Validation of a scale for measuring the adaptation of Peruvian university teachers to virtual academic settings

Validación de una escala para medir la adaptación de docentes universitarios peruanos a los medios académicos virtuales

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Abstract:

University teachers have had to adapt to the changes required by virtual education. The aim of this study is to adapt and validate the scale of adaptation to virtual academic media in Peruvian university teachers. The participants were 252 university teachers selected using purposive non-probability sampling. The instrument being adapted was the student adaptation to college questionnaire of Rodriguez-Ayan and Sotelo (2014), which consists of eleven items distributed across three dimensions. The content validity was studied by means of the judgement of twelve experts. We carried out exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) and estimated the reliability using Cronbach's alpha. Before calculating the Kaiser-Meyer-Olkin coefficient (0.916) and performing Bartlett's test of sphericity ($\chi^2 = 2571.3$, $p < 0.001$), we performed EFA. As a result, we found an underlying three-factor model, which was corroborated by CFA with satisfactory goodness of fit indexes ($\chi^2 = 107.55$, $df = 37$, $\chi^2/df = 2.907$; $p = 0.000$; RMR = 0.034; GFI = 0.943; AGFI = 0.899; CFI = 0.972; TLI = 0.959; NFI = 0.959; IFI = 0.973, and RMSEA = 0.077), and acceptable reliability (alpha = 0.897). The scale of adaptation to virtual academic settings shows evidence of validity and reliability and can be applied to Peruvian university teachers.

Keywords: educational system, evaluation, validation, online learning, information technology, teaching, higher education, university teacher, Peru, questionnaire, test reliability, test validity.

Resumen:

Los docentes universitarios han tenido que adaptarse a los cambios que demanda la educación virtual. El objetivo de este estudio es adaptar y validar la escala de adaptación a los medios académicos virtuales en docentes universitarios peruanos. Los participantes fueron 252 docentes universitarios seleccionados con base en un muestreo no probabilístico intencional. El instrumento objeto de adaptación fue el cuestionario de adaptabilidad a la vida universitaria de Rodriguez-Ayan y Sotelo (2014), el cual consta de once ítems distribuidos en tres dimensiones. La validez de contenido se estudió por medio del juicio de doce expertos. Se realizó un análisis factorial exploratorio (AFE) y un análisis factorial confirmatorio (AFC), y se estimó la fiabilidad a través del coeficiente alfa de Cronbach. Previo al análisis del coeficiente Kaiser-Meyer-Olkin (0.916) y a la prueba de esfericidad de Barlett ($\chi^2 = 2571.3$, $p < 0,001$), se efectuó el AFE. El resultado fue un modelo de tres factores, que fue corroborado por el AFC con índices de bondad de ajuste satisfactorios ($\chi^2 = 107.55$, $df = 37$, $\chi^2/df = 2.907$; $p = 0.000$; RMR = 0.034; GFI = 0.943; AGFI = 0.899; CFI = 0.972; TLI = 0.959; NFI = 0.959; IFI = 0.973 y RMSEA = 0.077) y una confiabilidad aceptable (alfa = 0.897). La escala de adaptación a los medios académicos virtuales da muestras de validez y confiabilidad, y puede ser aplicada en docentes universitarios peruanos.

Palabras clave: sistema educativo, evaluación, validación, aprendizaje en línea, tecnología de información, enseñanza, enseñanza superior, profesor de universidad, Perú, cuestionario, fiabilidad del test, validez del test.

1. Introduction

The current social environment has undergone significant changes owing to the rapid advance of technology and its spread into different areas. It is now common for information and communication technologies (ICT) to be integrated into people's daily routines (Aguilar y Otuyemi, 2020). The changes caused by the digital era have had a significant impact on ways of working and communication, with a move from paper-based records to software that facilitates much more effective data management. This context has led university teachers to reflect on the integration of digital technology in their classes (Rivera et al., 2021). Preparing for a virtual class requires more than having knowledge of a specific field and the desire to communicate effectively. It is essential to have basic teacher training in ICT, that includes the ability to manage virtual classrooms, as well as presenting information in an instructive and interesting way (Juanes et al., 2020).

The growth of online social networks has created new working contexts, making exploration of their use within the university community attractive and important, especially between students and teachers. This idea has arisen when observing the growth of these platforms and discussions on the topic (Arceo et al., 2021). The change from in-person classes to online ones has put considerable pressure on teachers, both in doing their jobs and in the need to adapt to this new situation (Tejedor et al., 2021). These technologies have brought about the creation of innovative educational focuses that are adapted to students' needs, giving rise to a varied offer of online training, ranging from short courses to diplomas and other postgraduate qualifications (Navarro et al., 2021).

