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Artículos científicos

Implicaciones del coronavirus covid-19 en los procesos de enseñanza en la educación superior

Implications of the Coronavirus COVID-19 in the Teaching Processes in Higher Education

Implicações do coronavírus covid-19 nos processos de ensino no ensino superior

Luis Alejandro Gazca Herrera
Universidad Veracruzana, México
lgazca@uv.mx
https://orcid.org/0000-0001-7637-2909

Resumen

El sistema educativo en todo el mundo ha tenido que afrontar la crisis generada por la covid-19, lo que ha exigido nuevos retos para cambiar la manera en que interactúa la sociedad y la forma de prepararse en lo profesional y académico. La presente investigación tiene como objetivo diagnosticar las consecuencias que ha tenido la covid-19 sobre los procesos de enseñanza en la educación superior. Para ello, se realizó una investigación de tipo no experimental, exploratoria, descriptiva y cuantitativa, bajo una metodología conceptual y teórica que permitió llevar a cabo la conceptualización. También se diseñó un instrumento con validez y confiabilidad que midió, según el criterio de percepción, el impacto en los ámbitos tecnológicos, de capacitación, social, económico y de salud que se han presentado en la comunidad académica debido a la covid-19. En los resultados se pudo identificar que los profesores cuentan con infraestructura tecnológica para impartir clases en línea con una plataforma institucional que es bien aceptada, lo que posibilita el transitar paulatino a la educación en línea. Por otra parte, los estudios estadísticos inferenciales no paramétricos con correlaciones dieron como resultado que hay asociación significativa entre las variables de edad y capacitación tecnológica con las competencias para dar clases en línea y la edad de los profesores con las afectaciones que han tenido en salud; en caso contrario, no se evidenció relación entre las variables de grados académicos y tipo de contratación con las competencias para

dar clases en línea. Sin embargo, los resultados de las correlaciones son entre moderadas y bajas, por lo que no se puede ser concluyente en las afirmaciones de la correlación existente. Finalmente, la amenaza latente tiene que ver con que si la pandemia no se resuelve a corto plazo puede generar incertidumbre para una correcta planeación académica.

Palabras clave: clases virtuales, covid-19, diagnóstico, educación superior.

Abstract

The education system around the world has had to face the crisis generated by COVID-19, which has required new challenges to change the way society interacts and the way to prepare professionally and academically. This research aims to diagnose the consequences that COVID-19 has had on the teaching processes in higher education. A non-experimental, exploratory, descriptive and quantitative research was carried out, under a conceptual and theoretical methodology that carried out the conceptualization. An instrument with validity and reliability was also designed that measured, according to the perception criteria, the impact on the technological, training, social, economic and health fields that have been presented in the academic community due to COVID-19. In the results, it was possible to identify that professors have a technological infrastructure to teach online classes with an institutional platform that is well accepted, which makes possible to move online. On the other hand, non-parametric inferential statistical studies with correlations resulted in a significant association between the variables of age and technological training with the skills to teach online and the teacher's age with the health effects they have had. Otherwise, there was no evidence of a relationship between the variables of academic degrees and type of hiring with the online teaching skills. However, the results of the correlations are between moderate and low, so it is not possible to be conclusive in the affirmations of the existing correlation. Finally, the latent threat has to do with the fact that if the pandemic is not resolved in the short term, it can create uncertainty for proper academic planning.

Keywords: Virtual Classes, COVID-19, Diagnosis, Higher Education.

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Resumo

O sistema educacional em todo o mundo tem enfrentado a crise gerada pela covid-19, que tem exigido novos desafios para mudar a forma como a sociedade interage e a forma de se preparar profissional e academicamente. A presente pesquisa tem como objetivo diagnosticar as consequências do covid-19 nos processos de ensino no ensino superior. Para tanto, foi realizada uma pesquisa não experimental, exploratória, descritiva e quantitativa, sob uma metodologia conceitual e teórica que permitiu a realização da conceituação. Também foi elaborado um instrumento com validade e confiabilidade que mede, segundo o critério de percepção, o impacto nos campos tecnológico, formativo, social, econômico e da saúde que tem sido apresentado na comunidade acadêmica devido a covid-19. Nos resultados, foi possível identificar que os professores possuem uma infraestrutura tecnológica para ministrar aulas online com uma plataforma institucional bem aceita, o que possibilita a transição gradativa para a educação online. Por outro lado, estudos estatísticos inferenciais não paramétricos com correlações resultaram em associação significativa entre as variáveis idade e formação tecnológica com as competências para ensinar online e a idade dos professores com os efeitos na saúde que têm; Por outro lado, não houve evidência de relação entre as variáveis de titulação acadêmica e tipo de recrutamento com as habilidades para ministrar aulas online. Porém, os resultados das correlações estão entre moderado e baixo, não sendo possível ser conclusivo nas afirmações da correlação existente. Por fim, a ameaça latente tem a ver com o fato de que, se a pandemia não for resolvida em curto prazo, pode gerar incertezas para o planejamento acadêmico adequado.

