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Artículos científicos

Impacto de las TIC en la enseñanza-aprendizaje: caso de estudio en la carrera de Tecnología de la Información de la Universidad Técnica de Manabí

Impact of ICT on Teaching-Learning: Case Study in the Information Technology Career of the Technical University of Manabí

Impacto das TIC no ensino-aprendizagem: estudo de caso na licenciatura em Tecnologia da Informação da Universidade Técnica de Manabí

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Resumen

El estudio resalta la relevancia de las TIC en la educación superior, mostrando actitudes positivas de docentes y estudiantes. La correlación entre competencia en TIC y desempeño educativo destaca la necesidad de formación continua. El estudio utilizó un enfoque cuantitativo y un diseño cuasiexperimental para investigar el impacto de TIC en educación superior. Se seleccionaron 169 participantes mediante muestreo aleatorio estratificado. Se recolectaron datos con una encuesta validada y se analizaron estadísticamente, respetando consideraciones éticas y legales. Los docentes muestran un alto nivel de reconocimiento y uso de las TIC, con un 66,67% de hombres y un 70,00% de mujeres indicando un uso constante. Los estudiantes también muestran interés y participación, con un 49,54% de hombres y un 57,14% de mujeres. La competencia en TIC correlaciona positivamente con la actitud docente y el cumplimiento en su uso, destacando la importancia de desarrollar habilidades específicas en TIC. Los hallazgos resaltan el compromiso de los docentes y

estudiantes con las TIC en la enseñanza-aprendizaje, subrayando la necesidad de formación continua para una integración efectiva y promoción de la innovación educativa en la era digital.

Palabras clave: TIC, enseñanza-aprendizaje, educación superior.

Abstract

The study highlights the relevance of ICT in higher education, showing positive attitudes of teachers and students. The correlation between ICT competence and educational performance highlights the need for continuous training. The study used a quantitative approach and a quasi-experimental design to investigate the impact of ICT in higher education. 169 participants were selected through stratified random sampling. Data was collected with a validated survey and analyzed statistically, respecting ethical and legal considerations. Teachers show a high level of recognition and use of ICT, with 66,67% of men and 70,00% of women indicating constant use. Students also show interest and participation, with 49,54% men and 57,14% women. ICT competence correlates positively with teaching attitude and compliance in its use, highlighting the importance of developing specific ICT skills. The findings highlight the commitment of teachers and students to ICT in teaching-learning, underlining the need for continuous training for effective integration and promotion of educational innovation in the digital age.

Keywords: ICT, teaching-learning, higher education.

Resumo

O estudo destaca a relevância das TIC no ensino superior, mostrando atitudes positivas de professores e alunos. A correlação entre a competência em TIC e o desempenho educativo realça a necessidade de formação contínua. O estudo utilizou uma abordagem quantitativa e um desenho quase experimental para investigar o impacto das TIC no ensino superior. Foram selecionados 169 participantes por meio de amostragem aleatória estratificada. Os dados foram coletados por meio de pesquisa validada e analisados estatisticamente, respeitando considerações éticas e legais. Os professores apresentam um elevado nível de reconhecimento e utilização das TIC, com 66,67% dos homens e 70,00% das mulheres a indicarem utilização constante. Os estudantes também demonstram interesse e participação, sendo 49,54% homens e 57,14% mulheres. A competência em TIC correlaciona-se positivamente com a atitude docente e a conformidade na sua utilização, realçando a

importância do desenvolvimento de competências específicas em TIC. As conclusões destacam o compromisso de professores e alunos com as TIC no ensino-aprendizagem, sublinhando a necessidade de formação contínua para uma integração eficaz e promoção da inovação educativa na era digital.

Palavras-chave: TIC, ensino-aprendizagem, ensino superior.

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Introduction

Contemporary society is characterized by its relentless search for and generation of knowledge, with Information and Communication Technologies (ICT) being a key factor in this dynamic. This environment, called the knowledge society or the information society, reflects the rapid expansion and accessibility of information in all social spheres. ICTs have transformed both education and the way people interact and learn, influencing areas such as educational planning, knowledge management and the very nature of work. The convergence of computing, telecommunications and data processing has driven this progress, presenting challenges and opportunities in equal measure. Education has not escaped this technological influence, with ICT-driven educational innovation being a central driver for social change and human development (Hernández, 2017).

