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Comparative Study on the Perception and Use of ICT in Public and Private Universities of Ecuador

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Abstract

This comparative study between public and private universities in Ecuador examines how Information and Communication Technologies (ICT) are integrated into and perceived in Ecuadorian higher education teaching. Using an adapted questionnaire and a Likert scale, data from university professors are analyzed, focusing on their attitude towards ICT and its impact on education. The results reveal mixed emotions from professors towards ICT, highlighting both positive aspects and challenges. A positive relationship is observed between the effective use of ICT and its acceptance, as well as a significant impact on educational effectiveness and student attitude. It concludes by emphasizing the need for a balanced and adaptive approach in the integration of ICT, underscoring the importance of developing digital and pedagogical skills and the implementation of effective educational policies and practices.

Keywords: *Information and Communication Technologies (ICT); Higher Education; Perception and Attitude; Integration and Pedagogical Effectiveness.*

Introduction

Innovative learning methods, which are an integral part of educational modernization, not only improve the teaching process but also transform society, fostering growth and proposing solutions to urgent problems (Skordoulis et al., 2022). According to Player-Koro (2012) argues that education has been selected by political powers as a key tool to bridge the gap between technology and society. In this vein, the integration of information, communication, and technology (ICT) in educational aspects implies the use of computer-based communications integrated into the daily instructional process in the classroom (Ghavifekr & Rosdy, 2015).

Muhammad et al. (2011) has defined ICT as one of the most used means to increase effectiveness and efficiency in the learning process. However, it is often noted that their effective integration is not an automatic guarantee of improved educational practices, highlighting the need for adequate infrastructure and teacher training (Araujo de Cendros & Bermudes, 2009). In this context, Pardo Gómez María Elena et al., (2007) emphasize that the use of ICT in higher education implies both a methodological and formative transformation, as de-spite significant efforts and resources allocated to educational computing by various governments, different studies indicate a lack of concrete evidence on improvements in educational levels due to ICT (Ottestad, 2010).

Teachers' perceptions and motivation in the use of ICT are two of the main factors determining the success of their integration into learning activities (Mubarak Al-Awidi &

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M Aldhafeeri, 2017). However, Mayo et al., (2011) note that there exists a paradox: although teachers feel equipped to use ICT, they frequently face difficulties in integrating it effectively. This challenge is magnified with the increase of non-face-to-face teaching and the emergence of new learning environments (Rienties et al., 2013). This diversity in the approaches and attitudes of teachers towards ICT, influenced by personal and contextual factors such as age, gender, and their educational level, is complemented by the influence of elements like infrastructure, training, and institutional support.

Scientific production in the field of knowledge establishes a correlation between the age of educators and their ability to handle ICT (Vera Noriega et al., 2014). Similarly, it is observed that educators, regardless of their age, show limitations in the use and efficient management of these technologies (Rosario Noguera & Vásquez Melo, 2012). Consequently, two main trends are described in teachers' perception of ICT: those reluctant to new forms of teaching and those willing to adopt innovative roles (Riascos-Erazo et al., 2012).

The process of adopting ICT in education is not limited to a single step but in-volves a series of continuous and permanent stages that support teaching and learning, as well as information resources (Young, 2003). This comparative analysis aims to offer a holistic perspective on how ICT is influencing higher education in Ecuador.

Review of literature and formulation of research assumptions

ICT from the Teacher's Perspective

From the teacher's perspective, Information and Communication Technologies (ICT) represent a significant shift in educational reform and are an integral part of the school curriculum, as suggested by Papanastasiou & Angeli (2008). However, the reality of their implementation does not always meet these expectations. A study cited by Sipilä (2013) from Kankaanranta & Puhakka (2008) reveals a decrease in the pedagogical use of ICT by teachers, accompanied by a lack of confidence in their ability to promote learning. The attitudes and perceptions of teachers towards ICT, according to Gilakjani et al., (2013), play a crucial role in their adoption and use in the classroom.

Teo (2008) have argued that the attitudes of both teachers and students are fundamental for the successful incorporation of technology in education. In this regard, research like that of Almekhlafi & Almeqdadi (2010) has examined the perceptions and methods of integrating ICT, finding variations in application and approaches among teachers.

Sipilä (2013) emphasizes the importance of understanding not only teachers' perceptions of ICT but also their competence and the obstacles they face. Additionally, studies like those of Göktas (2009) highlight the generally positive perceptions among teachers and their use of the Internet as a supportive tool, though they note the need for improved ICT competencies.

Based on the preceding analysis, the research hypothesis H1 was developed: "Positive attitudes of teachers towards ICT correlate with more effective use in the classroom and better academic outcomes in urban secondary schools."

Teacher Self-Efficacy in the Use of ICT

Teacher self-efficacy in the use of Information and Communication Technologies (ICT) is a critical factor influencing the quality and effectiveness of education in the digital age. Thomas & Hong (2013) suggest that ICT can facilitate the use of specific technological pedagogical knowledge and skills, while Trouche (2017) discusses instrumental orchestration techniques for human-machine interaction, both of which are crucial in the modern educational environment.