Increasing digitisation requires educators to be trained in how to integrate these tools flexibly into the teaching process, especially in higher education, where command of technological and digital competences is essential to promote the development of skills that allow students to use these tools (Cruz et al., 2022). For the integration of technologies in universities to be a success, teachers must adapt to changes in their teaching methods and improve their pedagogical competences (García, 2023). In this context, teachers currently find themselves facing new challenges, as they have had to acquire technological skills that are now fundamental in teaching, unlike with technology's earlier role as a supporting tool (Cardona, 2021). In this sense, educators as a group have undergone significant changes and have had to transform their pedagogical focuses to adapt to online teaching, with the aim of maintaining their functionality and preserving their livelihoods (Vicentini, 2020).

In this digital setting, teachers at various levels of education have abruptly had to reinvent their educational focuses, finding themselves obliged to adopt new working tools that go beyond the field of paper, tests, and other formative methods (Arriagada, 2020) with the aim of reacting to the new demands, which combine with the previously known ones in the context of online teaching (Murillo, 2020). The need to plan and prepare lessons, review materials, adapt content and manage the design, delivery, receipt and feedback on students' individual activities are some of the challenges they have had to meet (Ruiz, 2020).

Adaptability is people's ability to handle constant changes in their working environment, responding proactively to the demands of their role at work (Arias, 2021). In this instance, adaptability enables greater synchronisation of workers with their duties as they conform to the needs of the employer and the demands of their position (Arnau, 2011). People's capability for adaptation is reflected in their capacity to respond positively to changing situations, and is defined as the ability to learn and adjust to fluctuations in surroundings (Garzón, 2018). Adaptability is regarded as a type of psychological focus, a personality trait that involves flexibility and willingness to change (Fraga, 2014). Teachers and universities had to confront an unusual situation when adopting a hybrid educational focus to keep providing lectures throughout the academic year (De Obesso et al., 2023). In this situation, students and their families, like the teachers, had to adapt to the requirements, tools, and essential elements to continue learning from their homes (Portillo et al., 2020).

When referring to adaptation in the field of ICT, it is essential to understand that this involves changes. It entails defining which areas will be affected and the situations that will require changes, such as reorganising routines, changes to working timetables and patterns, and changes to the management and dissemination of information; all of this through new patterns relating to ICT (Arias, 2021). In relation to this, researchers note that teachers' capacity to adapt has transcended the educational sphere, as

the online workload, the urgent need for training, technological challenges (access and handling), and communicating with an audience through a camera, among other experiences, have led to psychological exhaustion that has affected the mental health of the population in general, and of teachers in particular (Reynosa et al., 2020).

With regards to measuring adaptability, the literature includes numerous studies that have examined the psychometric properties of documented evaluation instruments. For example, in Spain (Arnau, 2011), indicators of analysis of internal validity have been presented. They show the presence of three factors explaining 56.58% of variability, which coincide with the theoretically proposed dimensions of attitudes (cognitive, behavioural, and emotional) that should be considered if we intend to improve the predisposition towards action. A study in Argentina (Rodriguez-Ayan & Sotelo, 2014) on the adaptation of students in Uruguay to university life included a questionnaire and analysed its psychometric characteristics. The results showed that the academic and social dimensions were positively associated with academic performance, while there was no correlation between social adaptation and emotional exhaustion. On the other hand, a negative impact was observed in institutional adaptation in performance. In Peru, Arias (2021) research has been performed on adaptation to information and communication technologies (ICT) in the context of workplace procrastination in the public sector. The main results showed that workers in this sector displayed a low degree of adaptability to ICT, resulting in high workplace procrastination. This study showed a significant inverse relationship between the two variables.

Although there are tools for measuring adaptation, versions adapted to the current context and moment to evaluate adaptation to online classes have seemingly not yet been developed. In this context, and taking into account the evident deficiencies in Peru's higher education system, we believe it is crucial to investigate the psychometric properties of a scale designed to measure the adaptation of higher-education teachers to virtual academic settings.

Consequently, the aim of this study is to modify the adaptation to virtual academic media scale for university teachers in Peru, given the current importance and relevance of having an instrument of this type. The specific objectives are to validate the scale of adaptation to virtual academic media for university teachers in Peru

and to examine the psychometric properties of a scale of adaptation in the context of virtual education.

