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Challenges Faced by Teachers When Integrating Technology in the Teaching of Virtual Courses in a Higher Education Institution

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Abstract

Justification: Latin America is undergoing dizzying changes in virtual education as part of an educational strategy to reach a greater number of students and be able to guarantee access to higher education. Compliance with this strategy has faced difficulties due to the challenges of integrating technology into virtual courses in academic institutions. **Main objective:** Examine the challenges that teachers face when integrating technology into the teaching of virtual courses in a higher education institution. **Methodology:** The study design was descriptive-correlational. The selection of the sample was carried out by convenience and included the participation of 140 teachers from a private university in Puerto Rico. Data was collected through a validated questionnaire. **Results:** The most common challenges that teachers face when offering virtual courses through the integration of technology are linked to the use of free platforms by the university which deletes recorded classes in a limited time (30%) and access to online support services offered by the university (27.1%). The areas of the least difficulty presented by teachers were keyboard management and skills (89.3%) and programming and teacher-student interaction outside of class hours (88.6%). Furthermore, a negative relationship was found between having certifications to offer virtual courses and prior technological education with the use of technology ($r = -.525$; $p < .01$). **Conclusion:** Teachers present a few difficulties in managing technology in virtual courses and this is related to obtaining prior preparation in educational technology. Implications: Having a certification or preparation related to educational technology significantly minimizes the degree of difficulty that teachers may experience in the use of technology in teaching virtual courses.

Keywords: distance education, higher education, university course, technology

1. Introduction

Latin America is experiencing rapid changes in virtual education as part of an educational strategy to reach a greater number of students and guarantee access to higher education for certain sectors of society, which represents academic and social advancement in these countries. With a population of approximately 617 million, it spans North, Central, and South America and includes 19 countries with similar cultural, linguistic, and historical backgrounds. These include: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, the Dominican Republic, Puerto Rico, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. These countries have made progress in increasing virtual or distance learning offerings after the pandemic (Ferreyra et al., 2017).

In 2018, approximately 28 million students enrolled in higher education institutions in Latin America. While virtual education has increased by over 20% in university institutions compared to before the pandemic (World Bank, 2021), during the COVID-19 pandemic, higher education institutions have had to rethink how they deliver academic offerings to a generation of technological students. Consequently, virtual courses and programs have increased in university institutions because of the need to integrate into the globalization and internationalization of their academic offerings. This allows universities to be more competitive and position themselves as an educational alternative for international students. This change can be seen as a marketing process and an attempt to increase economic stability during a world experiencing an economic recession (Abreu, 2020).

Institutions participating in this transformation have developed distance education standards to ensure that their academic programs can meet the required academic rigor (Vilca et al., 2022; Literat, 2015). In addition, universities have acquired digital or electronic platforms on which they can transmit or display the content of virtual courses or academic programs. Among the most widely used tools are Learning Management Systems

(LMS). An LMS is web-based software that offers modules for the administrative and monitoring processes required for an educational system. These include modules that allow, among other things, course configuration, student enrollment, faculty registration, and grading (García Peñalva, 2005).

Despite the benefits that distance education can provide in higher education, this has become a challenge for teachers (Loncar et al., 2014). According to Valdivia-Vizarreta and Noguera (2022), it has been shown that developing appropriate virtual learning environments for students has generated several challenges (Markova et al., 2017; Ferri, Grifoni, & Guzzo, 2020). This is because teachers must maximize the use of teaching strategies other than face-to-face ones so that courses become positive learning scenarios (Llorente Cejudo, 2014; Martínez & Prendes, 2014). When traditional universities decided to adopt virtual teaching in some of their programs, it was not easy to demonstrate the quality of the programs and comply with the regulations that accredit these programs (Telli & Altun, 2020; Trust & Whalen, 2020). The lack of preparation at the institutional and technical levels, and the shortage of human resources trained in technology and computing are problems that affect academic offerings (Turnbull et al., 2021; Tulaskar & Turunen, 2022). Among the challenges faced by teachers that affect the quality of teaching are the lack of internet connectivity and failures in students to access the platforms (Kumar et al., 2017). In addition, gaps have been identified in the level of digital literacy and accessibility to technology for educators and students, which is often a pressing requirement to be able to offer and take distance courses (Octaberlina & Muslimin, 2020; Abu Talib et al., 2021; Nicklin et al., 2022). The lack of appropriate or sufficient technological devices at home and reliable internet aggravate the problem of virtual education. Given these difficulties, many students were unable to attend classes regularly as required, jeopardizing the quality of their academic preparation (Telli & Altun, 2020; Nicklin et al., 2020; Cesco et al., 2021).

