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University teachers' attitudes towards ICTs and the use of virtual environments during the COVID-19 pandemic

Actitudes hacia las TIC y uso de los entornos virtuales en docentes universitarios en tiempos de pandemia de la COVID-19

在COVID-19疫情期间大学教师对信息通信技术的态度和对虚拟环境的使用

Отношение к ИКТ и использование виртуальных сред преподавателями университетов во время пандемии COVID-19

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Resumen

El objetivo de la presente investigación ha sido determinar la relación entre la actitud hacia las tecnologías de la información y de la comunicación (TIC) y el uso de los entornos virtuales de enseñanza-aprendizaje en los docentes de la Universidad de Huánuco (Perú), en tiempos de la COVID-19. El estudio se sustentó en el paradigma positivista, enfoque cuantitativo, método analítico y diseño correlacional. La muestra estuvo integrada por 210 docenes a quienes se les aplicó la escala de actitud del docente hacia las TIC y el cuestionario de uso de entornos virtuales en enseñanza-aprendizaje. Como resultado, se halló una relación positiva (r_s = .53) y significativa (p = .00) entre ambas variables. Se concluyó que el uso de los entornos virtuales está relacionado positiva y significativamente con las actitudes hacia las TIC en los docentes universitarios de la muestra; es decir, a mayor actitud positiva hacia las TIC mayor uso de los entornos virtuales.

Palabras clave: entornos virtuales, actitud docente, tecnologías de información, docente virtual.

Abstract

The aim of this research was to determine the relationship between the attitude towards information and communication technologies (ICTs) and the use of virtual teaching-learning environments on the part of teachers at the University of Huánuco (Peru) during the COVID-19 pandemic. The study was based on the positivist paradigm and consisted of a quantitative approach, analytical method and correlational design. The sample comprised 210 teachers to whom the teacher's attitude towards ICTs scale and the questionnaire on the use of virtual teaching-learning environments were applied. As a result, a positive (r_s = .53) and significant (p = .00) relationship was detected between both variables. It was concluded that the use of virtual environments was positively and significantly related with the attitudes towards ICTs of the university teachers in the sample; in other words, the more positive the attitude towards ICTs, the greater the use of virtual environments.

Keywords: virtual environments, teaching attitude, information technologies, virtual teacher.

摘要

本研究的目的是确定瓦努科大学（秘鲁）教师在COVID-19期间对信息和通信技术（ICT）态度与对虚拟教学环境使用之间的关系。该研究基于实证主义范式，使用定量分析方法和相关性研究设计。研究的分析样本由210位教师组成，并使用了教师对ICT态度的量表和关于在教学中使用虚拟环境的问卷。结果显示，在两个变量之间呈现显著性（p = .00）正向关系（r_s = .53）。结论得出，虚拟环境的使用与样本中大学教师对ICT的态度成正相关且显着相关；也就是说，对ICT的态度越积极，对虚拟环境的使用就越多。

关键词: 虚拟环境,教师态度, 信息技术, 虚拟教学。

Аннотация

Целью данного исследования является выявление взаимосвязи между отношением к информационным и коммуникационным технологиям (ИКТ) и использованием виртуальной среды преподавания-обучения у преподавателей Университета Уануко (Перу) во времена COVID-19. Исследование было основано на позитивистской пара-

дигме, количественном подходе, аналитическом методе и корреляционном дизайне. Выборка состояла из 210 учителей, которым были предложены шкала отношения учителей к ИКТ и опросник по использованию виртуальных сред в преподавании и обучении. В результате была обнаружена положительная (rs = .53) и значимая (p = .00) связь между обеими переменными. Был сделан вывод, что использование виртуальных сред положительно и значительно связано с отношением к ИКТ у преподавателей университетов в выборке; то есть, чем более позитивное отношение к ИКТ, тем больше использование виртуальной среды.

Ключевые слова: виртуальные пространства, отношение к обучению, информационные технологии, виртуальный учитель.

Introduction

In these times of pandemic, globalisation and the massification of so-called Information and Communication Technologies (ICTs), as explained by Goller and Andrés (2012), have transformed "virtual" education, under the modalities of non-traditionalist or conventional online education, into the most common offensive methodological response adopted by countries to respond to the challenges arising in education deriving from the right to universal education, coverage and flexibility, demanded by demographic growth as an alternative to traditional face-to-face educational systems. In this regard, Pando (2018) argues that technological progress and virtual education seek to positively influence teaching-learning processes.

