Self-Efficacy and Digital Anxiety and their Influence on Virtual Educational Performance

A Diagnostic Study in a Sample of Students from a Private University in Lima – Peru

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Abstract—Digital self-efficacy is the personal confidence to use technology tools efficiently. Digital self-efficacy reduces anxiety and increases student performance. For these reasons, the present research proposes to analyze the levels of digital self-efficacy and anxiety, as well as their influence on virtual performance in university students in Peru. 116 students participated, 105 females (90.5%) and 11 males (9.5%) between 17 and 50 years of age (Mean = 26.78, SD = 7.02). The results showed that the students have optimal levels of digital self-efficacy and virtual performance. Nevertheless, they were hesitant to feel digital anxiety. Then, digital self-efficacy was related to virtual performance. Finally, the concept "digital native" is discussed because the youngest students did not achieve optimal levels of digital self-efficacy, neither with low levels of digital anxiety.

Keywords—ICT self-efficacy, computer anxiety, computer self-efficacy, online teaching, digital sources

1 Introduction

Globally, university education has been transformed by the COVID-19 pandemic, forcing it to face digital challenges and adapt new ways of teaching [1]. This accelerated the digitization of education [2]; demanding all countries to strengthen student capacities to use digital tools in this process of educational innovation [3–4]. However, at the same time, it favored the achievement of learning in universities [5]. These educational changes also demanded that teachers learn new teaching strategies [6]. However, in recent years, technological and digital literacy gaps have been observed [7]. For example, the weak development of digital competencies in teachers and students [8]. This is a cause for concern because the digital knowledge and attitudes of teachers are related to the curricular adaptation of virtual education [9]. Faced with this problem, the universities evaluated the technological skills of students and teachers. In addition, the need arose to evaluate the level of digital self-efficacy [10]; to efficiently execute virtual education.

1.1   Background

In today's context, technology has become a part of education [9]. This justifies the interest in digital self-efficacy during the pandemic. Even, how self-efficacy influences educational performance. For example, in research with 130 business administration students identified that digital self-efficacy influences informational skills and academic performance [10]. This interest was replicated in research with 34 Iranian university students who, possessing higher digital self-efficacy, performed better on foreign language assessments [11]. In addition, in studies with 113 elementary school students in Xinjiang (China) who participated in online camps developed their self-efficacy and computational thinking. Demonstrating that virtual experiences develop digital self-efficacy [12]. In addition, attention has been paid to digital anxiety, which is the fear of using technologies. For example, studies of 251 South African university students in the humanities and management sciences from rural South Africa found that low digital anxiety and self-efficacy were determinants of educational success; finding that a lack of technological resources generates digital anxiety [13]. Therefore, this problem generates interest in technological gaps and digital literacy [7], expressed in the weak development of digital competencies [8]; and academic efficiency [13].

1.2   Virtual education and digital self-efficacy

Although virtual education has existed since the last century, it was not a common modality in Latin America during the pandemic. He even demanded the need for educational institutions to provide technological resources to support students [14]. Because the lack of these resources generated the desertion of students [15]. Adding to this problem, the need arose for teachers to have the technological skills to adopt them in their pedagogical practice [9], and the need for student adaptation to digital environments [16]. For these reasons, this ability to adapt to virtuality generated attention to digital self-efficacy [10] [17]. Digital self-efficacy is not a recent concept. It is the ability to use technological resources such as hardware and software [10] of the computers [16–19]. It is related to the acceptance of virtual education, the desire to use technological resources [13] [17] and student performance. It is also associated with other educational practices such as digital activism [20].

In today's context, digital technology has become ubiquitous [9], occupying most aspects of life and education [21]. For example, mobile learning with smart classrooms [22], virtual camps [12] or digital political education [20]. This justifies why the relevance of digital self-efficacy in students. Even in teachers who during the pandemic managed virtual teaching; despite not having resources or technological knowledge [16]. Digital self-efficacy influences the perception of the ease [13] [20] and acceptance of virtual education [23–29]. In addition, it is associated with factors such as age. For example, it is claimed that younger people or "digital natives" are more digitally self-efficient [30]; because they are part of a world in which technologies are always present [9]. In addition, being from Generation Z influences self-efficacy [31]. Moreover, even women are said to be less digitally self-efficient [13], due to their lower interest in using Information and Communication Technologies [32].

1.3 Digital self-efficacy, digital anxiety and academic performance

As in the current context the use of technological resources is constant [9], the ability to use them is essential [16–17]. Therefore, it is relevant to analyze the problem of digital limitations focused not only as difficulty of access to ICTs, but also as cognitive disability and negative behaviors towards the use of ICTs [33]. Thus, interest arises in digital self-efficacy and its impact on the performance of university students [10]–[11] [32–34], and on teaching performance [35], which will be reflected in the efficient use of digital educational resources [36]. However, there are factors that generate fear of ICT and harm digital self-efficacy [31]. For example, the level of knowledge of ICT use in teaching [9]. On the other hand, the lack of digital resources [13]. This causes digital anxiety, which is the concern and insecurity to perform any virtual activity or to use new devices [33]. It is also called computational or computer anxiety [36]. This anxiety intimidates people in front of computer equipment in everyday activities [38], hindering the learning of technological skills and educational achievements [13].