Another barrier that educators and students have encountered when using distance learning courses is their attitude toward this modality. Many educators and even students have undermined and minimized the educational process by uploading reading materials to the platform or connecting to it to discuss a topic. Thus, the impression regarding the guidelines and requirements for blended and distance learning in course design and delivery is that they are simpler courses with a lower degree of difficulty than in-person education (Nuere & De Miguel, 2021; Callo & Yazon, 2020). On the other hand, although not all experiences among educators and students with virtual education are negative, the challenges teachers face with the use of technology in higher education teaching certainly remain a clear problem in university institutions (Bdair, 2021; Murphy, 2020; Camilleri, 2021).

These negative experiences with the use of technology, platforms, and virtual course development have led teachers to associate these situations with contradictory effects on student learning. Consequently, teachers often become more resistant to the integration of technology in their classrooms and have been led to resist using any element of distance or blended learning (Sun & Chen, 2016). In fact, some educators have judged distance education to be of lower quality and less reliable than in-person education, a dilemma that has remained unresolved for decades (Argandoña et al., 2020; Jiménez & Ruiz, 2021).

Despite extensive research on virtual education in Latin America, previous studies present significant limitations. First, most have focused on technological and infrastructural aspects, without delving into the pedagogical experiences of teachers. Second, there is a scarcity of research that systematically analyzes faculty resistance from a multidimensional perspective that integrates institutional, personal, and formative factors. Third, many studies have failed to establish a clear connection between technological challenges and their concrete effects on educational quality. This innovative study seeks to fill these gaps through a comprehensive analysis of teaching challenges in technological integration, examining not only technical obstacles but also attitudinal and pedagogical factors that condition the effective adoption of virtual education in higher education institutions. To this end, the main objective of this study was:

- To examine the challenges educators face when integrating technology into virtual courses at a higher education institution.

2. Materials and Methods

This research used an ex post facto descriptive correlational design. According to Hernandez-Sampieri et al. (2014), a descriptive design "aims to investigate the incidence of the modalities or levels of one or more variables in a population" (p. 152). Regarding the correlational design, Herbas and Rocha (2018) indicate that it is used to determine the relationship between two or more variables. This means analyzing whether an increase or decrease in one variable coincides with an increase or decrease in the other variable (Hernández-Sampieri et al., 2014).

The study population consisted of professors at a private university in Puerto Rico, which includes faculty from different Latin American countries and belonging to different academic schools. This population consisted of 137 full-time professors and 283 part-time or contract professors, for a total of 420 professors. Of these, approximately 135 faculty members were excluded who had not offered online courses during the January-May 2023 academic semester, for a total of 285 potential professors who could be included in the study. The study sample was chosen based on convenience. According to Hernandez-Sampieri et al. (2014), convenience sampling is a non-probability sampling technique used to create samples based on ease of access and the availability of individuals to be part of the sample within a given period. The sample inclusion criteria were: 1) Full-time or part-time professors working at a university, and 2) Professors who had offered at least one online course. The sample exclusion criteria were: 1) Professors who offer only in-person courses. The study data were collected using an instrument titled: Questionnaire to Measure the Challenges Faculty Face When Integrating Technology into Virtual Courses at a Higher Education Institution. The questionnaire was developed by researchers based on a review of literature related to the study topic. It consists of two parts. The first part explores sociodemographic data. The second part measures the challenges faculty face when integrating technology into online courses. This questionnaire underwent content validation testing through a panel of experts, as recommended by Polit and Beck (2022), in which it obtained 90% approval by the 10 experts who evaluated it. Likewise, the questionnaire underwent internal reliability (consistency) validation. To this end, a pilot test was carried out with approximately 20 faculty members working at a private higher education institution located in Puerto Rico. In this pilot phase, the mean, SD, median, scale range, Cronbach's α if the item is excluded, and Cronbach's α for each subdimension were determined. The item ranged from 4.98 ± 0.13 to 4.70 ± 0.53. The total Cronbach's α was 0.808, representing a satisfactory level of internal consistency for the items.