The incorporation of ICTs in daily activities is not a new phenomenon in this context. The presence of ICTs in information exchange processes is increasing. For this reason, the incorporation of technology in educational processes is seen as something more than a fad and is becoming increasingly important in academic programmes in educational/training contexts (Moreira & Delgadillo, 2014). In this respect, the use of virtual environments should stimulate the construction of students' knowledge to enable them to effectively adopt innovative learning strategies, in both virtual and face-to-face education, where there is also permanent interaction between teachers and students. Work in a virtual classroom must be divided into stages using new approaches since technology has created disruptive teaching-learning spaces (Moreira & Delgadillo, 2014).

Education is currently one of the most important values for society, in which investment in more virtual resources is a priority.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) indicates that university teachers play an important role in the learning process of students, as they are responsible for designing and facilitating learning opportunities such as suitable classroom environments. In this sense, Ahedo and Danvila (2013) allude to the fact that the virtualisation of education and the appearance of new technologies are tools that must be used to improve the educational level of students. However, it is very important to highlight that the teaching-learning process does not only consist in the transmission of knowledge, but also in the socio-formative impact on the learner. Thus, it must be designed to foster reflection on pedagogical practices and the adoption of socio-education in the curricular management of universities (Ruiz-Aquino & Ortiz, 2019).

According to Londoño (2013), teachers and also students must focus on new roles within the academic context and based on virtual methodologies that prioritise planning and the creation of learning environments. In this context, teacher training and teachers' attitudes towards ICTs are key elements for the success of innovative processes in the university context, in which virtual environments are fundamental. In this regard, Fernández (2009) adds that even with sufficient technological resources and teachers with proper training in their use, the level of integration of virtual environments will depend on their attitudes. Today, practising teachers need to be prepared to offer their students ICT-supported learning opportunities in order to use them and to understand how they can contribute to student learning. Therefore, these competences are currently an integral part of university teachers' profiles (Londoño, 2013).

In these times, the teacher paradigm has changed since teachers are now seen as "counsellors", "experts" or "facilitators" who provide guidance and feedback on processes instead of imposing them. In this teaching-learning paradigm, teachers, as virtual tutors, must exhibit and fulfil a series of characteristics and attributes in order to guide and promote dynamic educational processes (Moreira & Delgadillo, 2014). Virtual education also offers the opportunity for students to maintain permanent interactive contact with contents, teachers, materials, different interactivities, feedback and contacts specifically enabling the pedagogical use of ICTs (Londoño, 2013). As Moreira and Delgadillo (2014) explain, better use of virtual environments requires technologies and materials, as well as teachers with ICT skills who can teach subjects effectively, integrating virtual environments into their teaching (Hiraldo, 2013), thus enabling participants to work in their own time and space.

Baelo and Cantón (2009) revealed the existence of two groups of teachers: those who resist technology-mediated change; and those who are open to innovation and systematisation in teaching. These authors also maintained that the use of academic virtual environments fuels scepticism, fatigue, stress, anxiety and ineffectiveness, and may cause fatigue, discontent, dissatisfaction and difficulties in adapting, possibly coinciding with, for example, the symptoms mentioned previously in spite of the need to promote technology-mediated university education. According to Bandura (1973), some of the most negative consequences of the use of virtual environments by university teachers are permanent stress, emotional fatigue and ultimately, as a result of the foregoing, burnout syndrome.

In Guadalajara (Mexico), Padilla (2018) showed that the obstacles to the integration of ICTs were the lack of pedagogical support in 12% of cases, the need for teacher training in virtual environments in 20%, lack of institutional support in 8%, more flexible organisation of educational times and spaces in 14% and the reluctance of teachers to implement technologies in 17%. In Colombia, Mejía et al. (2018) found that a greater percentage of teachers expressed an unfavourable attitude towards the use of virtual environments. In Costa Rica, Echeverría (2014) found that teachers displayed a readiness and interest for incorporating ICTs to support their teaching. They also observed the need for training to promote the greater and better use of these technological resources.

In Lima (Peru), Alcas et al. (2019) found that teachers presented four levels of technophiles, 46.2% of teachers had low levels of technostress. Also in Lima, Reátegui et al. (2015) found that teachers' attitude towards ICTs was favourable (86%), whereas only one third of teachers displayed a very favourable attitude. In Huánuco, Rojas et al. (2018) showed that, regarding the use of technologies, teachers obtained the following results in the pre-test with respect to skills in the use of information (9.1%),

communication (22.7%), content creation (40.9%) and in 27.3% none of the aforementioned competences were dominant. Likewise, the results of the post-test were as follows: information management (72.7%), communication (18.2%) and content creation (9.1%).