Another factor is academic performance, which depends on digital self-efficacy [32] to achieve good grades [10]–[11] [34] [39]. It has even been observed that students with optimal levels of digital self-efficacy seek to perform more difficult technological activities, achieving better academic results [40]. Because of this, digital self-efficacy is essential in professional training, because it helps to use technology efficiently, motivates learning and improves performance. In addition, it favors novel virtual teaching strategies and mobile learning [21–22]. That is why, in academic contexts, the disadvantages of digital anxiety should be evaluated by reducing interest, proactivity [41] and performance [13] [38]. Also, evaluate the benefits of digital self-efficacy by increasing interest [40], research motivation [20], student performance [10]–[11] [40], and reducing digital anxiety [36]. Demonstrating the relevance of these assessments in university contexts.

1.4 Study objectives

In this context, in which ICT literacy is essential for success [32], we reflect on new digital disabilities [33]; and on the issue of virtual education in the pandemic [1]. These are difficulties in which students and teachers had to adapt quickly for educational innovation [3–4]. Even without possessing technological knowledge and resources [16]. Considering this problematic, it is relevant to study the influence of digital self-efficacy [18] [20], digital anxiety [34], and student performance [10] [11] [38] as a guarantee of academic success [13]. Therefore, according to what has been analyzed, the present study has the following objectives: first, to evaluate the levels of self-efficacy and digital anxiety; as well as the virtual educational performance of university students in the city of Lima – Peru. Second, to analyze the influence of digital self-efficacy and digital anxiety on the virtual educational performance of university students. Thus, by analyzing these variables, the novelty of this study is that it diagnoses self-efficacy and digital anxiety in the Peruvian university context, of which there are few reports. In addition, it contributes with the adaptation of two questionnaires to the Peruvian context, as well as the construction and validation of the virtual performance scale (See Figure 1 and Table 2).

2 Methods

The research methodology is quantitative [42]. For the achievement of the first objective, the study is summative evaluative [43]. Then, for the second objective, the study is correlational because it evaluates the relationship between variables [44].

2.1 Participants

Participants were selected by non-probability convenience sampling [45]. Thus, a sample of 116 university students was obtained, 105 females (90.5%) and 11 males (9.5%) from the first to the tenth cycle of studies, aged between 17 and 50 years (*Mean Age = 26.78, SD = 7.02*).

2.2 Instruments

Computer self-efficacy scale [33]. This questionnaire evaluates the levels of confidence in using computer resources. It has 7 items. In this study the scale was adapted to a 7-dimensional Likert scale (1 totally disagreeing to 7 totally agreeing). The validity of the scale was analyzed by Exploratory Factor Analysis (EFA) and the Kaiser Meyer and Olkin test (KMO). Optimal levels of reliability were achieved using Cronbach's Alpha coefficient statistic (see Table 1).

Digital anxiety scale [33]. This scale evaluates the levels of concern and intimidation when using computer tools. The original version has 8 items, but in the present study we worked with a 7-item version because item 1 (*"I am anxious about having to use the new system soon"*) presented an item-total correlation of .05, which is too low to be considered reliable [46]. It was also adapted to 7 response options (1 totally disagreeing to 7 totally agreeing). Table 1 shows the validity analysis and the reliability analysis with Cronbach's Alpha coefficient; demonstrating optimal levels of validity and reliability.

Virtual educational performance scale (own elaboration). This scale estimates performance when studying in a digital environment. It is a unidimensional scale of 5 items and 7 response options (1 totally disagreeing to 7 totally agreeing). It was constructed and validated by expert judgment [47], surpassing the minimum of 3 items to pass reliability levels [48]. Table 1 shows optimal levels of validity and reliability [49]. Since it is an instrument constructed for the present study, Figure 1 shows the analysis of dimensions with Cattell's Scree Plot, confirming the unidimensionality of the scale. Table 2 then details the reliability analysis for each item.

Table 1. Instruments validity and reliability

Optimal Values	Validity		Reliability	
	KMO	Bartlett Test	Cronbach	Item-Total
	≥ .50	*p* < .05	≥ .60 or .70	≥ .30
Computer Self-Efficacy	.87	.000	.90	.43–.79
Digital Anxiety Scale	.88	.000	.88	.50–.77
Virtual Educational Performance Scale	.77	.000	.78	.35–.69

Notes: The instruments were found to be valid by Exploratory Factorial Analysis (EFA) using the Kaiser-Meyer-Olkin test (KMO) and the Bartlett's Sphericity Test [49]. In addition, the Cronbach's Alpha coefficient evidences optimal levels of reliability [50].