The statistical analysis plan was descriptive and correlational, aimed at answering the research questions. The Statistical Product and Service Solution (SPSS) version 25 software was used to calculate and analyze the statistical data. The Pearson correlation coefficient (r) was used to calculate the inferential statistics with a 5% margin of error.

This statistical analysis was used to measure the following study variables, which are defined below:

- Challenges: This is a difficult objective to achieve and constitutes a challenge for those who decide to address it during their work duties or roles within an institution (Perez & Gardey, 2010).
- Technology in teaching: This is the scientific approach adapted to computer systems that provide educators with valuable tools for planning and implementing course content (Meza Izquierdo, n.d.).

3. Results and Discussion

The study included 140 professors from a private university in Puerto Rico, which includes faculty from various Latin American countries. They met the criteria of having offered at least one online or virtual course during the January-May 2023 academic semester. The sample of study participants was composed predominantly of female faculty (64.3%, n=90), as shown in Figure 1. The male group comprised 50 faculty members (35.7%). This gender profile is consistent with studies conducted by Mateus et al. (2022) and a study by Balbachevsky (2016), which indicate that most faculty members in higher education institutions are female.

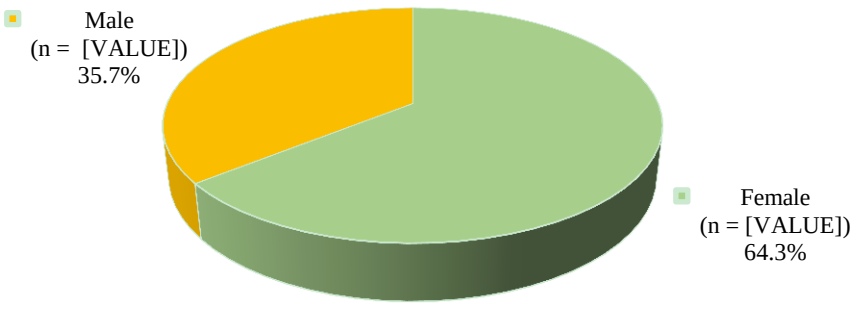

Figure 1. Distribution by gender

Furthermore, the participating professors were mostly between the ages of 55 and 64 (32.9%, n = 46). Half of the professors held a doctorate as their completed doctoral degree (50%, n = 70). In terms of the professors' country of origin, the majority were from Puerto Rico (64.3%, n = 90), followed by 5% to 8%, represented by the continental United States (n = 11), the Dominican Republic (n = 9), and Colombia (n = 8). According to Ramirez (2022), professors at higher education institutions in Latin America have been aging. The baby boomer generation poses a challenge for universities to replace highly experienced professors, as they are in the process of retiring and voluntarily withdrawing. This retirement entails individual expectations for those affected, as well as an important social impact on the changes that must occur in university institutions (Almeida, 2015). However, it is noteworthy that university professors come from diverse ethnic origins and countries. Studies cited by Ferreyra et al. (2017) indicate that, as part of their internationalization efforts, universities have recruited faculty from diverse cultures or racial backgrounds to project their image of diversity internationally. In fact, it has been shown that inviting faculty from internationally renowned faculties from other countries contributes to the academic excellence offered at these academic centers, an aspect that can be gleaned from the results of this study.

As part of the profile of the study participants, their years of experience as university professors were also examined. In this regard, it was observed that the majority had 6 to 10 years of teaching experience (n=47), representing 33.6%. Regarding this matter, Ramirez (2022), Cekada (2012), and Cervetti (2014) indicate that as "baby boomer" teachers are replaced, it is not unusual to find faculty with less experience in higher education institutions. This can affect the quality of teaching if institutions do not take the time to recruit specialists and experts in the different academic programs offered by university centers. Likewise, when examining the data corresponding to the time that professors have been offering distance or virtual courses, Figure 2 shows that 56.4% had been offering them for 1 to 5 years (n=79) and 20.7% had been offering them for 1 to 5 years (n=79). These data coincide with studies carried out by Ruiz (2017), Murphy (2020), Chacin et al. (2020), and Nicklin et al. (2022), which indicate that most university professors do not have experience offering distance or virtual courses or their experience is recent. In fact, this factor has been identified as one of the challenges faced by all faculty members because of the COVID-19 pandemic. The lack of experience in using technology and integrating it into virtual courses became a challenge to overcome, given the limited experience some faculty members have in this area.