This study is justified because previous studies have reported that teachers do not always have very unfavourable attitudes towards the use of virtual environments in teaching-learning. Therefore, it is already a matter of controversy and represents a problem in university education, since it has a negative impact on the teaching-learning process, thus preventing students from being able to develop specific professional skills. Research must therefore focus as a priority on the use of virtual environments and teacher attitudes in the teaching-learning process given the current "virtualisation" of higher education. This will allow them to obtain more knowledge of the current situation in order to strengthen skills in the use of virtual environments that contribute to the meaningful learning of university students. Consequently, this study aimed to determine the relationship between the attitude towards ICTs and the use of virtual teaching-learning environments among teachers at the University of Huánuco (Peru) in times of COVID-19.

Methods

The study consisted of a basic, correlational quantitative approach with a non-experimental, transectional, descriptive and correlational design. The study was carried out in the first quarter of 2020, during the first wave of the COVID-19 pandemic.

The population comprised 523 teachers from the University of Huánuco. The selected sample consisted of 210 teachers; a probabilistic, simple random, strata-based sampling approach was used. Teachers who voluntarily agreed to participate in the study were included, from the different undergraduate study programmes: Business Administration, Architecture, Accounting and Finance, Law and Political Science, Basic Education: Initial and Primary, Nursing, Environmental Engineering, Engineering Civil, Computer Systems Engineering and Information Technology, Marketing and International Business, Obstetrics, Dentistry, Tourism, Hospitality and Gastronomy.

The following measurement instruments were used: in the first instance, the questionnaire on the use of virtual teaching-learning environments q, comprising informative questions on the use of electronic devices (4 items), use of teaching-learning resources (4 items), frequencies of use of programmes or applications (22 items), presented using a Likert scale (never, almost never, sometimes, almost always, always). This instrument was applied to evaluate teachers' use of virtual environments. The second instrument was the teacher's attitude towards ICTs scale, which comprised the following dimensions: affective (10 items), cognitive (11 items) and behavioural (10 items), presented using a Likert scale (never, rarely, occasionally, frequently and very frequently). Both instruments were validated at qualitative and quantitative level, based on the criteria of three experts and two judges, who determined the extent to which the items in the measurement instrument were representative to verify the validity of their contents and the scope of the measured construct.

A pilot test was also carried out among teachers not included in the studied sample but with similar characteristics. Then, the reliability analysis was determined using Richardson's KR-20 method to determine the reliability of the questionnaire on the use of virtual environments and Cronbach's alpha in the attitude of university teachers

scale ($p < .05$). The reliability results were .71 for the questionnaire and .84 for the scale, indicating that the measurement instruments were of an acceptable level and applicable in the study sample.

For data collection, written authorisation was requested and obtained from the Academic Vice-Chancellor of the University of Huánuco. An online survey was carried out on the Google Docs platform, using the teachers' institutional emails, with prior acceptance of virtual informed consent. They were informed about the aim of the research and the importance of the study for the educational context. Then, the quality of the information gathered was controlled to ensure all the data were complete; otherwise they were eliminated.

The data were analysed was carried out descriptively, taking into account the central tendency and dispersion measures for the numerical variables and frequency for the categorical variables. For the inferential analysis, a bivariate analysis was performed using Spearman's Rho non-parametric test. For the electronic processing of the data, the statistical package SPSS (version 25) was used.

Results

The analysis of the general characteristics of the study sample revealed a predominance of adult participants (40 to 52 years). Also, half of the study sample [139 teachers (66.2%)] were male. As regards the academic programme, the majority [43 teachers (20.5%)] belonged to the Basic Education programme: Initial and Primary. In terms of the number of subjects taught in the 2020-I semester, a total of 193 teachers (91.4%) taught between 1 and 5 subjects. Therefore, availability in terms of the number of class hours per week was 0 to 19 [58.6% (123)]. With respect to years of experience as higher education teachers, 59.5% (125) had more than 5 years of experience (see Table 1).

When analysing the characteristics of the equipment and resources available for learning, it was observed that the majority had mobile phones [94.3% (198)], the second most common device being the laptop [93.8% (197)]. As regards the availability of Internet services, the majority had Internet at home [92.9% (195)]. Similarly, the device they felt most comfortable to carry out academic activities was the laptop [86.7% (182)]. The teachers did not make great use of virtual environments in teaching-learning processes during the final semester [53.8% (113)]. In terms of learning strategies, the vast majority prepared summaries [81% (170)] and also used different types of methodological learning strategies such as case studies [55.7% (117)] (see Table 2).