The introduction of ICTs in education has had a significant impact on the knowledge society, transforming both teaching methods and the learning process. These technological tools have evolved to become educational instruments that improve the quality of learning, allowing students to access, manage and interpret information more effectively (Guzmán, 2023). This change has entailed a redefinition of the roles of both students and teachers, who now use ICT as an integral part of the educational process. Education has adapted to this new learning environment, where the student assumes an active and autonomous role, and where the virtualization of learning and flexibility of time are key aspects. The integration of ICT in education poses new challenges and opportunities, demanding electronic literacy that is increasingly considered essential in the training of students (Armas-Alba and Alonso-Rodríguez, 2021).

Technological advancement in education poses significant challenges for teachers, who must adapt to a constantly changing environment and learn to effectively integrate ICT into the teaching and learning process. The rapid evolution of technology requires a thorough review of traditional educational methods and the adoption of new strategies to cultivate

technological competencies in students (Sánchez-Gutiérrez et al., 2024). In addition, educators must develop new pedagogical skills and create learning spaces that encourage collaboration and interaction with technology. Current challenges in education require a proactive response from professionals in the sector and a constant re-evaluation of educational practices to adapt to a constantly changing world (Hernández, et al., 2018).

The growing use of ICT in education is emerging as an essential element in the educational field, offering a futuristic perspective that promises to transform the teaching-learning process. This vision is supported by the integration of technological tools in educational environments, which would facilitate more collaborative and socially interactive learning, adaptable to the needs of today's society. The inclusion of ICTs in education requires a multidimensional approach that covers aspects such as access to information, effective communication and digital ethics, providing a solid framework for its successful implementation in educational institutions. (Barbosa-Quintero *et al.,* 2023).

Information and Communication Technologies (ICT) enrich the teaching-learning process, offering high-quality and accessible experiences for students. They facilitate education in virtual environments, allowing interaction and the exchange of knowledge through technological tools. Virtual education is presented as an updated and necessary option at all educational levels, especially in higher education. Previously considered a complement, virtual teaching has become essential in the current scenario, especially in health sciences, where the acquisition of practical skills and collaborative experiences is required in the professional training process (López et al., 2021).

The use of ICT in Higher Education is essential, as it offers a wide range of tools and resources that can transform the teaching-learning process. ICT allows educational dynamics to be altered, changing the environment, teaching methods, and the roles of students and teachers. In addition, they promote interaction, communication, and collaboration, which contributes to improving the quality of education. ICTs are omnipresent in everyday life and have created a new reality in society, affecting all aspects, including education. It is essential that teachers are trained to effectively integrate ICTs into their pedagogical practice, recognizing their potential to enrich learning and promote the construction of knowledge (Barrientos-Oradini et al., 2022).

The influence of ICTs on the development of competencies, the definition of learning goals, the mastery of content and skills related to the effective use of ICTs is highlighted. Likewise, the essential role of teachers in the successful integration of these tools is recognized, as well as their continuous training to adapt to technological advances (Viñas,

2021). In this context, the research aims to analyze how ICTs impact the teaching and learning process in Higher Education, specifically in the Information Technology program at the Technical University of Manabí. Through surveys and observations, we seek to understand how ICTs contribute to improving academic performance and educational quality in this university setting, promoting a more participatory and demonstrative learning environment for students.

Methodology

Approach, scope and research design

The approach adopted is quantitative and is oriented towards a descriptive correlational scope, with a quasi-experimental experimental design. This approach involves the use of strategies for collecting numerical data through surveys and observations. The importance of the researcher's control over the study variables is highlighted, as well as the need to adapt the design to the specific nature of the research. In addition, analytical methods are used to interpret the data and a synthetic methodology is followed to draw conclusions based on the specific objectives of the study. (Torres-Zapata *et al.*, 2022).

Participants

The probabilistic method of Stratified Random Sampling was used to select the sample. The population included 230 students from the Information Technology program at the Technical University of Manabí, from which a sample of 144 was taken, while the 25 teachers from the same program were selected in their entirety to form the sample. In total, the population included 255 individuals, from which a total sample of 169 was extracted.

To determine the sample size, various parameters were used, such as P for the probability of occurrence (50%), Q for the probability of non-occurrence (50%), N for the total population (230), e for the level of significance (5%), Z for the level of confidence (1.96), and n to represent the sample size, whose value was sought to calculate, resulting in a total sample of students of 144.

Subsequently, the 144 students selected for the sample were distributed in the eight levels defined for this study, randomly assigning 18 students to each level to carry out the surveys. It is important to note that some levels could have had less than 18 students, so it was considered to increase participation in the surveys in the levels with the largest number

of students. In summary, the lack of participants at one level was compensated by additional participation at another level with a larger number of students.