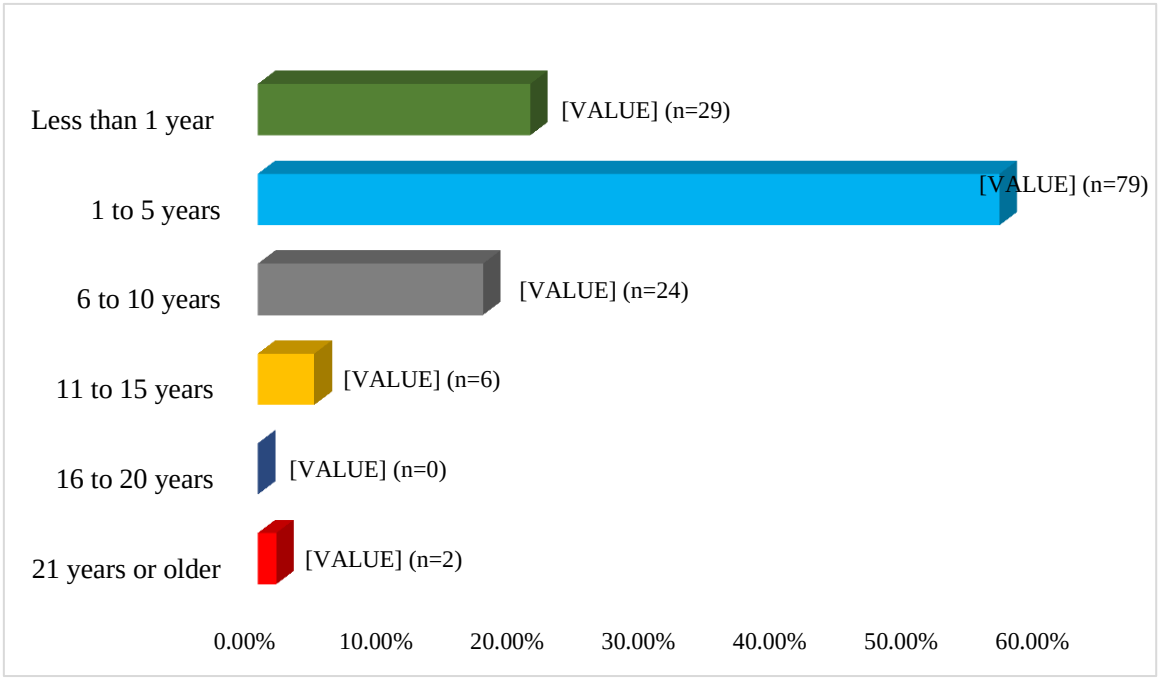

Figure 2. Distribution by time offering online distance or virtual courses

Additionally, data on teachers were examined regarding whether they held a distance education certification, reflecting that the majority (88.6%) held such a certification. Another aspect investigated in the study was how prepared teachers felt to offer fully remote courses. The information seen in Figure 3 shows that most teachers felt moderately prepared (45.7%, n=64). These data coincide with a study conducted by Burns (2023), which states that in response to the spread of the coronavirus disease (COVID-19), governments enacted "continuous teaching and learning" policies, with most universities moving toward online education. This transition occurred in a short period of time, with millions of teachers beginning to teach in front of a computer screen, while their students had to stay home and take courses online. This left some teachers and students unprepared for the process, even after receiving guidance or even certifications to train them in using virtual teaching platforms (United Nations Educational, Scientific and Cultural Organization, UNESCO, 2021, 2019). Palvia et al. (2018) found in their study that despite offering workshops and certifications to teachers to become experts in offering virtual courses, not all of them achieved these competencies. This data is consistent with that found in this study, which confirms that teachers feel moderately prepared to offer virtual courses even after receiving certification or taking workshops on distance education (Hordatt & Haynes, 2021).