2. Methodology

2.1. Type of study

This research is an instrumental, cross-sectional study; its aim is to validate a scale for measuring the adaptation of university teachers in Peru to virtual academic media (Montero & León, 2002).

2.2. Participants

Regarding the participants in the research, we used purposive non-probability sampling to select a total of 252 university teachers from three leading Peruvian higher-education institutions. Of this group, 31.50% were male, and 68.50%, female. The ages of these teachers ranged from 26 to 53 years, with a mean age of 34.26 years and a standard deviation of 8.97. With regards to their place of residence, 13.91% lived on Peru's coast, 58.39% in the mountains, and 27.70% in the jungle.

We should also note that the participants taught in a range of academic disciplines, distributed as follows: 39.08% in nursing, 27.72% in medicine, 17.20% in psychology, 9.69% in dentistry, 3.41% in biology, and 2.90% in nutrition.

2.3. Instrument

The research was carried out in the context of the Covid-19 pandemic, which necessitated the implementation of social isolation and quarantine measures in Peru. To collect the data, we designed a questionnaire using Google Forms and made it available for completion between 21 and 30 December 2021. This questionnaire was administered through social networks (Facebook and WhatsApp) and the academic platforms of the three participating universities. Teachers were asked to participate voluntarily, and they were given access to detailed information about the aims of the research, the commitment to respect their privacy, and the need for them to give informed consent. Only those who agreed to participate in the study and gave their consent answered the questionnaire.

The instrument that was adapted for this research was the "Teachers' Stressors in Times of Pandemic Scale", originally developed by Oros et al. (2020) for teachers in Argentina. This scale comprises 21 items distributed in five dimensions and uses a Likert-scale

that runs from "Not at all stressful" (1) to "Very stressful" (5). To evaluate its quality, we analysed its content validity, with the participation of twelve experts in the field of education. We also carried out an exploratory factor analysis to determine the construct validity, using the applicable KMO and Bartlett chi-squared sampling adequacy indexes. The scale also showed an acceptable internal consistency, with a coefficient omega (ω) of 0.92.

2.4. Process

We went on to collect the data and cleansed them carefully to identify missing data and outliers. We also recalibrated the scores for the inverse items. We did the study in various stages.

First, to evaluate comprehension of the items, we adapted it culturally through semi-structured interviews with twelve experts in higher education. We did this because, although the terms were the same in Spanish, their interpretation could differ owing to cultural differences. As a result of this process, we modified items 1, 2, 4, 6, 7, and 9 to 21, ensuring there were no linguistic biases (Van de Vijver & Hambleton, 1996).

Second, we submitted the adapted scale for assessment by twelve specialists in higher education, who evaluated the clarity, representativeness, and relevance of the items. They used a validation format that made it possible to calculate the Aiken's V coefficient to determine the validity based on the content (Ventura-León, 2019).

Finally, to collect data, we administered the questionnaire using Google Forms, with the link to it being active from 9 to 30 August 2021. We contacted the participants through social networks such as WhatsApp and teachers' institutional email addresses. The importance of informed consent was emphasised and we explained that participation was entirely voluntary.

2.5. Data analysis

The analysis was divided into three different phases. In the first phase, we carried out an exploratory factor analysis (EFA) to evaluate the model's adequacy, using Bartlett's chi-squared and the Kaiser-Meyer-Olkin (KMO) coefficient. Then, in the second phase, we performed a confirmatory factor analysis (CFA), in which we evaluated various measurements of fit, such as the comparative fit index (CFI), the Tucker-Lewis index (TLI), the goodness of fit index (GFI), and the adjusted goodness of fit index (AGFI). In the third phase, we determined the reliability of the construct using Cronbach's alpha, along with the respective confidence intervals. We used the SPSS Amos version 25 software for all of these analyses.

2.6. Ethical considerations

This research was approved by the ethics committee of the Universidad Peruana Unión with reference number: 2021-CE-EPG-000066.

3. Results

3.1. Cultural adaptation of the scale of adaptation to virtual academic media

Table 1 shows the adaptation of the items from the original version in time and context for the aims and objectives of the present research, situations during the Covid-19 pandemic.

TABLE 1. Adaptation of items from the scale of adaptation to virtual academic media.