When analysing the use of virtual teaching-learning environments, the most used electronic device was the laptop, with an average of 4.41; the average for mobile phones was 3.39. Email was the most used electronic communication resource, with an average of 4.12, followed by instant messaging, with an average of 3.67. In terms of the most used electronic programmes or applications, these were the word processing application Word (average = 4.10), PowerPoint presentations (average = 4.56) and the University's educational platform (average = 4.28) (see Table 3) .

Table 1

General characteristics of university teachers at the University of Huánuco, 2020

General characteristics	n = 210	
	fi	%
Age in years		
27 to 39	68	32.4
40 to 52	92	43.8
53 to 65	47	22.4
66 to 77	3	1.4
Gender		
Male	139	66.2
Female	71	33.8
Academic programme		
Business Administration	24	11.4
Architecture	7	3.3
Accounting and Finance	17	8.1
Law and Political Science	23	11.0
Basic Education: Initial and Primary	43	20.5
Nursing	19	9.0
Environmental Engineering	6	2.9
Civil Engineering	20	9.5
Systems Engineering and Information Technology	7	3.3
Marketing and International Business	1	.5
Obstetrics	8	3.8
Dentistry	19	9.0
Psychology	15	7.1
Tourism, Hospitality and Gastronomy	1	.5
Number of subjects taught in the 2020-I semester		
1 to 5	192	91.4
More than 5	18	8.6
Availability of number of class hours per week		
0 to 19	123	58.6
Over 19	87	41.4
Years of experience as a higher education teacher		
0 to 5	85	40.5
More than 5	125	59.5

Table 2

Availability of equipment and resources for the teaching-learning process in the sample of university teachers at the University of Huánuco, 2020

Characteristics of learning equipment and resources	n = 210	
	fi	%
Availability of equipment at home		
Desktop computer	99	47.1
Laptop	197	93.8
Mobile phone	198	94.3
Tablet	52	24.8
Printer	145	69.0
Availability of Internet services		
Internet at home	195	92.9
Internet on mobile phone	134	63.8
Type of equipment with which you feel most comfortable performing academic activities		
Desktop computer	63	30.0
Laptop	182	86.7
Mobile phone	36	17.1
Tablet	7	3.3
Use of virtual environment in the teaching-learning process during the last semester		
Yes	97	46.2
No	113	53.8
Use of learning strategies		
Summaries	170	81.0
Mental maps	68	32.4
Conceptual maps	130	61.9
Flowcharts	56	26.7
Other	60	28.6
Use of different types of methodological learning strategies		
Case study	117	55.7
Project learning	43	20.5
Problem-based learning	109	51.9
Problem resolution	101	48.1
Discussion of topics	67	31.9
OTHER	99	47.1

Table 3

Use of virtual environments for the teaching-learning process by teachers at the University of Huánuco, 2020

Use of virtual environments for teaching-learning	Average	Standard deviation
Electronic equipment		
Desktop computer	2.94	1.5
Laptop	4.41	.9
Mobile telephone	3.39	1.3
Tablet	1.72	1.1
Electronic communication resources		
Email	4.12	1.0
Instant messaging	3.67	1.1
Social networks	3.40	1.3
Electronic programmes or applications		
Word word-processing software	4.10	1.0
Databases	3.27	1.3
Excel spreadsheets	3.26	1.3
PowerPoint presentations	4.56	.8
Sound editors	2.71	1.2
Video editors	2.99	1.3
Image Editors	3.03	1.3
Web browsers	3.80	1.2
Internet browser	4.00	1.1
Blog/website editors	2.66	1.3
Collaborative work tools	3.07	1.2
University's educational platform	4.28	1.1
Video-conferencing systems	4.18	1.1
Games	1.89	1.1
Virtual libraries	3.38	1.1
Access to educational information pages	3.49	1.2
Learning forums	3.14	1.2
YouTube in education	3.42	1.2

The dimensions in which virtual teaching-learning environments were used most by university teachers were electronic communication (average = 3.5), followed by electronic programmes or applications (average = 3.4) and electronic equipment (average = 3.1). In terms of the dimensions of the university teachers' attitude towards the use of virtual environments, these were determined by affective and behavioural attitudes (average = 4.5), followed by cognitive attitude (average = 4.3)

Finally, in terms of the correlation between the teacher's attitude and the use of virtual environments for teaching-learning, a rs = 53 was obtained; $p \leq .000$.

Discussion and conclusions

The study showed that the use of virtual environments (computers, communication and applications) was significantly related to the attitude towards ICTs among the university teachers studied. Thus, if a teacher has a positive attitude towards ICTs, he/she will also make greater use of virtual environments.