Instruments

The research focused on a survey directed to 25 teachers and 144 students of the Information Technology program at the Technical University of Manabí. Data collection was carried out using instruments corresponding to a descriptive (quantitative) design. The instrument consists of a total of 13 questions for teachers and seven questions for students, distributed in three dimensions for each group. Each dimension addressed specific aspects related to the use of ICTs, as detailed in Table 1. Validation of the survey by experts was carried out as part of the research process. A group of specialists in the area reviewed the questionnaire to ensure its relevance, clarity and relevance to the study in question. This validation guaranteed that the questions asked were suitable for collecting the necessary information and that the survey as a whole was effective in achieving the objectives of the study.

Table 1. General characteristics of the instrument

Unit of Observation	Dimensions	Indicators	Items
Teachers of the Information Technology Career of the Technical University of Manabí	ICT	Literacy level in the use of ICT, applied in Higher Education	1
		Teaching level in Higher Education	2
	Compliance	Index of tools and/or applications in Higher Education	3
		Frequency in the use of the main technological devices for teaching Higher Education.	4
	Attitude	Teacher's attitude towards the use of ICT	5
		Level of personal interest in innovating	6
Teachers and students of the Information Technology Career of the Technical University of Manabí	Use of ICT	Level of knowledge of the use of ICT	7
		Degree of problem solving and decision making	8
	Trust	Participation in environments where they interact with ICT	9
		Degree of interest in learning the use of ICT	10
	Involvement	Accessibility of space to interact with digital resources	11
		Level of time organization that favors learning	12
		Availability of tools and/or applications	13

Source: Own elaboration

The DELPHI method was used to apply the instrument, using anonymous questionnaires as an exploratory technique, after delimiting the context and time period, and selecting a panel of committed experts. This method, characterized by anonymity, iteration and controlled feedback, was divided into phases that began with the formulation of questions related to the research objectives. A detailed survey was carried out on the ICT tools and applications, while the involvement of teachers and students was assessed through virtual and face-to-face observations, capturing the tools used. These tools were classified as transmissive, active and interactive, and it was assessed whether the students applied and understood them, as well as their degree of involvement in the teaching-learning process.

Data collection procedure

Data collection was conducted from May to September 2023 using an online survey conducted through Google Forms. Administrative procedures for research approval were followed and the voluntariness, anonymity, and independence of participants were guaranteed. Informed consent was obtained from students before beginning data collection. Subsequently, with the authorization of all participants, including faculty, the application of the instruments was scheduled in an appropriate environment. Participants were provided with detailed information about the purpose and structure of the questionnaires before they completed the survey, with an estimated response time of approximately 15 minutes.

Data analysis

The data were analyzed using Microsoft Office and SPSS, version 23.0 for Windows. Descriptive statistics techniques such as frequencies, proportions, measures of central tendency and dispersion, as well as non-parametric inferential analysis using Spearman's correlation, based on the results of the Kolmogorov-Smirnov Normality Test, were applied.

Ethical considerations

The study was based on the Organic Law of Higher Education 2021, protecting the privacy and anonymity of the participants. It was conducted at a university in Portoviejo, Manabí, and was reviewed by the research committee of the Institute of Basic Sciences of the Technical University of Manabí. Authorization was obtained through informed consent, ensuring that the results would not be used to the detriment of the participants.

Results

Research on the impact of ICT on the teaching-learning process of students has revealed the complexity inherent in this topic and has contributed significantly to differentiating and specifying its various dimensions.

Table 2, 3 and 4 provide a detailed overview of the teachers' descriptive results in relation to the dimensions studied: a) ICT in the teaching-learning process, b) Teachers' attitude towards ICT, and c) ICT compliance. This table covers a wide range of relevant data and analysis, all based on the evaluation of a total of 25 teachers.