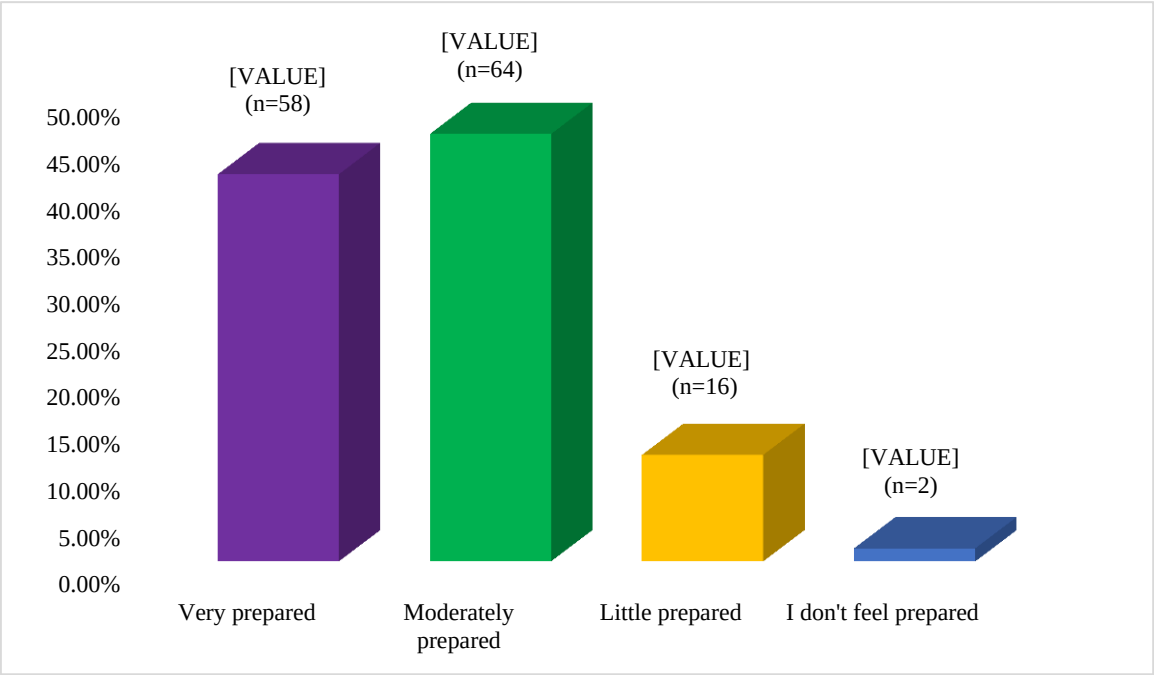

Figure 3. Distribution by how prepared they felt to offer fully distance courses

Regarding the level of difficulty, they experienced adapting during the transition from in-person to distance learning courses, many educators indicated that they experienced some or little difficulty (n = 66, 47.1%). These data coincide with a study conducted by Contreras et al. (2021), where the virtual modality, if necessary, can be faced by most of the faculty with minimal difficulty. Although the transition from in-person to virtual classes in some institutions has been successful, students and faculty encountered difficulties and disadvantages in using platforms for online classes, especially when it came to administering exams and interacting between faculty and students. Along these same lines, a study conducted by Atwa et al. (2022) showed that faculty and students reported that addressing online education was not difficult, although the transition was not easy. Contrary to what Villa et al. (2020) argue, as part of the results of their study, universities are not prepared to address distance education and struggle to meet the accreditation and quality standards expected in professional programs. Consequently, universities such as teaching centers, faculty, and students face difficulties or challenges to overcome to ensure the quality of teaching through Information and Communication Technologies (ICT) in virtual programs. These aspects have been considered as part of the objectives outlined in the results of these programs below:

The first objective under study aimed to identify the challenges or difficulties that teachers face when dealing with virtual courses and managing virtual platforms. As a first finding, it should be noted that most teachers indicated that they faced some or no difficulties associated with ICT-related challenges. However, when examining the percentages in the classifications of high or moderate difficulty, five aspects stood out that represented challenges for more than a quarter of the teachers who offered at least one virtual course. Table 1 reveals that the most common challenge that teachers faced when facing the use of technology in teaching was linked to the institutional use of a free platform that deletes recorded classes in a limited time of two weeks to 15 days (30%), followed by access to online support services offered by the university for teachers (27.1%), having high or moderate difficulty in the management and use of strategies for both measurement and student evaluation, along with virtual teaching strategies and techniques (25%), to this are added the difficulties of using technology to promote interaction with students (24.3%). Studies carried out by Tito et al. (2022) support these results. These authors found that the adaptation to online education exposed significant educational gaps between faculty and students, resulting in a lack of motivation in academic work because institutions were not organized to adapt teachers to technological integration. In fact, Salifu and Abonyi (2023) show that teachers' complaints generally focused on environmental limitations and inadequate institutional support, those whose difficulties included the use of virtual tools with which they had no experience, where the lack of institutional support emerged as a determining factor in improving teachers' digital literacy. Likewise, studies carried out by Campbell and Daley (2017) and Cayo and Agramonte (2020) report difficulties in virtual courses in those careers that include clinical practices, since virtual simulators are required that universities sometimes did not have, causing significant difficulties in ensuring that students could achieve the skills required during their professional training. In fact, the faculty encountered difficulties in assessing students theoretically when offering unsupervised exams and faced challenges in assessing students when they had to measure manual skills (dexterity) for handling patients or performing procedures, for example.