The results are complemented by the findings of Sánchez et al. (2020), who also conducted research in the context of the pandemic and concluded that university teachers make frequent use of email and social networks (Facebook and WhatsApp) in their academic activities to communicate with students. For academic work, they used Google Classroom, Moodle and Google Suite, and for synchronous sessions they preferred Zoom, Google Hangouts and Skype. The aforementioned authors also identified a need to strengthen competences in the use of virtual environments for education.

The context of the health emergency caused by COVID-19 has accelerated changes in all sectors of employment. As a result, professionals in different fields have been forced to adapt to this new normal, many in a proactive and outstanding manner. Virtual education was implemented on a mandatory basis in the educational system. ICTs were the key resource in this process to promote learning, especially in university education, which requires greater innovation due to its specialised and diverse nature. Teachers have become key stakeholders against this backdrop of historical changes, and face the challenge of adapting to new environments and responding in the best way possible to the training demands of students (Buenard, 2020).

In this sense, the findings reported here allow positive conclusions to be drawn regarding the first stage of development of virtual environments. Based on the data obtained, it can be interpreted that universities have shown little resistance to change and a willingness to tackle a crisis that threatened the continuity of education for more than 24 million university students in Latin America and the Caribbean. The work of teachers undoubtedly complements the efforts made by other professionals in the first line of response to COVID-19 (Villafuerte et al., 2020).

The study sample was collected in three weeks after the start of virtual academic activities, coinciding with the most critical moments in the adaptation to the new educational modality. Hence, it is very likely that the positive trend has continued in terms of both the attitude towards ICTs and the use of virtual environments. In this sense, our findings coincide with those reported by Del Rio et al. (2020), who affirmed that the knowledge and use of ICTs fosters the development of more interactive and innovative academic processes in the new role of teachers. In other words, they infer that these changes highlight the need to explore other educational fields and acquire skills to

operate in a new digital world. Likewise, Sales et al. (2020), indicate that, despite the stress produced by the transition from face-to-face to virtual education, due to the excessive workloads of teachers and the additional effort required to reconcile family and professional life in different cases, teachers are satisfied with the accelerated adaptation of virtual teaching, resulting in a positive attitude towards learning to use online platforms and tools and a greater readiness to improve the training of university students. Quezada et al. (2020) described the following characteristics of university teachers in the context of COVID-19: "innovation in learning sessions, promotion of collaborative work, leadership, use of ICTs, constant updating of knowledge and a willingness to be of service" (p. 119).

In short, the process of reconfiguration of education has started and must continue during the post-pandemic period. Adaptation must make way for innovation and transform these formal changes into structural changes. Times are coming in which the main form of education will be multi-modal. Nevertheless, teachers display a favourable attitude towards new changes in an environment dominated by virtuality, leaving aside traditional face-to-face teaching, as a common practice adopted by university teachers (Ruiz-Aquino, 2020). There are also serious gaps in digital skills, as highlighted by Martínez and Garcés (2020), who found that the most developed digital competences of university teachers are computerisation, information literacy, communication, collaboration and problem solving. In contrast, the creation of digital content and security are the weakest. Also, few teachers achieve an innovative level of competence.

Silas and Vázquez (2020) argue that university teachers encountered various logistical, technological and material difficulties when dealing with the pandemic. They also reported a significant increase in the number of work hours per subject, a decrease in the frequency and quality of interaction with their students, and yet they claimed to be confident and happy. In contrast, De La Hoz (2020) reported that teachers displayed a good attitude towards the use of ICT resources. However, their perception of their own skills, aptitudes and knowledge to execute them was less positive. This same perspective, within higher education in general, has favoured the introduction of ICTs as an innovative element in the teaching-learning process and has also encouraged the creation of new roles that add value to the tools teachers have at their disposal. Therefore, they have a greater impact in the current circumstances, coupled with the greater need and importance to ensure the continuity of the educational system in times of COVID-19 (Santana-Sardi et al., 2020).

Finally, based on the results obtained here and contributions from other researchers, it can be argued that the situation has required teachers to move towards the next stage of development, namely to progress from a level of consumption of digital and traditional resources and contents in a context that allows them to better understand the potentialities in the available technological environment. It is clear that university teachers have historically had great responsibility; hence, a positive attitude to new challenges is a good starting point.

It may therefore be concluded that in times of COVID-19, the use of virtual environments (equipment, communication and applications) is positively and significantly related to the attitudes of teachers at the University of Huánuco (Peru) towards ICTs. Therefore, it follows that a more positive attitude towards ICTs will also lead to greater use of virtual environments.

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