Table 2. Descriptive analysis of teachers in relation to the dimension: ict in the teaching-learning process

Question 1: Do you use technological resources when teaching your classes to improve academic performance?				
Item	Men		Women	
	f	%	*f*	%
Always	10	66,67	10	66,67
Almost always	5	33,33	5	33,33
Many times	0	0,00	0	0,00
Seldom	0	0,00	0	0,00
Question 4: Do you understand and articulate ICT tools in the face-to-face class with the virtual class in an innovative way in the teaching-learning process of Higher Education students?				
Always	6	40,00	7	70,00
Almost always	8	53,33	2	20,00
Many times	0	0,00	1	10,00
Seldom	1	6,67	0	0,00
Question 5: Do you engage correctly with ICT tools to develop interest in the teaching-learning process in Higher Education students?				
Always	8	53,33	5	50,00
Almost always	6	40,00	5	50,00
Many times	1	6,67	0	0,00
Question 9: Do you feel confident when using ICT?				
Always	11	73,33	8	80,00
Almost always	3	20,00	2	20,00
Many times	0	0,00	0	0,00
Seldom	1	6,67	0	0,00

Source: Own elaboration

The analysis of the responses provided by teachers regarding the dimension of ICT in the teaching-learning process, according to their perception, reveals a series of interesting patterns and significant trends. Firstly, in Question 1, it is observed that both men and women report a high level of use of technological resources to improve academic performance in their classes, with a percentage of 66.67% for men and 70.00% for women indicating that

they always use them. This suggests a general recognition by teachers of the importance and added value that ICT can bring to the teaching-learning process. Regarding Question 4, it is highlighted that both men and women show an innovative understanding and articulation of ICT tools, with a high percentage indicating that they do so always or almost always, which reflects an effort by teachers to effectively integrate technology into their pedagogical practices. On the other hand, in Question 5, it is evident that both men and women engage adequately with ICT tools to foster interest in the teaching-learning process, with a significant percentage indicating that they do so always or almost always. This suggests a commitment on the part of teachers to the active use of technology to motivate their students and improve their educational experience. Finally, in Question 9, it is highlighted that both men and women show a high level of confidence in the use of ICT, with a high percentage indicating that they feel confident using them always or almost always. This finding underlines the importance of training and continuous professional development of teachers in the field of ICT, as well as the need to promote a supportive and trusting environment to foster an effective integration of technology in the classroom. Taken together, these results suggest a positive outlook regarding the perception and use of ICT by teachers in the educational context, which can significantly contribute to improving the quality and effectiveness of the teaching-learning process.

Table 3. Descriptive analysis of teachers in relation to the dimension: teachers' attitude towards ict

Question 2: Do you motivate your Higher Education students with the use of digital tools?				
Item	Men		Women	
	f	%	*f*	%
Always	12	80,00	7	70,00
Almost always	3	20,00	2	20,00
Many times	0	0,00	1	10,00
Question 6: Would you like to know how to innovatively implement ICT in your classes?				
Always	9	60,00	8	80,00
Almost always	5	33,33	2	20,00
Many times	1	6,67	0	0,00
Question 7: Would you like to propose events with technological resources in classes?				
Always	7	46,67	6	60,00
Almost always	8	53,33	4	40,00
Question 10: Would you like to be at the forefront regarding the use of ICT?				
Always	11	73,33	6	60,00
Almost always	4	26,67	4	40,00

Source: Own elaboration

The analysis of the responses provided by teachers in relation to the dimension of Teachers' Attitude towards ICT, according to their perception, reveals a series of relevant trends and considerations. Firstly, in Question 2, it is observed that both men and women indicate a high degree of motivation towards their Higher Education students through the use of digital tools, with a significant percentage indicating that they do so always or almost always. This suggests a commitment on the part of teachers to the active integration of technology to improve the educational experience of their students. Regarding Question 6, it is highlighted that both men and women show a notable interest in learning how to innovatively implement ICT in their classes, with a high percentage indicating that they would like to know how to do so always or almost always. This finding reflects a willingness on the part of teachers to improve their skills and knowledge in the effective use of technology in the classroom. On the other hand, in Question 7, it is evident that both men and women show interest in proposing events with technological resources in their classes, with a high percentage indicating that they would like to do so always or almost always. This suggests a willingness on the part of teachers to enrich the learning environment with innovative activities that effectively integrate technology. Finally, in Question 10, it is highlighted that both men and women show a desire to be at the forefront in the use of ICT, with a high percentage indicating that they would like to always or almost always. This

finding underlines the importance of continuous updating and professional development of teachers in the field of technology, as well as the need to promote a dynamic and innovation-focused learning environment. Taken together, these results indicate a positive and proactive attitude on the part of teachers towards the use and integration of ICT in the educational context, which can significantly contribute to improving the quality and effectiveness of the teaching-learning process.