According to EFA, Cattell's Scree Plot shows that the 5 items of the Virtual Educational Performance Scale are organized in a single dimension (See Figure 1).
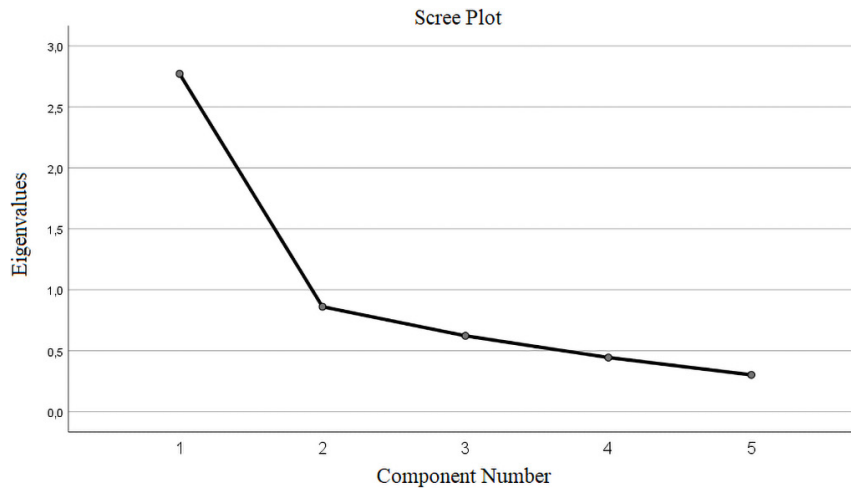

Fig. 1. An eigenvalue is seen showing that the scale is one-dimensional

Then, Table 2 shows the values of each item in the corrected total item correlation [46] and Cronbach's Alpha if the item is removed. These results show that the items confirm the reliability of the scale.

Table 2. Descriptive statistics

	Items (Elements)	Total Element Correlation Corrected	Cronbach's Alpha if the Element is Removed
1	My performance with educational digital tools is currently efficient to achieve my professional learning.	.35	.81
2	I have managed to learn my subjects well because I use the tools of the virtual classroom optimally.	.59	.73
3	I always know how to efficiently use educational digital tools such as the classroom or the virtual library.	.59	.73
4	My virtual performance is reflected in the successful use I give to educational digital tools.	.69	.69
5	Since I receive virtual education, I can perform efficiently in class using technological tools.	.63	.72

Note: Optimum values of the corrected total correlation of elements are greater than or equal to .20 [46].

2.3   Ethical procedures

The application of the three scales was carried out after coordination with the Research Director of the university. Then, we proceeded according to research ethics criteria by showing an informed consent protocol, explaining that participation in the study was voluntary and anonymous [51]. Then, to include 17-year-old participants (considered minors in Peru), we proceeded in accordance with the Civil Code of Children and Adolescents (No. 27337), which states that people over 16 years of age are autonomous to decide their actions [52].

3   Results

3.1   Exploratory analyzes

Table 3 explains the analyses of the descriptive statistics that provide an overall assessment by variable. In the digital self-efficacy variable, students "agree" that they are able to use computer equipment efficiently. Regarding digital anxiety, students "neither agree nor disagree" in feeling fear and intimidation when using computer equipment. Finally, for virtual educational performance, students express "agree" that they perform efficiently.

Table 3. Descriptive statistics

	Variables	Minimum	Maximum	Mean	SD
1	Digital Self-Efficacy	3	7	5.92	.85
2	Digital Anxiety	1	7	3.77	1.55
3	Virtual Educational Performance	3	7	5.82	.81

Note: SD represents the standard deviation.

More specifically, the variables were analyzed by age. Thus, to identify students with digital counseling needs, Figure 2 explored the digital self-efficacy variable. Thus, students aged 26, 27, 32, 34 and 41 years old were located close to value 4 ("neither agree nor disagree"); demonstrating doubts regarding their self-confidence to use computer equipment; which is a reason for attention because this may represent educational difficulties.
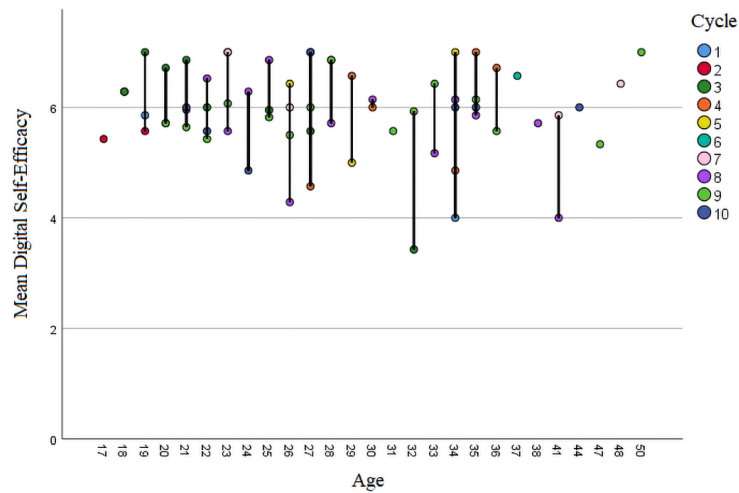

Fig. 2. Mean vertical lines of digital self-efficacy by age and by cycle of studies