Teachers' affective variables, including attitudes, dispositions, beliefs, values, tastes, and preferences, along with beliefs about utility, subjective norms, and especially self-efficacy beliefs, are determinative in how and how much they use ICT in their teaching (Thurm & Barzel, 2020). However, it's important to recognize that there are obstacles and complexities, such as the perceived difficulty of digital integration, that can influence this self-efficacy (Clark-Wilson et al., 2020). Self-efficacy as the belief in one's own abilities to perform a task (Buket Akkoyunlu & Serap Kurbanoğlu, 2003). Teachers with high self-efficacy see difficult tasks as challenges to overcome, and this mindset is crucial when integrating new technologies into their teaching methods (Hodges, 2018).

Teacher self-efficacy is not only important for the successful implementation of ICT but is also related to job satisfaction and professional commitment, retention in the profession, and is a significant predictor of student motivation and achievement (Atashpanjeh et al., 2020). It is emphasized that a teacher's efficacy belief is a judgment about his or her abilities to achieve desirable student engagement and learning outcomes (Christophersen et al., 2016).

Based on the preceding analysis, the research hypothesis H2 was developed: "Teachers' self-efficacy in the use of ICT improves the integration and technological effectiveness in the classroom, positively impacting student learning outcomes."

Teacher Demographic Profiles

Gender is one of the most analyzed factors concerning the adoption and use of ICT. Vekiri & Chronaki (2008) observed that male teachers tend to use computer-mediated school activities more frequently than female teachers. Age is another demographic factor that influences teachers' relationship with ICT. Inan & Lowther (2010) discovered a negative correlation between teachers' age and their computer knowledge, often complicating the integration of ICT in teaching.

Additionally, the cultural characteristics of teachers can also significantly impact the adoption of ICT methods in education, as evidenced in studies exploring the benefits, disadvantages, and factors affecting the use of e-learning (Toro Gulavani & Joshi, 2013). The analysis of the academic literature review indicates that the way teachers perceive the incorporation of ICT in education in various settings has not been thoroughly explored. Therefore, this research aims to examine educators' opinions about access to ICT.

Based on the detailed exploration of how teacher demographic profiles influence the perception and utilization of ICT in education, the following research hypothesis can be formulated:

H4: The demographic characteristics of teachers, including gender, age, and cultural background, are significant predictors of their attitudes, self-efficacy, and adoption behaviors towards ICT in education.

Materials and Methods

The research was conducted using the adaptation and implementation of a questionnaire, which is the ideal instrument when seeking to acquire a large set of information from a population. For this purpose, it should contain easy to answer questions (Malhotra et al., 2017) . In terms of study design, this questionnaire was developed using references from specialized literature (Mahdum et al., 2019), and a five-point Likert scale was employed for structuring the questions, which were carefully adapted and modified, resulting in a total of 23 items.

It should be noted that the questionnaire was translated into Spanish to facilitate the collection and analysis of data, in addition to being configured using an electronic forms platform. Likewise, absolute confidentiality of the collected information was guaranteed,

ensuring careful and private handling of the data. Subsequently, it was disseminated among higher education academics through direct digital links, a methodology consistent with the guidelines and standardized protocols in the relevant scientific literature.

The sections of the questionnaire are detailed in Table 1, shown below.

Table 1. Questionnaire Format and Composition.

Questions	Description
1-3	Emotions about the use of ICTs
4-6	Perception of the impact of ICTs on society
7-10	Perceived contribution of ICT to productivity
11-15	Perceived effectiveness of ICT in education
16-20	Perception of the impact of ICT on students
21-23	Perceived self-efficacy

Regarding the sample size, it is important to note that there are various methodologies for determining it. Due to the lack of prior data, a more commonly used method proposed by Saunders et al. (2009) was employed. This method is based on the estimation of the total population of the research and a level of significance, which in this study was determined to be 5%, in line with the standards of previous research in the scientific field. Consequently, it was established that a minimum sample size of 225 observations would be adequate to ensure representativeness in this study (Tokmakidis et al., 2013). In total, 250 valid responses were obtained.

The data were analyzed using JASP software, where the primary objective of the study was to determine a relevant structure defined by the variables to be analyzed, starting with the existing correlation between the questions of the questionnaire defined by the different established dimensions. Therefore, the statistical analysis aims to verify whether, based on the data obtained, the instrument is indeed associated with the same dimensions.

Table 2 presents the demographic data of the participants, providing vital information on the composition and representativeness of the sample. It is important to highlight that men represent a significant majority in the sample, constituting 70.87%. In the context of this study, these findings corroborate gender representativeness in the research.

Table 2. Demographic Information of Survey Participants

		% Percent
Gender	Male	70,87
	Female	29,13
Age	25-35	15,27
	36-45	57,8
	46-55	20,45
	56-65	6,48
Level of education	Bachelor’s degree	23,56
	Master’s degree	60,85
	Doctoral degree	15,59
Years of experience	Less than 5 years	5,32
	5-10 years	17,76

	10-15 years	25,98
	15-20 years	22,45
	20-25 years	15,31
	25-30 years	7,55
	Más de 30 years	5,63
ICT certification	Yes	64,75
	No	35.25
Type of unit	Public	92,68
	Private	7,32

Regarding the age of the respondents, it is observed that most survey participants, representing 57.8%, are between 36-45 years old. This contrasts with the age group of 56 to 65 years, which obtained the lowest percentage, indicating a low representation of veteran teachers in the higher education workforce.