Table 4. Descriptive analysis of teachers in relation to the dimension: compliance with ict

Question 3: Do you use the following ICT tools in the academic activities of the classes?				
Item	Men		Women	
	f	%	*f*	%
Infographic	9	15,00	4	8,70
Briefcase	6	10,00	4	8,70
Tasks	12	20,00	8	17,39
Projects	13	21,67	8	17,39
Forums	5	8,33	6	13,04
Chats	4	6,67	7	15,22
Workshops	11	18,33	9	19,57
Total	60	100,00	46	100,00
Question 8: How often do you use audios and videos in your classes?				
Always	3	20,00	1	10,00
Almost always	4	26,67	3	30,00
Many times	5	33,33	1	10,00
Seldom	3	20,00	5	50,00
Question 11: Do you use digital resources such as: image projector and/or digital whiteboard?				
Always	9	60,00	6	60,00
Almost always	4	26,67	4	40,00
Many times	2	13,33	0	0,00
Question 12: Would you like to develop activities to establish compliance with the use of ICT and improve the teaching-learning process you provide to your students?				
Always	10	66,67	5	50,00
Almost always	4	26,67	5	50,00
Many times	1	6,67	0	0,00
Question 13: Do you use ICT tools and/or applications?				
Item	Men		Women	
	f	%	*f*	%
Word processor (Microsoft Word, Notepad)	11	11,34	9	12,33
Multimedia presentations (Power Point, Prezi, Genially, Canva, Piktochart)	13	13,40	8	10,96
Spreadsheets (Microsoft Excel, Open Calc)	12	12,37	8	10,96

Image editors (Microsoft Paint, Photoshop)	5	5,15	4	5,48
Audio editors (Audacity, Adobe Audition)	4	4,12	4	5,48
Web pages (Classroom Blog, Digital school library)	7	7,22	6	8,22
Blog (E-learning, Other education)	3	3,09	5	6,85
Discussion forums (Virtual platform)	7	7,22	7	9,59
Virtual Community (Moodle, Teachstars)	7	7,22	7	9,59
Educational social networks (Interuniversities, Internet in the classroom)	9	9,28	6	8,22
Virtual environments to share and store documents and videos (Google drive, Dropbox, YouTube)	13	13,40	8	13,40
Specify another tool and/or application	6	6,19	1	6,19
Total	97	100,00	73	100,00

Source: Own elaboration

The analysis of the responses provided by teachers in relation to the dimension of ICT Compliance, according to their perception, reveals a series of relevant trends and considerations. Firstly, in Question 3, it is highlighted that both men and women use a variety of ICT tools in their academic activities, with a diverse distribution between the different options. It is observed that men tend to use tools such as assignments and projects to a greater extent, while women show a slightly greater preference for tools such as workshops and forums. This diversity in the use of tools reflects an adaptation by teachers to adapt their teaching methods to the specific needs of their students and the learning objectives. Regarding Question 8, it is noted that both men and women use audios and videos in their classes with varying frequency, although in general, men show more frequent use compared to women. This suggests that teachers recognize the pedagogical value of audiovisual resources and actively integrate them into their teaching practices to enrich the learning experience of their students. On the other hand, in Question 11, it is observed that both men and women use the image projector and/or the digital whiteboard in their classes, with a similar trend in terms of frequency of use. This indicates a general acceptance of these tools as effective means to facilitate teaching and learning in the classroom. In Question 12, it is highlighted that most teachers express an interest in developing activities to establish compliance with the use of ICT and improve the teaching-learning process. This finding suggests a commitment on the part of teachers to promote effective use of technology in the classroom and thus optimize the academic results of their students. Finally, in Question 13, it is evident that both men and women make use of a wide range of ICT tools and applications

in their academic activities, with an equitable distribution between both genders in most of the options. This reflects a willingness on the part of teachers to explore and use various technological tools in order to enrich the teaching-learning process and improve the educational experience of their students. Taken together, these results indicate a commitment and willingness on the part of teachers to effectively integrate ICT into their teaching practice and thus promote a dynamic and enriching educational environment.

Analysis of results of technology students at the Technical University of Manabí

Tables 5, 6 and 7 present an analysis of the descriptive results of the students in relation to the dimensions investigated: a) Use of technological resources, b) Student involvement with ICT, and c) Confidence towards technology. This set of data and analysis covers a wide variety of relevant aspects, all derived from the evaluation of a total of 144 students.