Item	Original version	Adapted version
1	I have made new friends at university.	I have been able to contact my colleagues using the virtual platform provided by the university where I work.
2	I have met people I can study with at university.	Through the virtual academic platform, I have been able to make a group for study/research or other related activities.
3	I communicate well with my classmates.	Communication with my peers through the virtual academic platform is adequate.
4	I participate in the recreational activities organised in my faculty.	The virtual academic platform enables recreational activities.

5	In my free periods, I use the canteen, multi-function building, etc. to meet and speak with classmates.	In free periods, I can use the virtual academic platform to meet with students/colleagues.
6	I am aware of what research and university extension are.	The virtual academic platform has tools for research and university extension.
7	I am aware of what university autonomy and co-governance are.	The virtual academic platform gives me the possibility of interacting with my managers and/or the university's senior management.
8	I have the information I need about the student welfare service.	Through the virtual academic platform, I have access to digital libraries/databases.
9	I have the information I need about my modules (timetables, programmes, activities I must do, etc.).	The virtual academic platform has all of the information about my modules, timetables, academic events, and other things.
10	I am clear about what the essential concepts I should learn in my subjects are.	The virtual academic platform enables me to show clearly the objectives of the subjects I teach.
11	I am clear that the teachers of my modules expect that I will be able to complete or resolve problems.	I am clear that my immediate managers expect that I will be able to achieve learning through the virtual academic platform.

3.2. Content validity

All of the items received a favourable evaluation (Table 2). In this case, items 2, 6, and 9 were shown to be most relevant (V = 0.94, *CI 95%*: .80-0.99); items 2, 6, 9, and 11 were shown to be most representative (V = 0.94, *CI 95%*: .80-0.99); and items 1, 2, 8, 9, 11 were clearest (V = 0.94, *CI 95%*: .80-0.99).

We performed an exhaustive review of the format validity based on reviewing the responses and suggestions

of the experts. With this information, we repeated the Aiken V analysis. This detailed revision has allowed us to improve the quality and coherence of the study (Table 2).

3.3. Exploratory factor analysis

The result of the Kaiser-Meyer-Olkin measure was 0.916, while Bartlett's test of sphericity had the following values: χ^2 = 2571.3, p <0.001. Consequently, we could reject the null hypothesis that there was no correlation between the variables. Furthermore, the

TABLE 2. Aiken's V for the evaluation of the relevance, representativeness, and clarity of the items on the scale.

Item	Relevance (*n* = 12)				Representativeness (*n* = 12)				Clarity (*n* = 12)			
	M	*SD*	*V*	*CI 95%*	*M*	*SD*	*V*	*CI 95%*	*M*	*SD*	*V*	*CI 95%*
1	2.67	0.49	0.89	0.73-0.96	2.75	0.45	0.92	0.76-0.97	2.83	0.39	0.94	0.80-0.99
2	2.83	0.39	0.94	0.80-0.99	2.83	0.39	0.94	0.80-0.99	2.83	0.39	0.94	0.80-0.99
3	2.75	0.45	0.92	0.76-0.97	2.75	0.45	0.92	0.76-0.97	2.75	0.45	0.92	0.76-0.97
4	2.67	0.49	0.89	0.73-0.96	2.67	0.49	0.89	0.73-0.96	2.75	0.45	0.92	0.76-0.97
5	2.58	0.67	0.86	0.70-0.94	2.75	0.45	0.92	0.76-0.97	2.75	0.45	0.92	0.76-0.97
6	2.83	0.39	0.94	0.80-0.99	2.83	0.39	0.94	0.80-0.99	2.83	0.39	0.94	0.80-0.99
7	2.75	0.45	0.92	0.76-0.97	2.75	0.45	0.92	0.76-0.97	2.75	0.45	0.92	0.76-0.97
8	2.67	0.65	0.89	0.73-0.96	2.67	0.65	0.89	0.73-0.96	2.83	0.39	0.94	0.80-0.99
9	2.83	0.39	0.94	0.80-0.99	2.83	0.39	0.94	0.80-0.99	2.83	0.39	0.94	0.80-0.99
10	2.75	0.45	0.92	0.76-0.97	2.75	0.45	0.92	0.76-0.97	2.75	0.45	0.92	0.76-0.97
11	2.75	0.45	0.92	0.76-0.97	2.83	0.39	0.94	0.80-0.99	2.83	0.39	0.94	0.80-0.99

Note: *M* = mean, *SD* = standard deviation, *V* = Aiken's V coefficient, *CI 95%* = confidence interval of Aiken's V.

levels obtained with both instruments confirmed that performing an EFA with the sample was appropriate (Quiroz Campas et al., 2021). We did this taking into account a principal components extraction method and Varimax rotation. As a result, we found that items were in three underlying factors: the first with 5 items, the second with 3 items, and the third with 3 items (Table 3). In this case, the accumulated variance was 77.65%, which indicates that little information is lost when obtaining three factors.