Palavras-chave: aulas virtuais, covid-19, diagnóstico, ensino superior.

Fecha Recepción: Mayo 2020 **Fecha Aceptación:** Octubre 2020

Introduction

Given the current situation, covid-19 has forced the general population - and especially the academic one - to face new challenges, hence the National Association of Universities and Institutions of Higher Education (Anuies) (2020) has had to publish the characteristics, organization and processes that higher education institutions (HEIs) in Mexico must follow. In this sense, the Ministry of Public Education (SEP, 2020), in coordination with the National Council of Educational Authorities (Conaedu) and in collaboration with the Ministry of Health, decided to suspend face-to-face school activity (in the case of autonomous universities , the decision was taken by its collegiate bodies) to continue with the provision of distance classes through digital media.

However, in order to implement virtual education successfully, instructional design methodologies must be known, which seek to promote the generation of student knowledge, as well as autonomy in learning. For this reason, a question arises: are teachers prepared for this task or are they only trying to solve a problem by coping with the situation? To try to answer this question, it is essential to carry out a diagnosis that provides information on how the teaching staff in HEIs are facing the new modality of education in the midst of this social, economic and health context generated by the pandemic.

Therefore, in this research we have sought to know if there is any relationship between the academic degrees that the teachers have, the training in educational technology they have previously taken, the type of hiring they have, as well as their ages and their competencies to teach online classes. Likewise, an attempt was made to identify the health problems that have occurred in this period.

Covid-19 has shown not only that diagnoses such as the one developed in this study are essential for making relevant decisions in teaching processes, but also that at any time the parameters of education can change abruptly, which implies a radical adjustment for which we must be prepared in terms of the needs and capacities of teachers and students.

Conceptual framework

The World Health Organization (WHO) (February 24, 2010) calls the global spread of a new disease a pandemic. In this sense, knowledge of the exact structure of this disease is vital, since its spread must be monitored, as well as determining the possibilities for developing vaccines

and other technological resources that can save lives, although it is worth noting that, due to various factors, such opportunities are often more limited for developing countries (WHO, 2011).

Speaking about pandemics, the WHO (June 10, 2010) has published three definitions of pandemic flu in the context of the global alert phases. These definitions appeared in more general guidelines on pandemic preparedness, published in 1999, 2005 and 2009. Research related to influenza pandemics and pandemic viruses intensified significantly as a result of the first human cases of H5N1 virus infection. avian influenza in 1997. These considerations, however, changed over time as a result of new knowledge and the need to improve the precision and practical applicability of the definition of the different phases.

In December 2019, a new coronavirus was identified as the etiologic agent of a severe acute respiratory illness in people exposed to a seafood market in Wuhan, Hubei province, China. This virus was temporarily named (on January 7, 2020) by the WHO as new coronavirus 2019 (covid-19). Subsequently, the virus was renamed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and the disease it causes was named coronavirus disease 2019 (covid-19). The month following its appearance, the virus spread rapidly in and out of Hubei province and even in other countries (Morales, 2020), which gave rise to two types of crisis: first, a health crisis that will cause thousands of deaths from the direct effects of the disease; and secondly, an economic and productive crisis that will cause an imbalance between supply and demand. These two collateral effects, logically, are closely linked, so it is essential that the economic and health policies of the countries are coordinated (Blackman et al., 2020).

An analysis carried out by Ríos (2020) indicates that we are experiencing an unprecedented time, where connectivity plays a fundamental role for all sectors of the economy. The crisis generated by covid-19 has faced us with challenges to change the way we interact with each other. As a consequence, the need arises to reinvent in a more accelerated way the way in which businesses, industries and even educational institutions were conceived.