Table 1. Most common challenges faced by teachers in the use of technology in higher education teaching

Challenge	Difficulty level		
	Much	Moderate	Total
The institution is not licensed; therefore, it uses a free platform, and recorded classes are deleted within two weeks to 15 days.	20.0	10.0	30.0
Access to the virtual support services offered by the university for instructors.	4.3	22.9	27.1
Management and use of virtual student measurement and evaluation strategies.	1.4	24.3	25.7
Management and use of virtual teaching strategies and techniques.	3.6	21.4	25.0
Interaction with virtual students.	3.6	20.7	24.3

The second objective under study investigated areas that did not represent a substantial challenge or difficulty for teachers when confronting or using technology in the teaching process. In this regard, most teachers (70% to 89.3%) agreed that they faced little or no difficulty when integrating technology. However, it is worth highlighting the most common areas in which more than 82% of teachers identified little or no difficulty when applying technology to teaching virtual courses: keyboard management and skills (89.3%), programming and teacher-student interaction outside of class hours (88.6%), and the integration as an educator with the technologies or applications required in the virtual course (87.9%), handling of various devices for use in virtual courses (84.3%), access to the platform (83.6%), and ability to organize content within it (83.5%), among others (See Table 2). Part of the data reflected in this study is confirmed by another research related to the subject. Dung (2020) shows that virtual courses were recognized by many professors for their positive impacts on the student's learning experience and that they had little or no difficulty in offering virtual courses. Adding to this premise, Aquino et al. (2021) states that the pedagogical experience is enriched, and better knowledge is acquired, and skills are developed through collaborative work in virtual classrooms, an aspect that is reflected when the teacher possessed the skills and digital literacy necessary for the integration of technology. Meletiou et al. (2022) point out that, by easily handling the applications and platforms where virtual courses are structured, faculty members enable

students to acquire pedagogical experiences and access to technology, achieving the learning required in distance education courses.

Table 2. Most common areas that teachers identify with little or no difficulty when applying technology in teaching virtual courses in a higher education institution

Area	Difficulty level		
	Some or little	None	Total
Keyboard skills and handling	27.9	61.4	89.3
Programming and interaction between instructors and students to answer questions, answer questions, or hold virtual meetings outside of class hours	44.3	44.3	88.6
Integration as an educator with the technologies or applications required for the online course	39.3	48.6	87.9
Proficiency in using a computer, desktop, or tablet with a microphone and camera for use in online courses	25.7	58.6	84.3
Access to the platform (steps to follow) to access the virtual course	32.9	50.7	83.6
Ability to organize platform content to offer the virtual course	41.4	42.1	83.5
The platform used by the university to offer online courses (e.g., Blackboard, Canvas, Moodle, Microsoft Teams, etc.)	36.4	46.4	82.8
Unlimited access to a reliable digital device (e.g., laptop, tablet, etc.)	30.7	52.1	82.8
Access to a printer to offer online course materials	32.9	49.3	82.2