TABLE 3. Results of the exploratory factor analysis (EFA).

Indicator	Factor		
	1	2	3
AD2	.819		
AD1	.817		
AD3	.693		
AD5	.619		
AD4	.488		
AD8		.841	
AD7		.821	
AD6		.710	
AD11			.867
AD10			.836
AD9			.789

Note: extraction method: principal component analysis.

### 3.4. Confirmatory factor analysis (CFA)

A CFA was then carried out based on the eleven indicators and the three factors or latent variables. As can be noted, all the goodness of fit indexes complied with the criteria of the case (Table 4) and confirmed the three-factor model (Figure 1): $\chi^2 = 107.55$, $df = 37$, $\chi^2/df = 2.907$; $p = 0.000$; RMR = 0.034; GFI = 0.943; AGFI = 0.899; CFI = 0.972; TLI = 0.959; NFI = 0.959; IFI = 0.973, and RMSEA = 0.077. Therefore, the scale is valid, and the model, adequate.

TABLE 4. Goodness of fit indexes.

Goodness of fit index	Value	Goodness of fit index	Value
RMR	0.034	TLI	0.959
GFI	0.943	NFI	0.959
AGFI	0.899	IFI	0.973
CFI	0.972	RMSEA	0.077

FIGURE 1. Internal structure of the scale of adaptation to virtual academic media.
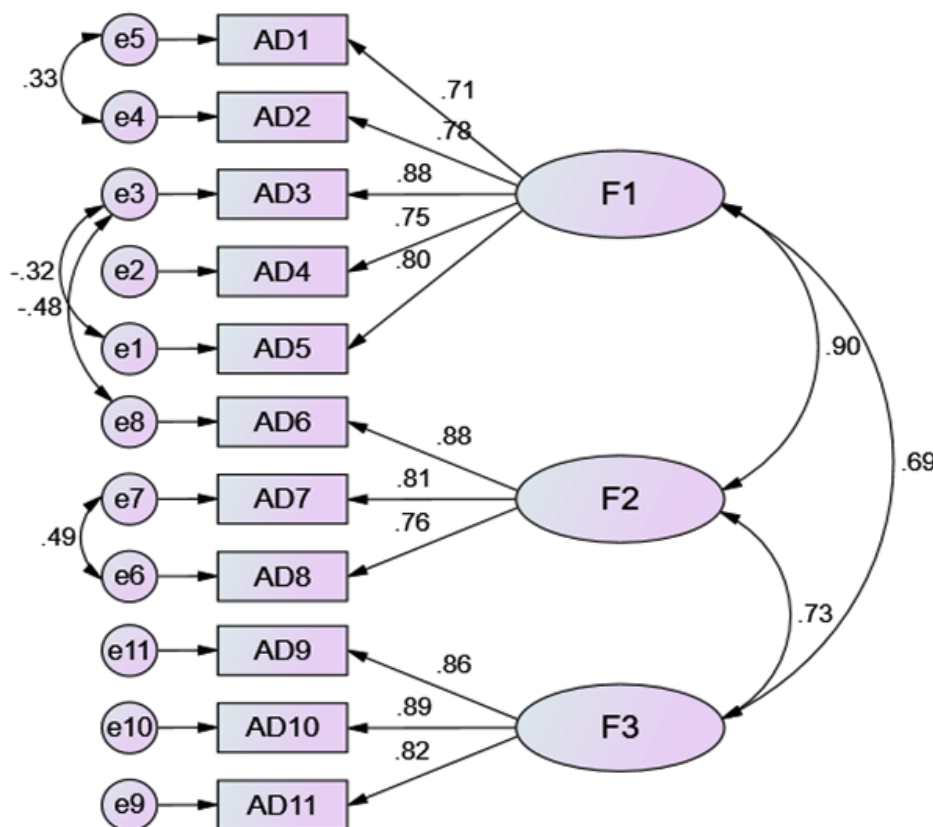
3.5. Reliability

We calculated the internal consistency using Cronbach's alpha, obtaining a figure of 0.89 (*CI 95%* = 0.85-0.90), which indicated that the instrument is highly reliable.