Contextual framework on impacts and recommendations by Unesco

In a report issued by UNESCO and the International Institute for Higher Education in Latin America and the Caribbean (Iesalc), a report is presented where the impacts of covid-19 are analyzed and recommendations are offered to governments and HEIs to that can be served for the benefit of the academic community:

> The COVID-19 pandemic adds a further degree of complexity to higher education in Latin America and the Caribbean, which comes from facing unresolved challenges, such as growth without quality, inequities in access and achievement, and loss progressive public financing. This is indicated by the UNESCO International Institute for Higher Education in Latin America and the Caribbean, IESALC in its most recent work entitled COVID-19 and higher education (Iesalc, 2020).

The report begins with the immediate, medium and long-term impacts of the pandemic on the different actors in the sector:

- Students have been forced to enter into an unplanned dynamic of distance classes, which affects their daily lives, costs and financial burdens, as well as the continuity of their learning and international mobility. Those who have not had a quality continuity offer and individualized follow-up will probably become disconnected from the academic rhythm and increase their risk of leaving the system.
- In the case of Latin America and the Caribbean, entering a remote study phase requires a high rate of quality connectivity, and only one out of every two households is connected; In addition, mobile line rates are extremely high and in many cases exceed the figure of one line per person. This is undoubtedly an opportunity for HEIs, which should focus their efforts on technological solutions and content for use on mobile phones.
- The access of students to the technologies and platforms required for distance education (76%) and the actual capacity of the institutions, in technological and pedagogical terms, to offer quality online education (75%), leaves out 25% of students and institutions (Iesalc, 2020).

Institutional responses have focused on covering the health front, adjusting calendars, contributing from research and development to mitigate the pandemic and address the immediate emergency with a view to guaranteeing the well-being of citizens.

The Iesalc report recommends that all higher education actors prepare as soon as possible for the reopening of HEIs, which will probably happen in a context of economic recession with cuts in public investment in education. In this context, Unesco calls on States to ensure the right to higher education for all people within a framework of equal opportunities and non-discrimination as a first priority, through regulatory, financing and of adequate incentives, as well as of impulses to inclusive, relevant and quality initiatives to "leave no student behind". This implies meeting the

pedagogical, economic, and also socio-emotional needs of those students with greater difficulties to continue their training in non-traditional modalities (Iesalc, 2020).

Governments and HEIs are recommended to generate concertation mechanisms that allow joint progress in generating greater resilience capacity of the higher education sector in the face of future crises. HEIs are recommended to anticipate a long-term suspension, focusing efforts on ensuring continuity of training and guaranteeing equity, generating efficient governance, monitoring and support mechanisms; design pedagogical measures to formatively evaluate and generate mechanisms to support the learning of disadvantaged students; document the pedagogical changes introduced and their impacts; learn from mistakes and scale digitization, hybridization and ubiquitous learning, as well as promote internal reflection on the renewal of the teaching and learning model (Iesalc, 2020).

Reference framework and actions implemented by the Universidad Veracruzana

For this case study, the Veracruzana University (UV) was considered, which is located in the five regions of the state of Veracruz (Xalapa, Veracruz, Orizaba-Córdoba, Poza Rica-Tuxpan and Coatzacoalcos-Minatitlán), with the presence in 27 municipalities around the state. It has 322 educational programs at different levels of study; Currently, most of the student population attends programs with national and / or international recognition of quality, hence this house of studies is distinguished by being the state public university with the greatest diversification in its offer (UV, 2019a). Its enrollment is 83,388 students, distributed as follows: 64,721 students in formal education, 108 in technical, 465 in higher university technician, 62,115 in undergraduate, 319 in specialization, 1,166 in master's and 522 in doctorate; likewise, 22 633 students in non-formal education, which represents 25% of the enrollment in higher education in Veracruz (1 of 4 students enrolled in the UV) (UV, 2019b).

The UV has not ignored the actions that must be taken to protect the academic community; For this reason, its main actions include the following:

- Suspension of face-to-face academic activities.
- Adjustment of the 2020 school calendar.
- Re-scheduling of application dates for the new admission exam.
- Supports to give continuity to educational experiences.