The third objective of research was to establish whether there was a relationship between the degree of difficulty that teachers exhibited regarding the use of technology in their teaching process when considering whether they had distance education certification when offering virtual courses. To answer this question, the total score of the degree of difficulty of teachers in the use of technology in teaching virtual courses was calculated taking into account the following scale: From 1 to 20 points corresponded to No difficulty, from 21 to 40 points it was Some or Little difficulty, from 41 to 60 points it referred to Moderate difficulty, and from 61 to 80 points it referred to Great difficulty. According to the distribution by the degree of difficulty calculated, 50.7% of teachers exhibited some or little difficulty. This group is followed by 33.6% who fell under the alternative that reflects moderate difficulty, and 20 teachers reported facing no difficulty (14.3%), while two experienced a lot of difficulty (1.4%). Studies such as those conducted by Mateus et al. (2022) point to the need for relevant training in the management of ICTs for faculty, as well as strategies to address connectivity gaps, the lack of adequate environments, and work overload, since although the majority presented mild or low levels of difficulty in managing technology in the virtual classroom, there were aspects that they did not fully master. Perdomo et al. (2022) concluded in their study that faculty of virtual academic programs must be experts in the management and integration of technology. However, the faculty that offered online courses, although the majority mastered the platform used by the university, needed a training plan to continue offering quality education with effective teaching methodologies and models. In other words, although the majority of faculty can master ICTs in their classrooms, there is still a high percentage of teachers in higher education institutions who do not have the mastery or the necessary skills to offer a virtual course at levels of excellence and that manage to meet student expectations and academic regulations and accreditations (Vasquez et al., 2022).

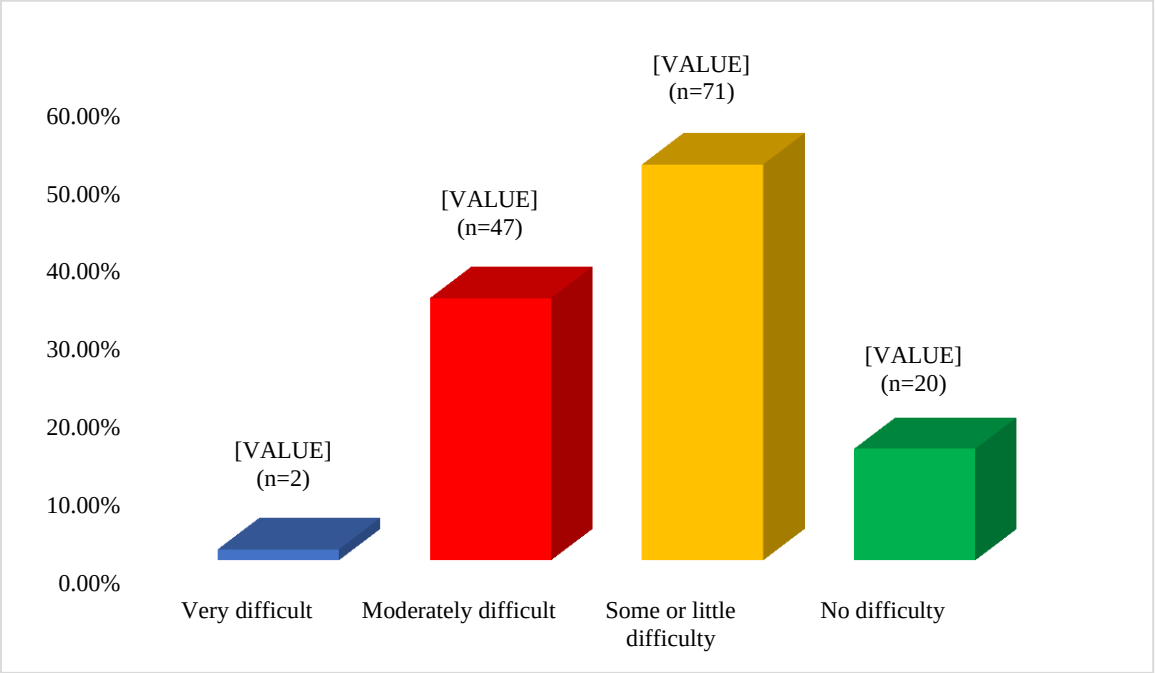

Figure 4. Distribution by degree of difficulty of teachers in the use of technology in teaching virtual courses

In fact, the analysis corresponding to the last and third objective continued with the calculation of Pearson correlation coefficients between the degree of difficulty teachers had in using technology in teaching virtual courses and holding a distance learning course certification. This correlation test presents coefficients that can fluctuate between $-1 \leq \rho \leq 1$. In this way, the degree of relationship or association existing between the two variables examined is measured (Polit & Beck, 2022).