Table 5. Descriptive analysis of students in relation to the dimension: use of technological resources

Question 2: How often does the teacher use audios and videos in his classes?				
Item	Men		Women	
	f	%	*f*	%
Always	21	19,27	2	5,71
Almost always	28	25,69	6	17,14
Many times	20	18,35	8	22,86
Seldom	32	29,36	16	45,71
Never	8	7,34	3	8,57
Question 5: Do you use digital resources in your class such as: image projector and/or digital whiteboard?				
Always	71	65,14	21	60,00
Almost always	21	19,27	7	20,00
Many times	7	6,42	1	2,86
Seldom	8	7,34	4	11,43
Never	2	1,83	2	5,71

Source: Own elaboration

The descriptive analysis of students in relation to the dimension of Use of Technological Resources reveals significant patterns regarding the frequency with which teachers use different tools in the classroom. In Question 2, which asks about the frequency of use of audios and videos by teachers, a considerable discrepancy is observed between genders. A notable 45.71% of women report using these resources "often", followed by 22.86% who do so "almost always". On the other hand, in the case of men, 25.69% indicate

using them "almost always", while 29.36% say they do so "very rarely". This gender difference suggests a possible gap in the integration of audiovisual resources in the teaching-learning process, which could impact the diversity and quality of students' learning experiences. On the other hand, in Question 5, which addresses the use of digital resources such as image projectors or digital whiteboards in the classroom, a similar trend is observed between men and women in terms of frequency of use. Both genders report frequent use of these resources, with a remarkable 65.14% of men indicating that they use them "always" and 60.00% of women reporting the same. This suggests a widespread acceptance of these technological tools as an integral part of the educational environment, which can contribute to enriching the learning experience of students by facilitating the presentation of content in a visual and dynamic way. Together, these findings highlight the importance of addressing gender differences in access to and use of technological resources in the classroom, as well as the need to promote greater equity in the integration of technology in the educational process to ensure inclusive and enriching learning experiences for all students.

Table 6. Descriptive analysis of students in relation to the dimension: student involvement with ict

Question 1: Would you like to participate in events with technological resources in classes?				
Item	Men		Women	
	f	%	*f*	%
Always	54	49,54	20	57,14
Almost always	39	35,78	6	17,14
Many times	13	11,93	4	11,43
Seldom	3	2,75	4	11,43
Never	0	0,00	1	2,86
Question 6: Would you like to participate in activities establishing the use of ICT to improve your learning process?				
Always	51	46,79	20	57,14
Almost always	42	38,53	10	28,57
Many times	11	10,09	3	8,57
Seldom	5	4,59	2	5,71
Question 7: Do you use ICT tools and/or applications?				
Item	Men		Women	
	f	%	*f*	%
Word processor (Microsoft Word, Notepad)	97	11,63	34	12,78
Multimedia presentations (Power Point, Prezi, Genially, Canva, Piktochart)	92	11,03	27	10,15
Spreadsheets (Microsoft Excel, Open Calc)	71	8,51	26	9,77
Image editors (Microsoft Paint, Photoshop)	62	7,43	18	6,77
Audio editors (Audacity, Adobe Audition)	44	5,28	12	4,51
Web pages (Classroom Blog, Digital school library)	66	7,91	18	6,77
Blog (E-learning, other education)	52	6,24	17	6,39
Discussion forums (Virtual platform)	57	6,83	23	8,65
Virtual Community (Moodle, Teachstars)	66	7,91	21	7,89
Educational social networks (Interuniversities, Internet in the classroom)	65	7,79	18	6,77
Virtual environments to share and store documents and videos (Google drive, Dropbox, YouTube)	92	11,03	30	11,28
Specify another tool and/or application	70	8,39	22	8,27
Total	834	100,00	266	100,00

Source: Own elaboration

The analysis of the responses provided in relation to the dimension of student involvement with ICTs, in questions 1, 6 and 7 of the survey, provides significant information on the attitudes and practices of university students in relation to the use of technology in the educational context. Firstly, question 1 reveals that both men and women show considerable interest in participating in events that involve technological resources in classes, with a percentage of 49.54% for men and 57.14% for women indicating that they would like to always participate. This finding suggests a strong appetite for the integration of technology in the learning process by students, regardless of their gender. On the other hand, question 6 delves into the willingness of students to use ICTs as a tool to improve their learning process. It is observed that both men and women show a high predisposition towards this idea, with significant percentages indicating that they would like to always or almost always participate in activities that use ICTs for this purpose. This suggests a recognition by students of the potential of technology to enhance their educational experience and maximize their academic performance. Finally, question 7 provides a detailed insight into the frequency and diversity of ICT tools and applications used by students. It is evident that students make use of a wide range of technological tools, from word processors and multimedia presentations to educational social networks and virtual environments for storing documents and videos. This finding underlines the ubiquity of technology in the academic life of university students, as well as their ability to adapt and use various digital tools to meet their educational needs. Taken together, these results indicate a high level of technological engagement and competence among university students, as well as a recognition of the importance of ICT in their learning process.