- Publications, videos and dissemination material on covid-19.
- Temporary suspension of trips abroad, postponement of the 2020 International University Book Fair.

Likewise, a covid-19 contingency plan was launched, in which official notices, preventive measures and immediate actions directed at students, academic, administrative, technical and manual staff are released.

Method

The present investigation was of a non-experimental, exploratory, descriptive and quantitative type, supported by a conceptual and theoretical methodology that allowed the conceptualization to be carried out through a deductive process that later allowed to carry out the operationalization following the phases of theoretical representation of the concept and its identification . In this way, the dimensions with their indicators emerged and an instrument with validity and reliability was designed that measured, through the perception criterion, the impact caused by covid-19 in the educational, technological, training, social, economic and health fields.

Research objective

This research is part of an international study that aims to diagnose the implications that covid-19 has had on teaching processes in higher education, as well as its impact on the technological, social, economic and health fields. Based on the results achieved, an attempt is made to establish recommendations for future contingencies, all based on what is established by Unesco in its report on covid-19 and higher education.

Instrument design

To provide a context of what is to be measured reliably, the operationalization for the design of the instrument was carried out. Prior to its application, it was endorsed by five expert judges on the subject. In addition, the Cronbach's alpha technique was applied to determine its validity and reliability. Table 1 shows the result of the operationalization.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
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Tabla 1. División de las dimensiones, indicadores e ítems, resultado de la operacionalización para profesores

Variable	Dimensión	Indicador	Ítems
Impacto del coronavirus covid-19 en la educación superior (profesores)	**Infraestructura tecnológica**	Hardware	1.- Cuento con equipo de cómputo actualizado para llevar a cabo el proceso de enseñanza virtual.
			2.- Cuento con dispositivos periféricos (impresora, escáner, bocinas, cámara, entre otros) para llevar a cabo el proceso de enseñanza virtual.
			3.- Tengo conocimiento de mis estudiantes sobre los aspectos tecnológicos con los que cuentan para el proceso de enseñanza-aprendizaje.
		Software y Conectividad	4.- Cuento con conexión de internet con ancho de banda aceptable para llevar a cabo el proceso de enseñanza virtual.
			5.- Cuento con *software* que me permita llevar a cabo el proceso de enseñanza virtual.
			6.- La institución educativa cuenta con las plataformas educativas adecuadas para favorecer los procesos de enseñanza-aprendizaje.
	Capacitación	Diagnóstico	7.- Previo a la contingencia, la institución educativa realizó los procesos de diagnósticos de capacitación para la enseñanza virtual.
			8.- Durante la contingencia la institución educativo realizó los procesos de diagnóstico de capacitación para la enseñanza virtual.
		Cursos	9.- Cuento con las competencias para llevar a cabo los procesos de enseñanza bajo la modalidad virtual.
			10.- He tomado cursos de capacitación en el ámbito de la tecnología educativa para llevar a cabo los procesos de enseñanza bajo la modalidad virtual.
			11.- Implemento la modalidad asíncrona para el proceso de enseñanza bajo la modalidad virtual.
	Social, Económica Y Salud	Medidas implementadas	12.- Fueron correctas las prácticas de medidas implementadas por las autoridades educativas para favorecer el aprendizaje de los estudiantes en la modalidad virtual.
			13.- Las prácticas implementadas fueron establecidas en los tiempos adecuados.
			14.- La difusión de la propuesta de las prácticas para favorecer el aprendizaje de los estudiantes bajo la modalidad virtual fue correcta.
			15.- Las autoridades educativas realizaron un diagnóstico para identificar si los estudiantes tienen la posibilidad de aprender bajo la modalidad virtual.
			Como profesor realicé un diagnóstico para identificar si mis estudiantes tienen la posibilidad de aprender bajo la modalidad virtual.
		Costos	16.- Representa gastos adicionales a mis ingresos el llevar a cabo la educación bajo la modalidad virtual.
			17.- He recibido mi salario de acuerdo con los tiempos y montos establecidos.