Then, Figure 3 explored the levels of digital anxiety and identified particular cases of students aged 19, 22, 27, 29, 32, 33, 35, 47 and 50 years old, close to value 6, who indicate that they "agree" in feeling worried about using computer equipment and fear of damaging it. This is another indicator to intervene at the educational level to avoid difficulties in student performance.
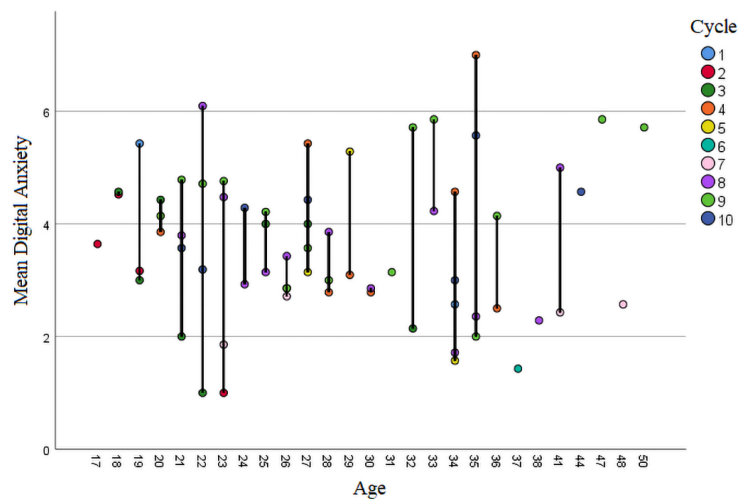

Fig. 3. Mean vertical lines of digital anxiety by age and by cycle of studies

For the virtual educational performance variable, the mean was 5.82 showing that students "agree" that they have an adequate level of performance using technological tools such as the virtual classroom or library. Nevertheless, Figure 4 shows students with ages 24, 26, 29, 34 and 41 next to value 4 who "neither agree nor disagree"; in possessing a good virtual performance.
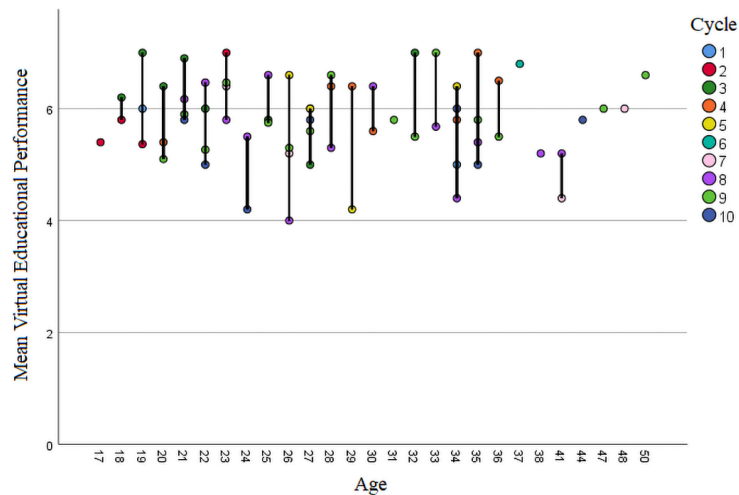

Fig. 4. Mean vertical lines of virtual educational performance by age and by cycle of studies

3.2 Relation between variables

The analysis of relationships between variables was interpreted according to Cohen's criteria, who establishes mild relationships if they are .10 to .23, moderate from .24 to 36, and strong if they are greater than .37 [53]. Table 4 shows that digital self-efficacy is positively, strongly and significantly related to virtual educational performance (*r*=.59***); that is, optimal levels of digital self-efficacy are associated with good virtual educational performance; and low levels of self-efficacy would be linked to low performance. Then, digital anxiety is positively, mildly and significantly related to the study cycle (*r*=.21*). This relationship explains that digital anxiety is higher as students advance to higher study cycles; on the contrary, digital anxiety is lower in the first cycles.

Table 4. Relationship between variables

	Variables	**1**	**2**	**3**	**4**
1	Digital Self-Efficacy	(.90)			
2	Digital Anxiety	−.17	(.85)		
3	Virtual Educational Performance	.59***	−.06	(.78)	
4	Cycle	−.06	.21*	−.12	…
5	Age	−.04	−.03	−.01	.25**

Notes: *, **, *** shows significant relationships. *p < .05, **p < .01, ***p < .001(bilateral).

4   Discussion

In the current context, it is essential to analyze technological inequalities analyzed as digital capabilities or disabilities; as well as the acceptance or rejection of ICTs [33]; mainly observed in virtual education during the pandemic [1]. In addition, today society faces the challenge of virtual education despite the lack of knowledge and technological resources of many people [16]. Lack with which students and teachers have had to cope [3–4]. That is why, the relevance on the reflection of concepts such as digital self-efficacy [13] [33], digital anxiety [13] [34] and virtual educational performance [11] [32–34]. In this context, the first objective of this research was to evaluate the levels of digital self-efficacy [18], digital anxiety [37] and virtual academic performance in Peruvian university students. This objective responds to the needs of virtual education [9], mainly during the pandemic, in which students faced difficulties in adapting to the digital environment [16]; which somehow affected their performance. In this analysis, it was identified that students feel self-efficient using digital tools. In addition, they are insecure in suffering from digital anxiety; but they have an optimal level of virtual educational performance. These findings are favorable because, according to several studies, optimal levels of digital self-efficacy reduce digital anxiety and consequently increase student performance [10] [11] [32–34]. For example, in a study with 6173 students in New Zealand, they identified that computational self-efficacy mediates the learning of digital reading [32].