Table 7. Descriptive analysis of students in relation to the dimension: trust towards technology

Question 3: Do you think that the teacher feels confident when using ICT?				
Item	Men		Women	
	f	%	*f*	%
Always	36	33,03	4	11,43
Almost always	42	38,53	13	37,14
Many times	24	22,02	15	42,86
Seldom	7	6,42	3	8,57
Question 4: Would you like to be at the forefront regarding the use of ICT?				
Always	39	35,78	17	48,57
Almost always	46	42,20	8	22,86
Many times	13	11,93	6	17,14
Seldom	11	10,09	4	11,43

Source: Own elaboration

The descriptive analysis of students' responses to the Technology Confidence dimension provides insightful insights into students' perceptions and attitudes toward teachers' technological competence and their willingness to stay up-to-date in their use of ICTs. In Question 3, which asks about students' perceptions of whether teachers feel confident using ICTs, a discrepancy between genders is observed. While a considerable 71.56% of women believe that teachers feel confident "always" or "almost always", 61.56% of men share this perception. These results suggest that, in general, students perceive a considerable level of confidence from teachers in their use of ICTs, although women tend to have a slightly more positive perception compared to men. In Question 4, which explores students' interest in staying up-to-date in their use of ICTs, a similar trend is observed between genders. Both men and women show a high level of interest in being at the forefront of ICT use, with a remarkable 77.98% of women and 78.98% of men expressing interest in being up-to-date “always” or “almost always”. This indicates a general willingness on the part of students to keep up with the latest technologies and trends in the educational field. Taken together, these findings highlight the importance of promoting confidence and technological updating among teachers, which can contribute to improving the quality and effectiveness of ICT use in the teaching-learning process.

Correlation results

Normality tests were performed for each of the teacher groups in relation to the dimensions of ICT, attitude and compliance. The results indicate that the data from the ICT group present a distribution significantly different from a normal distribution according to the Kolmogorov-Smirnov test ($p = 0.001$) and the Shapiro-Wilk test ($p = 0.000$). Similarly, the attitude group shows a significant difference from a normal distribution according to both tests ($p = 0.006$ and $p = 0.003$ respectively). However, the data from the compliance group do not show a significant difference from a normal distribution according to the Kolmogorov-Smirnov test ($p = 0.200$), although the Shapiro-Wilk test shows a significant difference ($p = 0.377$). These findings suggest that the data in the ICT and attitude groups do not follow a normal distribution, while the data in the compliance group might be closer to a normal distribution. Since the variables of the ICT and Attitude dimensions do not follow a normal distribution, with p-values lower than 0.05, the Spearman correlation coefficient was used to evaluate the relationships between these variables. The results reveal a significant and positive correlation between the ICT and Attitude dimensions, with a correlation coefficient of 0.714 ($p = 0.000$). This suggests that as competence in the use of information and communication technologies (ICT) increases, so does the teacher's general attitude in the educational context. In addition, a significant and positive correlation was found between the ICT and Compliance dimensions, with a correlation coefficient of 0.652 ($p = 0.000$), indicating that a higher level of competence in the use of ICT is associated with greater compliance with these in the teaching-learning process. On the other hand, the correlation between the dimensions Attitude and Compliance was moderate and not significant (correlation coefficient = 0.310, $p = 0.131$), suggesting that the teacher's attitude has no direct influence on his or her level of compliance in the use of ICT. These results highlight the importance of ICT competence as a key predictor of teacher performance in the current educational context.

Significant correlations ($p < 0.05$) are observed between the ICT dimension and Attitude, as well as between the ICT dimension and Compliance. This suggests that there is a significant association between the level of ICT competence and both the teacher's attitude and his or her degree of compliance in the use of these technologies in the educational process. However, no significant relationship was found between the Attitude dimension and Compliance. These findings indicate that while ICT competence is related to both teacher attitude and teacher compliance in using these technologies, teacher attitude is not directly

related to teacher compliance in the context of teaching with ICT. This highlights the importance of developing specific ICT skills to improve teacher performance and effectiveness in implementing these tools in the classroom.

Discussion

According to (Alcívar, Vargas, Calderón, Triviño, Santillan, Soria, and Cárdenas 2019), the issue is challenging due to the difficulty of addressing ICTs in general terms. Although these technologies share the ability to manipulate and communicate information in digital format, their applications, functions, and characteristics vary considerably. In addition, ICTs are tools and, therefore, can be used in multiple ways depending on the context and specific objectives.