			18.- Para mis estudiantes representan gastos adicionales a sus familias para su aprendizaje en la modalidad virtual.
		Salud	19.- Cuento son seguridad médica para que en caso de contagiarme con el virus del covid -19 pueda ser atendido.
			20.- Tengo conocimiento de los protocolos establecidos por las autoridades educativas y sanitarias para poder ser atendido en caso de contagiarme del virus covid -19.
			21.- He atendido las recomendaciones de las autoridades sanitarias para evitar el contagio del covid-19.
			22.- Me ha afectado en términos de salud el confinamiento por la cuarentena establecida por las autoridades sanitarias.
			23.- Me ha afectado en términos emocionales el confinamiento por la cuarentena establecida por las autoridades sanitarias.
			24.- Realizo actividades de ejercicios que mejoran mi salud como parte de la cuarentena establecida por las autoridades sanitarias.
		Seguridad	25.- He sufrido de algún tipo de violencia en casa a causa del confinamiento por la cuarentena establecida por las autoridades sanitarias.
			26.- Al género femenino le representa mayor carga de actividades domésticas, profesionales y de cuidado de los hijos que al género masculino como parte del confinamiento por la cuarentena por el virus covid-19.
	Competencias digitales	Información	27.- Representa mayor trabajo, esfuerzo y dedicación la modalidad de la educación virtual.
			28.- Utilizo colecciones de revistas académicas y científicas que brindan información digital de calidad (Scopus, Scielo, JCR, Redalyc) en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
			29.- Obtengo información de bancos de datos como fuentes de información secundarias para actividades académicas o de investigación (Inegi, Banxico, Bancomext, entre otros) nacional o internacionales en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
		Comunicación y colaboración	30.- Utilizo plataformas de almacenamiento en la nube (Dropbox, Google Drive, iCloud, entre otras) en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
			31.- Utilizo gestores de aprendizaje como Eminus, Moodle, Blackboard, Joomla, Word Press, entre otros, como plataformas de aprendizaje en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
			32.- Utilizo las redes sociales como recurso dentro del aula en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
			33.- Trabajo en ambientes de aprendizajes y colaboración en la nube (Dropbox, Google Drive, Mega, Office365, iCloud), en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.

			34.- Uso herramientas para detectar el plagio en los documentos (Turnitin, Paper Rater, Viper, Plagium, entre otros), en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
		Creación de contenidos	35.- Empleo plataformas digitales de trabajo grupales con mensajería (Skype, Zoom, Line, WhatsApp, Telegram messenger, entre otros) en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
			36.- Uso *software* para presentaciones multimedia en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.
			37.- Creo y edito contenido multimedia (audios, videos, imágenes, textos) en apoyo a los procesos de enseñanza-aprendizaje bajo la modalidad virtual.

Fuente: Elaboración propia

Instruments validity and reliability techniques

Expert judgment is a widely used validation method in quantitative research. This basically consists of asking a series of people for an assessment or opinion about an object, instrument or teaching material (Cabero and Llorente, 2013, cited by Robles Garrote and Rojas, 2015). The selection of the judges was carried out in accordance with what Escobar and Cuervo (2008) propose, that is, the academic training of the experts, their experiences and recognition in the community. In addition to this, a minimum of five judges was considered, two of whom had to be experts in measurement and evaluation.

On the other hand, the Fleiss Kappa coefficient was used --as cited in Torres and Pereda (2009) -, which generalized the application of Cohen's Kappa index to measure the agreement between more than two coders or observers for scale data nominal and ordinal. The values obtained in the Fleiss Kappa coefficient for each criterion of the instrument evaluated by the experts for the teachers are shown in Table 3.

Tabla 2. Interpretación del índice de Kappa de Fleiss de acuerdo con Altman (1991)

Interpretación del índice Kappa (Altman, 1991)	
Valor de K	**Fuerza de concordancia**
< 0.20	Pobre
0.21 – 0.40	Débil
0.41 – 0.60	Moderada
0.61 – 0.80	Buena
0.81 – 1.00	Muy buena

Fuente: Torres y Pereda (2009)

Tabla 3. Coeficiente de Kappa de Fleiss obtenido para profesores

Suficiencia	Coherencia	Relevancia	Claridad
K = .902	K = .956	K = .891	K = .945

Fuente: Elaboración propia

If the ranges of values provided in Table 2 are taken, it can be seen that the agreement between the criteria evaluated by the judges results in a very good agreement for the criteria of sufficiency, coherence, relevance and clarity. Due to the aforementioned, there is a reliable instrument in accordance with the results of the coefficients in the concordance of the criteria evaluated by the judges.