However, exploratory analyses show that some students between 26 and 41 years of age have doubts about their digital self-efficacy. Generating reflection because, self-efficacy theories claim that it develops with experience. In addition, although cases of young students are found, they are few to identify a certain contradiction with the theory of "digital natives" [30–31]. However, they can be identified to support them in raising their self-efficacy. Of course, considering that self-efficacy is the belief about achievements in a specific activity [54], in the digital environment, it is beneficial for student [40] and teacher performance [35]. It also generates academic success [13] and favors the implementation of new learning programs [21–22]. Regarding digital anxiety, particular cases of students between 19 and 50 years old were identified, who showed high levels of fear when using computer equipment and fear of damaging it. Generating concern about the limitations caused by digital anxiety. For example, demotivation, decreased initiative [41] and performance [38]. It would even reduce the technological habitus [20]. These results invite to evaluate the evolution of the levels of digital anxiety and self-efficacy in teachers and students. Considering that low digital anxiety favors student performance [13] [38] and facilitates teaching work [35]. Mainly, in contexts in which students and teachers present difficulties of disposition and lack of technological knowledge [3–4] [13] [16].

Then, the exploratory analysis of virtual educational performance shows that students perceive that they have an optimal educational performance thanks to the use of computer resources. However, there are particular cases of five students between 24 and 41 years of age who doubted to have an adequate performance, evidencing difficulties in the use of virtual educational tools such as the classroom or the virtual library. In these cases, it is feasible to consider the possibility of making a better-individualized

diagnosis because weak levels of digital self-efficacy [40] or high levels of digital anxiety [38] could cause the weak performance. Also, consider that weak levels of self-efficacy, virtual performance and high levels of digital anxiety are due to poor access to ICTs [13]. This problem was also observed in teachers who showed little development of their digital competencies [8]. It is necessary for educational institutions to organize events to familiarize teachers with technologies and thus provide better teaching [9].

Finally, the study analyzed the relationship between self-efficacy, digital anxiety and students' virtual performance. Identifying, optimal levels of digital self-efficacy are associated with good virtual performance; and (vice versa). Confirming studies with 405 university students in Bosnia and Herzegovina in which it was identified that digital self-efficacy predicts academic performance and the application of meta-cognitive strategies [39]. These findings are consistent with research that achieved similar results [10]–[11] [32]. In addition, it was identified that high levels of digital self-efficacy are not associated with weak levels of digital anxiety. Being a result that disagrees with the study conducted with 174 university students in Brazil in which they identified that the feeling of computational self-efficacy reduces digital anxiety [33]. In addition, it was observed that digital anxiety is higher in the last cycles of studies. This confirms that younger people [30] and Generation Z [31] are more familiar with the use of ICTs [9] and consequently have less fear of damaging technological devices. However, it generates concern because in the more advanced study cycles there is a greater need to use ICTs. Therefore, knowing that digital anxiety is detrimental [41]; to student performance [37]. It is urgent to implement educational strategies to reduce it and optimize education [13] [32].

5   Conclusions and future works

The study concludes that digital self-efficacy is related to virtual academic performance; and digital anxiety is positively related to the advancement of study cycles. This showed that students with a better level of digital self-efficacy will have better performance; and that the levels of digital anxiety rise in the last study cycles. Therefore, it is important to promote a better use of ICTs in university students, so that they can have a better performance and lower levels of digital anxiety. On the other hand, although a relationship was found between age and digital anxiety. It is important that the relationship between age and digital anxiety can be further investigated in future work. This study has not been able to establish differences in terms of the gender of the students since the sample had a greater number of females and therefore, an analysis could not be performed based on this variable. However, the study has shown that digital self-efficacy is important for students in general, as it is related to better performance, which can be taken into account by teachers to improve teaching processes in universities.

6 Acknowledgment

7 References

[1] R. Eri; P. Gudimetla; S. Star; J. Rowlands; A. Girgla, "Digital resilience in higher education in response to COVID-19 pandemic: Student Perceptions from Asia and Australia", *Journal of University Teaching & Learning Practice*, vol. 18, no. 5, 2021. https://doi.org/10.53761/1.18.5.7

[2] O. Zawacki-Richter, "The current state and impact of Covid-19 on Digital Higher Education in Germany", *Human Behavior and Emerging Technologies*, vol. 3, no. 1, pp. 218–226, 2021. https://doi.org/10.1002/hbe2.238

[3] B. Anthony Jnr; S. Noel, "Examining the adoption of emergency remote teaching and virtual learning during and after COVID-19 pandemic", *International Journal of Educational Management*, vol. 35, no. 6, pp. 1136–1150, 2021. https://doi.org/10.1108/IJEM-08-2020-0370