The teaching-learning process seeks to improve students' knowledge and skills, with ICTs being vital tools for this task (Castillo, 2020). However, their effective use requires teachers to acquire skills and plan teaching strategies. UNESCO highlights the positive impact of ICTs on educational quality, but their implementation faces challenges, such as the digital divide. In Latin America, their adoption has been uneven. The role of the teacher becomes a guide to knowledge, promoting student autonomy. Continuous teacher training and the quality of technological resources are key to the success of this integration (Chapa and Cedillo, 2022).

Teachers' attitudes towards ICT are decisive for their integration in the classroom. Technological self-efficacy, perception of competence, and willingness to change influence their attitude (Padilla, 2018). The presence of technological resources and ICT training improve these attitudes. In addition, the teacher's teaching style also affects the integration of ICT, with constructivist approaches being more likely to be adopted. Modifying teachers' beliefs is crucial to implementing changes, but it implies challenging their deep-rooted educational paradigms (García et al., 2022).

According to (Flores-Tena et al., 2021), in the context of the implementation of ICT in the educational field, it is important to use various technological tools in teaching, including online platforms and specific applications. The frequent use of multimedia resources such as audio and video, as well as digital devices such as projectors and whiteboards, is also relevant. It is necessary to develop activities that promote the effective use of ICT and improve the teaching process. In addition, exploring ICT tools and applications can enhance the educational experience.

According to (Londero and Soria 2022), there is concern about the lack of technological skills among students when designing their final projects, particularly in the university environment. In addition, institutional changes towards a focus on greater use of technological resources are noted, which underlines the importance of understanding and improving the use of these resources by students in the educational field.

The use of technological applications and tools to engage students in the learning process is essential to counteract demotivation and poor performance. These tools allow for the creation of relevant and contextualized learning experiences, encouraging participation and the collective construction of knowledge (Sánchez et al., 2021). The advantages of educational applications include the possibility of learning in any context, the playful component that integrates gamification, the interactivity that breaks with passivity, the multimedia appeal that maintains attention, the personalization of learning, and the immediate application of what has been learned. It is important that these tools are used in a pedagogically intentional way by teachers to ensure their effectiveness in the training process of students (Daher et al., 2022),

By analyzing the importance of trust in technology among university students, covering their attitude towards technology and social networks, as well as their perception and use of it. It is highlighted that mobile technology in education offers an opportunity to improve teaching and learning, providing access to multiple sources of information and encouraging a more flexible learning model (Orgaz et al., 2018). In addition, it is evident that the use of mobile devices in learning increases student engagement and communication, although its effectiveness depends on careful integration into instructional design. Scientific literature supports the hypothesis that attitude towards technology and social media positively influences the perception and use of technology. Therefore, it is proposed to delve deeper into these relationships to promote an appropriate use of technology and technological resources in university education. (Torres-Zapata *et al.*, 2022).

Conclusion

The results of this study offer a comprehensive view on the impact of ICTs on Teaching-Learning in the educational field, both from the perspective of teachers and university students. The findings suggest a significant commitment by teachers towards the active integration of ICTs in the teaching-learning process, evidenced by the high level of use and interest in developing innovative technological skills. Likewise, university students show a

favorable attitude and technological competence in the use of ICTs to improve their educational experience, which underlines the importance of promoting a digital culture in the academic field. Furthermore, the correlations found between teachers' ICT competence and their attitude and compliance in the use of these technologies highlight the relevance of continuous training in ICTs to improve teacher performance and promote an effective integration of technology in the classroom. Taken together, these results emphasize the importance of recognizing and leveraging the transformative potential of ICTs in the educational process, as well as the need to promote a holistic and collaborative approach to drive innovation and improve the quality of education in the digital age.

Future lines of research

It is noteworthy that the most important and unavoidable technologies are those that have been considered to understand and accommodate, resulting in more future technological tools for the practice of executing work; this entails the high use of ICT tools in Higher Education as an indispensable element in the framework of the academic day, since its use has been decisive in strengthening the knowledge of technologies in their social environments, which is the basis for continuing to investigate and obtain other elements that collaborate to originate a complete technological discernment.

In this way, reliable conclusions are drawn from those that are specifically exposed so that it is feasible to develop a convenient assessment in that same line by other researchers and to correctly establish whether this research is used in other educational scenarios.

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