Another of the methods used was Cronbach's alpha, which is an index used to measure the reliability and reliability of the internal consistency type of a scale, that is, to assess the magnitude of correlation between the items of an instrument.

Tables 4 and 5 represent the reliability of the scale of the instrument obtained from a pilot survey applied to 20 teachers with 39 items, which yielded a Cronbach's alpha value of .867, which represents a good value according to George and Mallery (2003).

Tabla 4. Resumen del procesamiento de los casos de las variables para profesores

Resumen del procesamiento de los casos			
		N	%
Casos	Válidos	20	100.0
	Excluidos[a]	0	.0
	Total	20	100.0
a. Eliminación por lista basada en todas las variables del procedimiento			

Fuente: Elaboración propia con SPSS

Tabla 5. Alfa de Cronbach para instrumento de profesores

	Estadísticos de fiabilidad	
Alfa de Cronbach	Alfa de Cronbach basada en elementos estandarizados	N de elementos
.867	.881	20

Fuente: Elaboración propia con SPSS

With the results obtained, it is observed that there is an instrument with good consistency, valid and reliable.

Description or definition of the study subjects and units of analysis

The identified population or study subjects were the professors of higher level of the Universidad Veracruzana. According to the Strategic Program (2019) of the university, the identified population can be seen in table 6.

Tabla 6. Académicos adscritos a la Universidad Veracruzana

Total de académicos	**6235**
Profesores de tiempo completo	2093
De los PTC	
Con doctorado	1280
Maestría	629
Especialización	79
Licenciatura	105
Adscritos al SNI	447
Perfil Prodep	1,210

Fuente: Programa estratégico (2019)

According to García, Reding and López (2013), an important aspect in the research methodology is the calculation of the number of participants that should be included in a study. To determine the sample size for UV professors, the following formula was used to calculate the finite population at convenience:

$$n = \frac{N * Z^2 * p * q}{e^2 * (N-1) + Z^2 * p * q}$$

As:
Z = 95% confidence level, table value (1.96)
p = Probability that the event will occur 50% = .5
q = (1-p) Probability that the event will not occur 50% = .5
N = Population of 6235 teachers
e = Maximum accepted estimation error is 4.15 %.

Substituting the values, a sample of 512 teachers was obtained, to whom the instrument was applied. These professors —according to the convenience of the sampling— held full-time, part-time or subject positions in all academic areas and in the five regions covered by the UV in the state of Veracruz.

Results

This section presents the descriptive results of the instrument applied between April 4 and May 5, 2020, starting with the generalities and then by dimensions. For the interpretation of the results, the affirmative answers were grouped, in which there is totally agreement and in agreement with the questioning by making a single answer, and the non-affirmative when there is disagreement and totally in disagreement establishing a single answer.

Tabla 7. Estadística de los elementos

Estadísticas de elemento de resumen							
	Media	Mínimo	Máximo	Rango	Máximo / Mínimo	Varianza	N de elementos
Medias de elemento	2.906	1.304	3.751	2.446	2.875	.249	512
Varianzas de elemento	.834	.350	1.302	.951	3.716	.045	512
Covarianzas entre elementos	.104	-.242	.684	.926	-2.827	.021	512
Correlaciones entre elementos	.129	-.386	.791	1.177	-2.047	.030	512

Fuente: Elaboración propia con SPSS

Of the teachers who responded to the survey, 53% were men and 47% women. The most frequent age range was 41-45 years. The average age was 47 years. The oldest respondent was 76 years old and the youngest was 21 years old. Regarding the academic degrees, 43% were doctors, 40% with a master's degree, 12% with a bachelor's degree and 4% with a specialty. Regarding the type of hiring, 53% was by subject or subject, 46% full time and only 1% part time. Regarding the regions where the survey was applied, the one with the highest participation was Xalapa with 37%, Veracruz-Boca del Río with 20%, Poza Rica-Tuxpán with 22%, Coatzacoalcos-Minatitlán with 11% and Córdoba-Orizaba with 10%. Finally, regarding the academic areas where the professors are assigned, 60% of those who responded belonged to the technical area, 21% to the economic-administrative area, 8% to the biological area, 6% to the health sciences area and 5% to other academic areas.