[4] I. Shulga; Y. Li; J. Krokhina; V. Semenov; L. Ryazanova; A. Baranova, "Digital technologies' impacts on student social adaptation during Coronavirus pandemic", *World Journal on Educational Technology: Current Issues*, vol. 13, no. 4, pp. 740–748, 2021. https://doi.org/10.18844/wjet.v13i4.6261

[5] V. Tugun; A. R. Bayanova; K. G. Erdyneeva; N. A. Mashkin; Z. M. Sakhipova; L. V. Zasova, "The opinions of technology supported education of university students", *Int. J. Emerg. Technol. Learn. (iJET)*, vol. 15, no. 23, pp. 4–14, 2020. https://doi.org/10.3991/ijet.v15i23.18779

[6] Z. Ozcinar; N. A. Orekhovskaya; M. N. Svintsova; E. G. Panov; E. I. Zamaraeva; A. N. Khuziakhmetov, "University students' views on the application of gamification in distance education", *Int. J. Emerg. Technol. Learn. (iJET)*, vol. 16, no. 19, pp. 4–15, 2021. https://doi.org/10.3991/ijet.v16i19.26019

[7] R. Núñez; A. Gamboa-Suarez; W. R. Avendaño-Castro, "Development of digital competences in Latin American university students", *Journal of Language and Linguistic Studies*, vol. 18, no. 2, pp. 39–51, 2022.

[8] M. Osman, "Global impact of COVID-19 on education systems: The emergency remote teaching at Sultan Qaboos University", *Journal of Education for Teaching*, vol. 46, no. 4, pp. 463–471, 2020. https://doi.org/10.1080/02607476.2020.1802583

[9] S. Papadakis; J. Vaiopoulou; E. Sifaki; D. Stamovlasis; M. Kalogiannakis; K. Vassilakis, "Factors That Hinder in-Service Teachers from Incorporating Educational Robotics into Their Daily or Future Teaching Practice," In 13th International Conference on Computer Supported Education CSEDU (2) '04, 2021, pp. 55–63. https://doi.org/10.5220/0010413900550063

[10] O. Cardoso-Espinosa; A. Cortés-Ruiz; T. Cerecedo-Mercado, "Computational self-efficacy and information skills in postgraduate students in administration at the times of Covid-19", *Journal on Efficiency and Responsibility in Education and Science*, vol. 14, no. 2, pp. 118–129, 2021. https://doi.org/10.7160/eriesj.2021.140205

[11] A. Shakaramia; H. Khajeheia; K. Hajhashemib, "Digital self-efficacy and language learning enhancement in an online setting", *Journal of Basic and Applied Scientific Research*, vol. 3, no. 11, pp. 80–84, 2013. https://doi.org/10.2139/ssrn.2637404

[12] K. Chiang; Y. Zhang; D. Zhu; X. Shang; Z. Jiang, "The influence of online STEM education camps on students' self-efficacy, computational thinking, and task value", *Journal of Science Education and Technology*, no. 31, pp. 461–472, 2022. https://doi.org/10.1007/s10956-022-09967-y

[13] L. Schlebusch, "Computer anxiety, computer self-efficacy and attitudes towards the internet of first year students at a South African University of Technology", *Africa Education Review*, vol. 15, no. 3, pp. 72–90, 2018. https://doi.org/10.1080/18146627.2017.1341291

[14] M. Chalpartar-Nasner; M. Fernández-Guzmán; S. Betancourth-Zambrano; A. Gómez-Delgado, "Deserción en la población estudiantil universitaria durante la pandemia, una mirada cualitativa". *Revista Virtual Universidad Católica Del Norte*, no. 66, pp. 37–62, 2022. https://doi.org/10.35575/rvucn.n66a3

[15] F. Díaz-Barriga-Arceo; J. Alatorre-Rico; F. Castañeda-Solís, "Trayectorias interrumpidas: motivos de estudiantes universitarios para suspender temporalmente sus estudios durante la pandemia". *Revista Iberoamericana de Educación Superior*, vol. 13, no. 36, pp. 3–25, 2022. https://doi.org/10.22201/iisue.20072872e.2022.36.1181

[16] Y. Can; S. Bardakci, "Teachers' opinions on (urgent) distance education activities during the pandemic period", *Advances in Mobile Learning Educational Research*, vol. 2, no. 2, pp. 351–374, 2022. https://doi.org/10.25082/AMLER.2022.02.005

[17] A. Awofala; O. Olabiyi; A. Awofala; A. Arigbabu; A. Fatade; U. Udeani, "Attitudes toward computer, computer anxiety and gender as determinants of pre-service science, technology, and mathematics teachers' computer self-efficacy, *Digital Education Review*, no. 36, pp. 51–67, 2019. https://doi.org/10.1344/der.2019.36.51-67

[18] R. Compeau; A. Higgins, "Computer self-efficacy: Development of a measure and initial test", *MIS Quarterly*, vol. 19, no. 2, pp. 189–211, 1995. https://doi.org/10.2307/249688