In terms of educational level, the group examined has a high level of academic training, as more than half of the surveyed teachers (60.85%) possess a master's degree. Additionally, regarding the level of knowledge, ICT certification was also considered. According to the research findings, 64.75% of the examined teachers have ICT certifications. Another characteristic of the surveyed group pertains to the type of unit in which they are employed. As per the data from Table 1, 92.68% of them are employed in public units. Lastly, it was noted that 50.94% of the examined teachers declared having an experience of 15 years or more. Moreover, it is highlighted that teachers with less than 5 years of experience were the least represented in the sample (5.32%).

Results and discussion

In the first instance, a principal component analysis was conducted, a multivariate statistical procedure whose objective is to transform the research variables into a new set of variables. This process involves identifying clusters of highly correlated variables to reduce the dimensionality of the data set without losing essential information. To perform this analysis, it was imperative to evaluate the suitability of the data. According to the data presented in Table 3, it was determined that these were sufficient and appropriate for such analysis, evidenced by a Kaiser-Meyer-Olkin value of 0.978 and a p-value < 0.01 in Bartlett's test of sphericity, indicating the relevance of applying this method in the present study.

Table 3. Outcomes of the Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity

Statistical Test		Values
Kaiser–Meyer–Olkin		0.920
Bartlett’s test of sphericity	Chi-Square	18,378.311
	p-value	< 0.01

The Cronbach's alpha coefficient was applied to assess the reliability of the com-ponents, which, according to Delgado Marroquín (2013), suggests that the results should be between 0.7 and 0.9, as lower values would indicate that the scale might be measuring different phenomena, as can be seen in Table 4.

Table 4. Alpha Coefficient Scores for the Identified Components

Component	Cronbach´s Alpha Value	Variables in the Component
Emotions from Using ICT	0.813	3
Perceived impact of ICT on society	0.853	3
Perceived effectiveness of ICT in education	0.965	5
Perceived impact of ICT on students	0.916	5

The results obtained on the emotions associated with the use of ICT in the educational field reveal a complex range of reactions. On one hand, they contrast with re-search such as that of Aivazidi et al. (2023), which indicate that emotions related to the use of ICT are positive, demonstrating a special interest among teachers in adopting these technologies and acquiring new knowledge for themselves. The relationship between effective use and acceptance of ICT aligns with the findings of D'silva (2007), where it was observed that perceived usefulness and ease of use, along with job relevance and compatibility with the computer, have a significant positive correlation with actual computer usage. The perceived effectiveness of ICT in education is manifested in the significant improvement of students' knowledge and skills because of ICT training (Harerimana et al., 2023). Studies on teacher self-efficacy and job satisfaction show that those with higher levels express greater satisfaction with their work and use more diverse and humanistic teaching methods.

The perceived impact of ICTs on students is mainly manifested in how their use improves their attitudes during learning, significantly increasing their motivation and enjoyment in the educational process. Nor were gender differences found in attitudes towards computers and self-efficacy in basic computer tasks. In addition, it is identified that students' ICT self-efficacy acts as a partial mediator in the relationship between perceived teacher support and their engagement in online learning.

The array of emotions and perceptions associated with the use of ICT in education highlights its complex and transformative impact. Positive experiences reflect a growing eagerness among teachers to embrace these technologies and expand their professional knowledge. The influence of ICT extends beyond the classroom, significantly shaping policy formulation and societal development. Its role in enhancing students' knowledge and skills is as evident as the need for a comprehensive approach to integrate it effectively into educational settings.

Conclusions

The comparative study on the perception and use of ICT in public and private universities in Ecuador concludes that there is significant variability in the integration and application of ICT in these educational settings. It highlights the importance of a balanced approach that addresses both technological infrastructure and the development of digital and pedagogical skills among teachers and students. Additionally, it suggests the need for educational policies and practices that promote effective integration of ICT, aligning with global trends in education and preparing educators and students for future challenges.

Therefore, it expresses the need for customized strategies in public and private universities to improve the use and perception of ICT in Ecuador. It emphasizes the importance of adapting education to the digital age, proposing greater investment in technological resources and training. The analysis suggests that greater integration of ICT can enrich the educational process, preparing students for the demands of the current

labor market and fostering a culture of innovation and continuous learning in the university setting.

Finally, the study concludes by emphasizing the importance of effective and collaborative leadership in universities to foster a proactive culture in the use of ICT. It highlights the need to overcome structural and pedagogical challenges to achieve a more effective integration of ICT, which in turn can significantly improve the quality of higher education in Ecuador. This comprehensive approach, which includes policy development, teacher training, and infrastructure improvement, is essential for a more adaptive, interactive education aligned with the technological and educational demands of the 21st century.

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