Dimension 1. Technological infrastructure. With the technological infrastructure dimension, it was evaluated whether UV professors had the technological hardware, software and connectivity equipment to work in the virtual mode.

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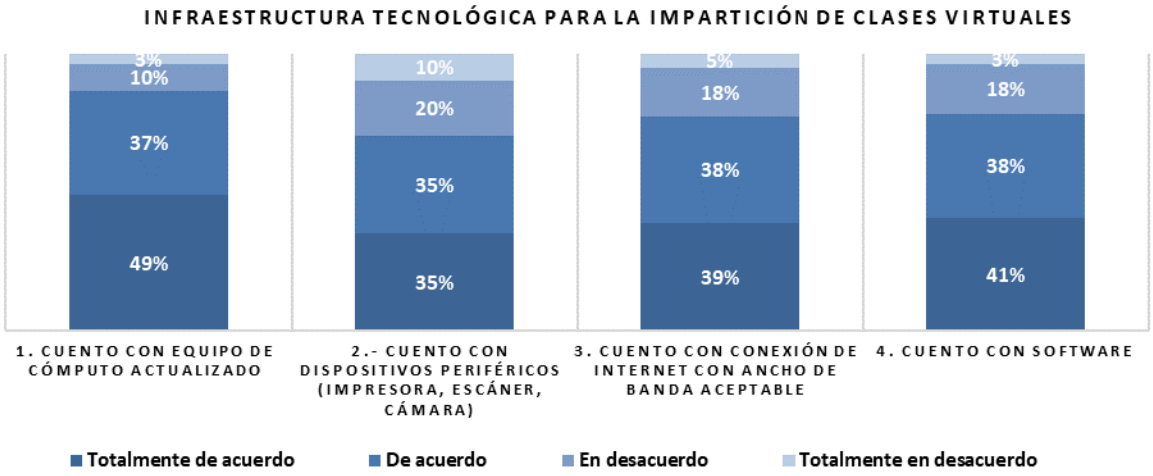
Figura 1. Infraestructura tecnológica para la impartición de clases virtuales



Fuente: Elaboración propia

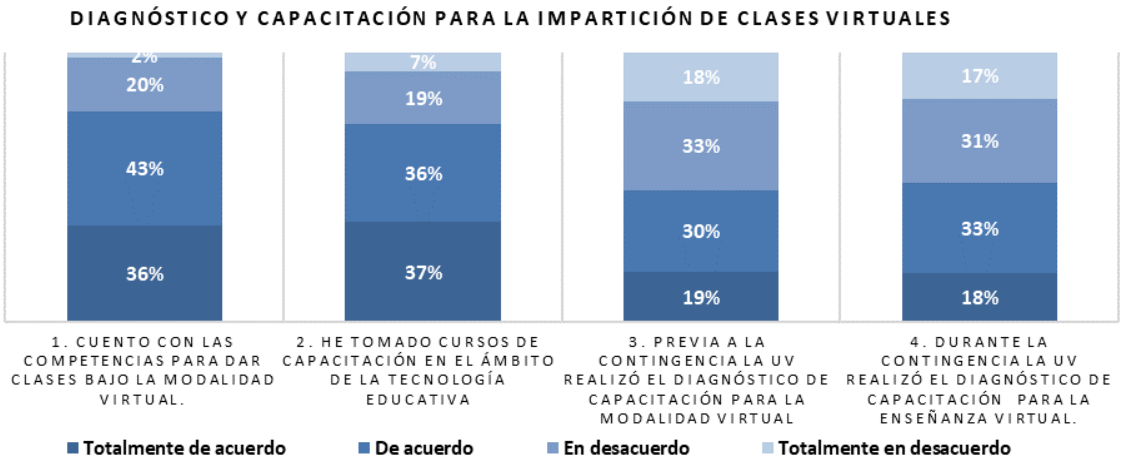
As can be seen in Figure 1 - referring to the technological infrastructure that teachers have to carry out teaching processes in the virtual mode - 86% have up-to-date computer equipment; 70% have peripheral devices, 77% have an internet connection with an acceptable bandwidth and 79% have software to teach their classes in virtual mode. These data establish that a significant percentage of teachers have the technological infrastructure to develop virtual classes.