[19] M. Marakas; Y. Yi; D. Johnson, "The multilevel and multifaceted character of computer self-efficacy: Toward a clarification of the construct and an integrative framework for research", *Information Systems Research*, vol. 9, no. 2, pp. 126–163, 1998. https://doi.org/10.1287/isre.9.2.126

[20] M. Aguayo; J. Valdés; V. Córdoba; M. Nájera; R. Vázquez; E. Muñoz; C. Lirios, "Digital activism in students at a university in central Mexico in the COVID-19 era", *Advances in Mobile Learning Educational Research*, vol. 2, no. 1, pp. 297–307, 2022. https://doi.org/10.25082/AMLER.2022.01.014

[21] A. Al-Hunaiyyan; R. Alhajri; S. Al-Sharhan; A. Bimba, "Human-computer interaction perspective on mobile learning: Gender and social implications", *Int. J. Interact. Mob. Technol.*, vol. 15, no. 11, pp. 4–20, 2021. https://doi.org/10.3991/ijim.v15i11.21367

[22] A. Al-Hunaiyyan; A. Al-Sharhan; R. Alhajri, "A new mobile learning model in the context of the smart classrooms environment: A holistic approach," *International Journal of Interactive Mobile Technologies (iJIM)*, vol. 11, no. 3, pp. 39–56, 2017. https://doi.org/10.3991/ijim.v11i3.6186

[23] A. Alfadda; S. Mahdi, "Measuring students' use of zoom application in language course based on the Technology Acceptance Model (TAM)", *Journal of Psycholinguistic Research*, vol. 50, no. 4, pp. 883–900, 2021. https://doi.org/10.1007/s10936-020-09752-1

[24] B. Al-Kurdi; M. Alshurideh; A. Salloum; M. Obeidat; M. Al-dweeri, "An empirical investigation into examination of factors influencing university students' behavior towards E-learning acceptance using SEM approach", *International Journal of Interactive Mobile Technologies*, vol. 14, no. 2, pp. 19–41, 2020. https://doi.org/10.3991/ijim.v14i02.11115

[25] M. Al-Rahmi; I. Alzahrani; N. Yahaya; N. Alalwan; B. Kamin, "Digital communication: Information and Communication Technology (ICT) usage for education sustainability". *Sustainability (Basel, Switzerland)*, vol. 12, no. 12, p. 5052, 2020. https://doi.org/10.3390/su12125052

[26] I. Mushtaque; M. Awais-E-Yazdan; H. Waqas, "Technostress and medical students' intention to use online learning during the COVID-19 pandemic in Pakistan: The moderating effect of computer self-efficacy", *Cogent Education*, vol. 9, no. 1, 2022. https://doi.org/10.1080/2331186X.2022.2102118

[27] A. Sendogdu; O. Koyuncuoglu, "An analysis of the relationship between university students' views on distance education and their computer self-efficacy", *International Journal of Education in Mathematics, Science, and Technology (IJEMST)*, vol. 10, no. 1, pp. 113–131, 2022. https://doi.org/10.46328/ijemst.1794

[28] N. Thongsri; L. Shen; Y. Bao, "Investigating academic major differences in perception of computer self-efficacy and intention toward e-learning adoption in China", *Innovations in Education and Teaching International*, vol. 57, no. 5, pp. 577–589, 2020. https://doi.org/10.1080/14703297.2019.1585904

[29] C. Wolverton; G. Hollier; A. Lanier, "The impact of computer self efficacy on student engagement and group satisfaction in online business courses", *Electronic Journal of e-Learning*, vol. 18, no. 2, 2020. https://doi.org/10.34190/EJEL.20.18.2.006

[30] J. Scott; S. Walczak, "Cognitive engagement with a multimedia ERP training tool: Assessing computer self-efficacy and technology acceptance", *Information & Management*, no. 46, vol. 4, 221e232, 2009. https://doi.org/10.1016/j.im.2008.10.003

[31] B. A. Miraja; S. F. Persada; Y. T. Prasetyo; P. F. Belgiawan; A. P. Redi, "Applying protection motivation theory to understand generation Z students intention to comply with educational software anti piracy law", *Int. J. Emerg. Technol. Learn. (iJET)*, vol. 14, no. 18, pp. 39–52, 2019. https://doi.org/10.3991/ijet.v14i18.10973

[32] H. Yu and J. Hu, "ICT self-efficacy and ICT interest mediate the gender differences in digital reading: A multilevel serial mediation analysis", *Int. J. Emerg. Technol. Learn. (iJET)*, vol. 17, no. 05, pp. 211–225, 2022. https://doi.org/10.3991/ijet.v17i05.25691

[33] C. Bellini; M. Filho; P. de Moura; R. Pereira, "Self-efficacy and anxiety of digital natives in face of compulsory computer-mediated tasks: A study about digital capabilities and limitations", *Computers in Human Behavior*, no. 59, pp. 49–57, 2016. https://doi.org/10.1016/j.chb.2016.01.015

[34] A. Brashi, "Self-efficacy in the prediction of GPA and academic computer use in undergraduate translation students at a Saudi University", *Frontiers in Psychology*, vol. 13, pp. 865581–865581, 2022. https://doi.org/10.3389/fpsyg.2022.865581

