication Technologies (ICT) affect personalized learning in the university context, and what are the main barriers and opportunities present in this process?.

## **METHODS**

**Information Collection:** To conduct this bibliographic study, an exhaustive search for documented information was carried out within the technological repositories of journals such as Scielo, Scopus, PubMed, and Web of Science. Using keywords such as higher education, learning, technology, technological tools, perception of technologies, use of technologies, information age, among others, documents were obtained that also addressed the presented topic and were considered relevant due to the recency of their information, categorizing them as notable for the treatment of the presented topic.

**Information Extraction:** For the clear and concise extraction of information, parameters were set to discern works that were relevant to the specific topic at hand. With the design and implementation of a review matrix for literary works, the necessary information was recorded to generate the present article. Special care was taken with documents that did not provide reliable and accurate information on the presented topic. The parameters established for obtaining reliable information included the compatibility between the objectives of this article and those referenced, the methodology used, the derived effects, and primarily the conclusions reached through previous research. The qualitative synthesis methodology also assisted in identifying sequences and directives from the gathered information, specifically focusing on the influence that communication and information technologies have on the personalization of learning, with a focus on the university student group.

**Synthesis of Results:** To synthesize the obtained results after matrix comparison, it was necessary to integrate and cross-compare the conclusions presented in the selected articles. This approach allowed for the identification of themes that shared the essence of the study and differentiated the methodological viewpoints recorded by other authors. Additionally, special attention was given to documents that involved the use of technological tools, such as AI.

**Research Demarcation:** To ensure the desired effectiveness of the study, inherent limitations were considered to prevent undesired extension. The development of this work examined the ease and availability of access to various information sources, databases, and records of previous studies, which enabled the gathering of a significant amount of information. However, without delimiting the study, the quality of the obtained results could have been reduced. Therefore, proper boundary demarcation was crucial to maintaining the academic quality of the study. Initially, the information delimitation focused on recently published studies, as they offered cutting-edge information reflecting the current reality of the educational field. Since the most relevant events were found within the open interval from 2019 to the present, information from the last five years was gathered. Nonetheless, studies unrelated to the influence of ICTs on the personalization of university students' learning were excluded, as they also yielded results on topics like telecommuting during the chosen time frame.

Since the study focused on a specific experimental unit, studies that did not adhere to this unit were excluded. As ICTs have impacted all educational levels (primary, secondary, and university), the collected information covered these three areas. However, the experimental unit of the study was specifically the university community. Lastly, to maintain the essence of the study, the research demarcation focused particularly on documents that did not include primary information and were developed under the same methodology.

## RESULTS

To achieve a concrete dissertation on the influence of implementing communication and information technologies in the personalization of learning within the university context, a documentary comparison matrix was designed and implemented, where the previously selected studies were placed. Out of a total of 15 articles addressing the aforementioned topic, a significant amount of information sharing the same objective was gathered. The influence that the use of information and communication technologies promotes for the personalization of learning among the university study group is evident, as it undoubtedly represents a better way to attain higher levels of knowledge.

To reach these findings, the articles underwent a thorough analysis, from which important information complementing the direction of the study was highlighted, all through the use of the matrix comparison presented below. The matrix comparison of documented information proves to be a very subtle and versatile tool for conducting these types of studies, as it allows for a well-founded and organized comparison of both objective and subjective viewpoints considered by various authors, thus establishing the solid foundations of the present research. Below is the matrix comparison conducted concerning the anticipated topic:

**Table 1: Matrix Analysis of Documented Information**

No	Title	Author(s)	Year	Abstract	DOI
1	Artificial Intelligence and its Implications in Higher Education	Fernández, Yolvi Fernández, Luis Aburto, Luzmila	2019	This article presents the new challenges that universities must face with the intrusion of technology and the benefits it brings to personalized learning.	1 0 2 0 5

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2	Preparing Students for Generation Z: Considerations on 3D Printing Curriculum TT - Getting Ready for Generation Z Students - Considerations on 3D	Popescu, Diana Popa, Diana Cotet, Beatrice	2019	The authors reveal that personalized learning focuses on teachers being part of Generation Z or digital, so that education can be enhanced through feedback.	10.20511/ pyr2019
3	The Challenge of New Technologies: The Use of the Virtual Classroom and its Influence on Academic Performance	Gómez, Katherine	2019	Katherine Gómez explains that the influence of technologies in the university context encourages teachers to have more up-to-date knowledge and design more personalized methodologies for students.	10.33936/ rehuso.v4i 3.2136
4	Problem Solving with Technology in a Collaborative Learning Environment using Wiki in Secondary Education	Calle-Álvarez, Gerzon Yair Agudelo-Correa, Iván Darío	2019	The study aims to characterize the process that higher education students use to solve problems with technology in a collaborative learning environment supported by wiki.	10.22335/ rlct.v11i2. 876
5	Technological Tools in the Teaching-Learning Process in Higher Education Students	Molinero, María del Carmen Chavez Morales, Ubaldo	2019	The objective of this work was to investigate which technological tools are most used by university students at a higher education institution and to identify how they influence their educational process.	10.23913/ ride.v10i1 9
6	Higher Education in Blended Modality:	Benítez González, MC	2019	This article analyzes the strengths and weaknesses of implementing higher education	10.18004/ ucsa/2409 -