4. Discussion

Peru, like all countries, had to confront the crisis caused by the Covid-19 pandemic unexpectedly and suddenly (Figallo et al., 2020). with education having to be provided through virtual platforms, thus necessitating the adaptation of teachers and students. In view of this, the aim of this research was to adapt and validate a scale of adaptation to virtual academic media of university teachers in Peru. Consequently, we conclude that this scale is applicable not only to research in the context of Peru, but also to contexts that include university teachers.

Analysis of the EFA and CFA shows that the model displays an adequate fit to the scale. The existence of three factors was also established, relating to the social, institutional, and academic sphere. This finding is similar to those from other research (Arnau, 2011; Riquelme-Plaza et al., 2022), which show that the in-strument is valid and reliable to evaluate maintenance, problems, information management, and recent changes in teaching and learning processes. Besides, it helps to measure students' acceptance of online learning, similar to the study of Segura-Robles et al. (2022). In this way, it is possible to assume that this measurement can be used in new studies in Peru (Gassen et al., 2020; Surkan et al., 2021), as the results corroborate satisfactory psychometric and validity properties of the scale. Nonetheless, some authors consider this instrument to be multidimensional, with four factors: academic, institutional, social, and personal-emotional adaptation (Domínguez-Lara, 2017). For them, transition to university life is closely linked to the physical and mental well-being of teachers and students in the university (Chacaltana-Hernández, 2022).

The results presented here underline the profound importance of the capacity to adapt to the challenges presented by virtual university platforms in the midst of stressful situations, given that the effect of stress (strongly marked in women) is lost when the level of adaptability before the event is high. Consequently, the motive of study scale provides a favourable empirical result for adaptation to virtual classes and university

teachers' predisposition towards adaptation to future professional changes. In turn, it is configured as a valid instrument to prepare an intervention aimed in an integrated way at future research works.

The importance of these results revolves around their utility in the context of the pandemic, for the effect and challenge that technological innovation has entailed for university teachers (as they have had to use virtual platforms) has been a cause for concern in the global and local university community. In combination with this, other authors (Reynosa et al., 2020) maintain that the magnitude of the spread of Covid-19 disrupted the global educational dynamic, imposing a break with everyday life and meaning that prevention, self-care, and access to technology were accepted as the most viable way to preserve human life without giving up on education. So, the process of teacher adaptation in the context of Covid-19 has driven the need for teacher training in the use of ICT.

In view of these findings, it is important to develop teachers' command of ICT in future through continuous professional development, including after the pandemic (González, 2021). It is also necessary to note that students must be introduced to the use of digital tools before these are implemented in the educational process, as these new technologies have brought about a change in education, both in the way in which the teaching-learning process takes place and in the scenarios in which it occurs. (Hernández et al., 2018). In the case of teachers, there is little evidence of autodidacticism in the use of virtual tools to combine the methodological strategies and making the educational process dynamic.

This work's limitations include the use of purposive non-probability sampling. Also, as the sample was not random, the results cannot be generalised beyond the context from which they were extracted. Future studies could use probability sampling to make the findings generalisable. Secondly, the scale was not applied to a broader sample of public and private universities in the country to compare the viability of adaptation.

We conclude that the scale of adaptation to virtual academic media in university teachers in Peru demonstrates adequate psychometric properties and can be used for research in Peruvian settings.

5. Conclusions

In conclusion, this validation of a scale for measuring the adaptation of university teachers in Peru to virtual academic settings, backed by solid psychometric properties, confirms its reliability and validity, and underlines its applicability to the context of Peru. The purpose of this adaptation is to provide a valid and reliable instrument that makes it possible to obtain the opinions of university teachers in Peru about virtual academic media. Consequently, it represents a contribution to scientific literature as instruments that measure this variable had not previously been found. This tool not only strengthens current research, but is also a valuable resource for future research. Accordingly, we hope that this scale will contribute to a deeper comprehension of the adaptation of teachers to virtual education in Peru.

In view of the previous analysis, it is important to note the emergence of future lines of research directed at the study of online learning, distance learning strategies, online distance learning platforms, and strategies for emotional support for teachers, among others. It is also expected that this research will promote continuous improvement in this educational field, thus supporting the continuous development and improvement of online teaching. As university teachers in Peru adopt more effective strategies and adapt to the changing demands of virtual education, it is hoped that a learning environment in constant evolution that benefits teachers and students alike will be fostered. This research lays the foundations for future developments and refinements in online pedagogy, which will boost the quality of higher education in Peru and in other parts of the world that currently face similar challenges.

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