[35] L. Wen, "Influencing factors of teachers' sharing behaviors of digital teaching resources in online teaching activities", *Int. J. Emerg. Technol. Learn (iJET)*, vol. 17, no. 06, pp. 95–109, 2022. https://doi.org/10.3991/ijet.v17i06.29465

[36] R. M. I. Khan; N. R. M. Radzuan; A. S. Alkhunaizan; G. Mustafa; I. Khan, "The efficacy of MALL instruction in business English learning", *Int. J. Interact. Mob. Technol.*, vol. 13, no. 08, pp. 60–73, 2019. https://doi.org/10.3991/ijim.v13i08.9562

[37] A. Awofala; O. Akinoso; O. Fatade, "Attitudes towards computer and computer self-efficacy as predictors of pre-service mathematics teachers' computer anxiety", *Acta Didáctica Napocensia*, vol. 10, no. 2, pp. 91–108, 2017. https://doi.org/10.24193/adn.10.3.9

[38] T. dos Santos and V. Santana, Computer Anxiety and Interaction: A Systematic Review. W4A '18: Proceedings of the 15th International Web for All Conference. no. 18, pp. 1–10, 2018. https://doi.org/10.1145/3192714.3192825

[39] M. Kömürcü, "Relationship between computer use related self-efficacy perceptions and academic success of conservatory students during distance education in the COVID-19 pandemic", *African Educational Research Journal*, vol. 9, no. 3, pp. 800–806, 2021. https://doi.org/10.30918/AERJ.93.21.114

[40] A. Ejubović; A. Puška, "Impact of self-regulated learning on academic performance and satisfaction of students in the online environment", *Knowledge Management & E-Learning*, vol. 11, no. 3, pp. 345–363, 2019. https://doi.org/10.34105/j.kmel.2019.11.018

[41] R. Widiyasari; B. Achadiyah, Computer Anxiety, Computer Self-Efficacy dan Perceived Usefulness oleh Pelaku UMKM. *Jurnal Akuntansi Aktual*, vol. 5, no. 3, pp. 203–214, 2019. https://doi.org/10.17977/um004v5i32019p203

[42] P. Leavy, Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches. The Guilford Press (2017).

[43] J. Ngan, "Implications of summative and formative assessment in Japan: A review of the current literature", *International Journal of Education & Literacy Studies*, vol. 8, no. 2, pp. 28–35, 2020. https://doi.org/10.7575/aiac.ijels.v.8n.2p.28

[44] E. Seeram, Euclid. An overview of correlational research. *Radiologic Technology*, vol. 91, no. 2, pp. 176–179, 2019. https://doi.org/10.1111/head.13789

[45] S. Stratton, Population research: Convenience sampling strategies, *Prehospital and Disaster Medicine*, vol. 36, no. 4, pp. 373–374, 2021. https://doi.org/10.1017/S1049023X21000649

[46] R. Aiken, Psychological testing and assessment. 11. ed. Boston: Allyn & Bacon, 2002.

[47] A. Colson; R. Cooke, Expert elicitation: Using the classical model to validate experts' judgments, *Review of Environmental Economics and Policy*, vol. 12, no. 1, pp. 113–132, 2018. https://doi.org/10.1093/reep/rex022

[48] D. Streiner, Figuring out factors: The use and misuse of factor analysis, *Can Journal Psychiatry*, vol. 39, no. 3, pp. 135–40, 1994. https://doi.org/10.1177/070674379403900303

[49] D. Saito; R. Yajima; H. Washizaki; Y. Fukazawa, Validation of rubric evaluation for programming education, *Education Sciences*, no. 11, p. 656, 2021. https://doi.org/10.3390/educsci11100656

[50] A. Conchado; I. Martón; R. Alcover; F. Villanueva; C. Bás; E. Vázquez; I. Sánchez; A. Carrión; M. Carot, Reliability analysis in scoring rubrics for assessing problem solving. pp. 6031–6037. 2017. https://doi.org/10.21125/edulearn.2017.2367

[51] M. Nduna; S. Mayisela; S. Balton; P. Gobodo-Madikizela; J. Kheswa; P. Khumalo; T. Makusha; M. Naidu; Y. Sikweyiya; L. Sithole; C. Tabane, Research site anonymity in context, *Journal of Empirical Research on Human Research Ethics*, 2022. https://doi.org/10.1177/15562646221084838

[52] Congreso de la República del Perú. Código del Niño y del Adolescente. Ley N°. 27337. Lima. Perú (2000). https://diariooficial.elperuano.pe/pdf/0003/4-codigo-de-los-ninos-y-adolescentes-1.pdf

[53] J. Cohen, Statistical power and analysis for the behavioral sciences. New York: Academic Press, 1988.

[54] Özgen Korkmaz; M. K. Korkmaz, "A validity and reliability study of the Basic Electronics Skills Self-Efficacy Scale (BESS)", *Int. J. Eng. Ped. (iJEP)*, vol. 6, no. 4, pp. 30–35, 2016. https://doi.org/10.3991/ijep.v6i4.6168

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