	Strengths and Weaknesses of its Implementation			in a blended modality through the use of ICT and the Internet.	8752/2019
7	TPACK Model: A Means to Innovate the Educational Process Considering Data Science and Machine Learning?	Salas-Rueda, Ricardo Adán	2019	This study demonstrates that the results of machine learning (50%, 60%, and 70% training) allow us to affirm that the application of information and communication technologies improves the teaching-learning process.	10.22201/enesl.20078064e.2018.19.67511
8	IMPACT OF TECHNOLOGY USE ON THE TEACHING-LEARNING PROCESS OF INTEGRAL CALCULUS	Villena Muñoz, M Rivas Maldonado, N.	2019	Villena Muñoz and Rivas Ronaldo demonstrated that the teaching-learning process is dynamic, and integrating information and communication technologies is the daily challenge for teachers and students.	1990-8644
9	Integration of ICT to Improve EFL Students' Skills in Vulnerable Communities	Roys Romero, Nancy Rosa	2019	This article identifies the limitations and impact of integrating information and communication technologies (ICT) in the classroom to improve students' skills.	10.18634/sophiaj.15v.2i.770
10	Evaluation of Student Perception Regarding the Use of the Moodle Platform from a TAM Perspective	Bedregal, Norka Cornejo, Víctor Tupacyupanqui, Doris Flores, Sidanelia	2019	The authors of this article concluded that the use of information and communication technologies in educational institutions has become widespread in recent years, making it necessary to measure their impact on pedagogical processes.	N/A
11	Quantification of the Influence of Smartphone Use on Practical Learning in Chemical Engineering	Pratto Burgos, Martin	2019	It was observed that the use of smartphones allowed most students to achieve scores between 60% and 79%, surpassing the minimum passing threshold.	10.24215/18509959.24.e05
12	SCIENCE-TECHNOLOGY-SOCIETY EDUCATION: A METHODOLOGY FOR 21st-	Rodríguez Morales, Alina	2019	Rodríguez Alina demonstrates that the introduction of information and communication tools has a significant impact on students in the chemical sciences pedagogy program.	conrado.ucf.edu.cu/index.php/conrado

	CENTURY TEACHERS				
13	INVERTED LEARNING AS AN APPROACH TO UNIVERSITY EDUCATIONAL QUALITY IN ECUADOR	Aycart Carrasco, Francesco	2019	This work argues that technologies have actively disrupted the world, generating new communication and learning dynamics for education. In the 21st century, it remains a challenge and a necessary culture for those who organize, facilitate, and construct the knowledge required by programs and society.	conrado.ucf.edu.cu/index.php/conrado
14	Cognitive Load and Learning with ICT: An Empirical Study in Third-Level Chemistry and Physics Students	Salica, Marcelo Augusto	2019	Salica Marcelo highlights that the way students acquire and process information is a key factor for successfully integrating Information and Communication Technologies (ICT) into the curriculum in science classes: Physics and Chemistry.	10.24215/18509959.24.e08
15	Learning Histology Through Game-Based Learning Supported by Mobile Technology	Rojas-Mancilla, Edgardo Conei, Daniel Bernal, Yanara A Astudillo, Dan Contreras, Yuri	2019	This work has shown that learning based on digital technologies and the testing effect are effective in improving learning. The use of information and communication technologies provides the opportunity to test innovative learning strategies in the classroom.	903-907, 2019

**Source:** Own elaboration.

## DISCUSSION

Once the matrix comparison of the different approaches presented in previous reports is completed, it is evident that the influence of information and communication technologies (ICT) within the context of personalized learning for university students has been a continuous evolutionary process. In the past, outdated teaching strategies led to a poor quality of education and learning (Roys Romero, 2019).

The most notable case focused on the engineering field, where it was observed that students, upon entering university for the first time, exhibited a strong interest in learning. However, as the years of study progressed, their interest and persistence decreased due to obsolete teaching and learning strategies. Not only engineering students, but others as well, found that prolonged exposure to outdated teaching methodologies and tools, which did not align with their contemporary

personalities, led to shifts in their goals towards merely staying sane, preserving self-esteem, and avoiding failure (Moreno et al., 2019).

This reality is supported by Ocaña-Fernández et al. (2019), who argued that the student body, along with the information age, demanded a significant paradigm shift, replacing rigid standards with more feasible ones. To improve this situation, the integration of ICT for personalized learning was proposed as the key to improving or completely changing the current scenario.

In their literary works, Salas Rueda (2019) and Ocaña-Fernández et al. (2019) asserted that incorporating ICT would bring about a considerable improvement in personalized learning. Authors such as Cunha & Hernández Vélez (2019), Villena Muñoz & Rivas Maldonado (2019), Rios Miranda & Portugal Durán (2019), and Baracaldo Guzmán (2019) observed during their studies that university students showed notable improvement in academically challenging areas.