Table 3 shows that the results of the relationship test reflect a negative relationship between the degree of difficulty teachers had in using technology in teaching virtual courses and holding one of the two types of certifications evaluated. A negative correlation was found between the degree of difficulty using technology in teaching virtual courses and holding a distance learning teacher certification, but this was not statistically significant ($r = -.043$; $p > .05$). In contrast, the correlation between the degree of difficulty teachers experiences in using technology to teach virtual courses and whether they hold a certification or were able to take teaching-related courses as part of their academic preparation was negative and significant ($r = -.525$; $p < .01$). This suggests that having a certification or preparation related to education, teaching strategies, measurement and evaluation, or other teaching topics significantly minimizes the degree of difficulty teachers may experience in using technology to teach virtual courses. There is no doubt that a faculty member's prior preparation related to a teaching career that includes technology integration, technological education, or digital literacy is related to success in implementing virtual courses (Ruggenthaler et al., 2015; Buckley, 2020; Dung, 2020; Lao et al., 2021). Likewise, teacher training during their formative years where the topics of educational technology and its use in the classroom have been integrated are observed with an advantage over those teachers who did not obtain said knowledge (Rizvi & Nabi, 2021; Contreras et al., 2021; Kebritchi et al., 2017). Given this reality, it is important to highlight the responsibility that higher education institutions must continue preparing and developing their faculty so that they can be part of the ICT era in the 21st century and transform virtual education into a real alternative in the university centers of their countries of origin (Sahito et al., 2022).

Table 3. Pearson Correlation Coefficients between the degree of difficulty of teachers in using technology in teaching virtual courses and having a certification to offer virtual courses or courses on topics related to teaching

		Degree of difficulty of teachers in the use of technology in teaching virtual courses	He has a certification as a distance learning teacher.	You have a certification or as part of your academic preparation you were able to take courses related to teaching.
Degree of difficulty of teachers in the use of technology in teaching virtual courses	*r*	1	-.043	-.525**
	p		.615	.000
	n	140	140	140
Has distance learning certification (to be able to offer virtual courses)	*r*	-.043	1	-.003
	p	.615		.975
	n	140	140	140
You have a certificate or as part of your academic preparation you were able to take courses related to teaching (education, teaching strategies, measurement and evaluation, etc.)	*r*	-.525**	-.003	1
	p	.000	.975	
	n	140	140	140

**. The correlation is significant at the 0.01 level (two-tailed).

4. Conclusions

The study reveals that the most common challenge faculty faced when using technology in higher education teaching was linked to the institutional use of a free platform that deletes recorded lectures within a limited timeframe of two weeks to 15 days, followed by access to online support services offered by the university for faculty. Concurrently, the study showed that most faculty felt they faced fewer difficulties integrating technology into their virtual classrooms in the following areas: keyboarding skills and programming, and faculty-student interaction outside of class hours. When the correlational analysis was conducted, more than half of the faculty members reported some or little difficulty. In fact, the results obtained reflect a negative relationship between the degree of difficulty faculty experienced in using technology in teaching virtual courses and holding one of the two types of certifications evaluated. To this end, it can be concluded that teachers experience few difficulties using technology in online courses, and this is related to their prior training in educational technology.

The implications of this study's results for the practice and development of educational technology are that having a certification or training related to educational technology significantly minimizes the degree of difficulty teachers may experience in using ICTs in teaching online courses. The benefit of this research's findings is the understanding that universities must have all the necessary elements for online teaching and establish a formal structure for online programs that reflects the regulations of each country and accrediting agencies to ensure that online programs and courses meet all the requirements for educational excellence. Likewise, it is important to consider the perceptions of students and teachers as crucial elements for teaching online classes and to leverage these lessons to better face the future. In short, to address the challenges of virtual education and the integration of technology in the classroom, higher education institutions must provide professional development for instructors, training for students, and technical support for content development. These findings undoubtedly call attention to faculty involved in virtual teaching, who must personally seek to continually update their skills and competencies in virtual delivery because it is an evolving educational approach in this emerging century.

The limitations of the study are centered on the type of sample selected, which was a convenience sample, which prevents generalization of the findings, and the fact that not all faculty members from the different academic programs were equitably represented. Therefore, given the findings of this study, future research on university students' perceptions and digital literacy is necessary. Likewise, studies should be conducted on faculty

perceptions of the use of virtual courses and students' academic achievement. Access to virtual education remains a challenge, so studies must be conducted to address the inequalities that hinder access to virtual education. Similarly, another challenge that must be investigated is careers such as nursing, medicine, and engineering, among others, which require the development of service-oriented skills. This makes it pertinent to investigate how virtual simulation can offer a real alternative to increase the skills required in each of these professions.

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