Not only did subjects like calculus, physics, chemistry, English, and algebra gain greater acceptance among university students, but even history became more engaging when personalized tools were developed to convey new knowledge. Rojas-Mancilla et al. (2019) suggested that one personalized strategy could be the use of 21st-century tutors, an idea supported by Galán Mireles & Moreno Tapia (2019), who confirmed that contemporary tutors would be the best option to ensure students do not feel misunderstood when discussing technological tools.

Despite the benefits presented in previous studies, there was also opposition regarding the application of a cognitive evaluation model to the personalized learning received by automation students, who were taught using technological tools. In his study, Salica (2019) noted that when an evaluation model was applied to students who had received personalized education through ICT, it became clear that the speed with which questions were answered suggested blatant and shameless cheating (Pratto Burgos, 2019).

Benítez González (2019) shares Pratto's perspective, as his study also highlighted that, despite the positive influence of ICT in the higher education context, issues of plagiarism and inappropriate acquisition of external academic content could arise.

The uncontrolled implementation of ICT could lead to violations of students' personal ethics, as it opens the door to using information without the prior consent of authors (Bedregal et al., 2019). Meanwhile, Gómez Vera (2019), in his work "The Challenge of New Technologies," emphasized that the influence of ICT on personalized learning requires a reasonable adaptation period, which not all students manage to complete (Calle-Álvarez & Agudelo-Correa, 2019).

Even though ICTs are presented as tools that favor the learning of all students, Bedregal et al. (2019) pointed out that not all university students have the resources to engage in the educational environment, as access to quality information often comes at a high cost.

They also argued that despite the autonomy and personalized learning offered by ICT, the role of the teacher cannot be overlooked (Molinero & Chavez Morales, 2019). This view was corroborated by Kraus et al. (2019), who emphasized that the influence of ICT on personalized learning also pushes teachers to be 21st-century educators. Since they share the same genesis as Generation Z, they would have greater options for personalizing learning. Nández-Rodríguez et al. (2019) also agreed with Molinero and Kraus, noting that ICT in university learning requires teachers to be trained from the beginning in computer skills, which involves the investment of significant resources such as time.

While Kraus, Molinero, and Nández defended the idea that the influence of ICT on the personalization of university learning demands preparation and commitment from both teachers and students, Aycart Carrasco (2019) argued that there is no comprehensive guide to facilitate the preparation of teachers and, in turn, of students who, not being part of Generation Z, struggle to adapt to education in a globalized context. Rodríguez Morales (2019) also shared this view, suggesting that the lack of

guiding methodologies and basic tools that consider those not part of Generation Z would have a negative impact on the community, turning the influence of ICT into something dark and bleak.

Despite the negative aspects, the influence of ICT on the personalization of university students' learning is viewed positively by parents. Angulo Armenta et al. (2019) referenced the surprised reaction of parents whose children are pursuing university degrees, expressing that they are more satisfied with the comprehensive education their children receive, as they themselves faced greater educational challenges in their time.

## CONCLUSIONS

This After conducting the analysis, it is concluded that ICTs enable university students to access a vast array of educational resources, from e-books to online learning platforms and educational videos. This facilitates personalized learning, as students can choose materials that best suit their learning styles and specific needs. E-learning platforms and online courses allow students to progress at their own pace, reviewing and revisiting materials as needed. This is especially beneficial for those who may require more time to grasp certain concepts or for those who wish to advance more quickly in their studies.

ICTs also offer interactive tools such as simulations, educational games, and online assessments, which not only make learning more engaging but also provide immediate feedback. This feedback enables students to quickly identify their areas for improvement and adjust their study strategies accordingly. The integration of ICTs into university learning facilitates access to education from anywhere at any time, breaking down geographical and temporal barriers. This is crucial for students who have work or personal responsibilities that make attending in-person classes challenging.

Another noteworthy aspect is that online communication tools, such as forums, chats, and video conferences, foster collaboration between students and professors, as well as among the students themselves. This collaborative environment allows for a more dynamic exchange of ideas and the development of teamwork and communication skills. ICTs allow for the creation of content in multiple formats (text, audio, video, interactive), making it easier to cater to different learning styles (visual, auditory, kinesthetic, etc.). This diversity in presenting information ensures that each student can learn in the most effective way for them.

ICT-based learning platforms collect data on student performance and behavior. This data analysis enables educators to personalize content and activities according to each student's strengths and weaknesses, thus improving the efficiency of the educational process.

The use of ICTs in the educational context also contributes to the development of digital competencies in students, an essential skill in today's world. Familiarity with technological tools and digital learning platforms prepares students for the modern work environment. The incorporation of ICTs in university education fosters innovation in teaching methodologies, allowing educators to experiment with new ways of delivering knowledge, such as project-based learning, gamification, and augmented reality, thereby enriching the educational experience.

The influence of ICTs on personalized learning in the university context is profound and multifaceted. By providing tools and resources that adapt to the individual needs of students, ICTs not only enhance the quality of learning but also promote more inclusive and accessible education. However, it is crucial that educational institutions and educators stay updated with technological advances and adopt pedagogical strategies that maximize the potential of these tools for the benefit of all students.

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