In addition to the above, it should be noted that teachers were also asked whether they knew what technological tools their students had. In this regard, 57% stated that they did know the type of infrastructure of their students, while 43% responded negatively. This data is relevant to know if students can respond to the academic activities proposed on various platforms (such as Eminus, the UV platform for virtual classes), as well as other digital educational resources.

Another question posed to the teachers was about the relevance of the platforms offered by the institution. On this, 87% expressed that Eminus is a platform that favors learning, so that it could move to an online education model. In addition, it should be noted that between March 23 and April 5, 2020, an average of 25,000 users per day accessed said portal.

Dimension 2. Training. In the context of this pandemic, it is significant that the UV professor has knowledge about virtual education and how he can use it to develop his academic activities. The training dimension has the purpose of identifying the way in which a teacher is prepared to teach in digital environments, if he has trained on his own or as part of the actions that the educational institution has implemented before and during the contingency generated by covid-19.

Figura 2. Diagnóstico y capacitación para la impartición de clases

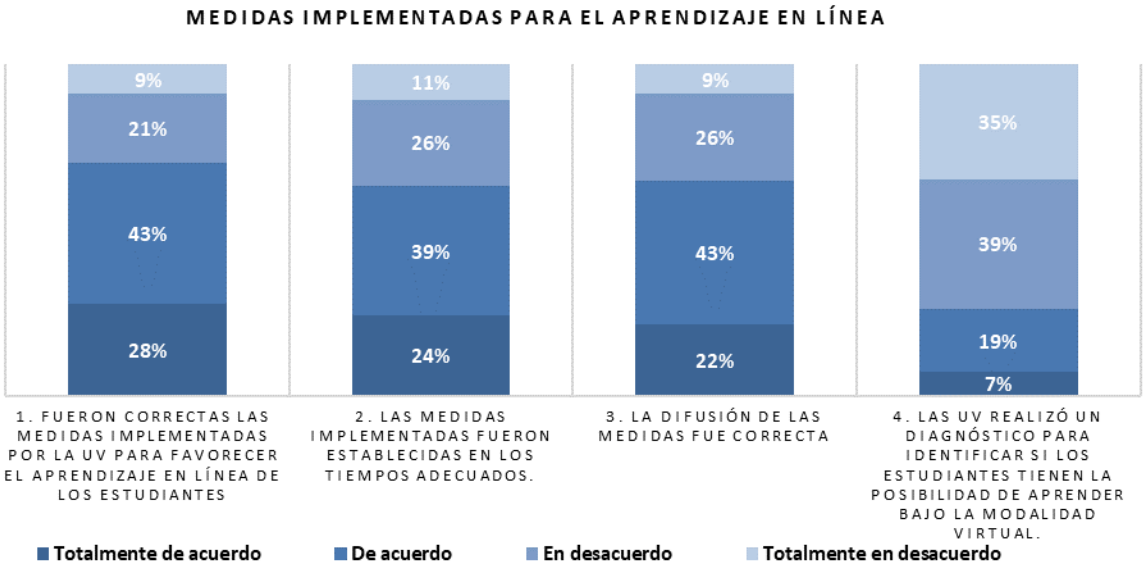


Fuente: Elaboración propia

Of the teachers surveyed, 79% consider that they have the skills to carry out the teaching-learning processes in the virtual modality. This result is very favorable, considering the actions that must be taken in the short term to increase this type of interaction. In this regard, 73% of the teachers responded that they have taken training courses in the field of educational technology; 49% mentioned that prior to the covid-19 contingency, the UV carried out the diagnostic processes for training in virtual education. This constitutes an opportunity so that efforts can be directed towards an institutional online training policy, and not isolated efforts to implement academic entities. Likewise, 51% of the teachers responded that during the contingency the UV carried out a training diagnosis for virtual teaching.

Dimension 3. Socioeconomic and health field. The objective of this indicator was to analyze the measures implemented by academic authorities to facilitate the teaching process under the virtual modality. In the economic sphere, an attempt was made to find out if the process has represented additional expenses, if their income has been affected, if they have the medical security to be treated in a public or private hospital, if they have taken the pertinent measures established by the authority health and, finally, if the confinement has caused any kind of damage to their health.

Figura 3. Medidas implementadas para el aprendizaje en línea

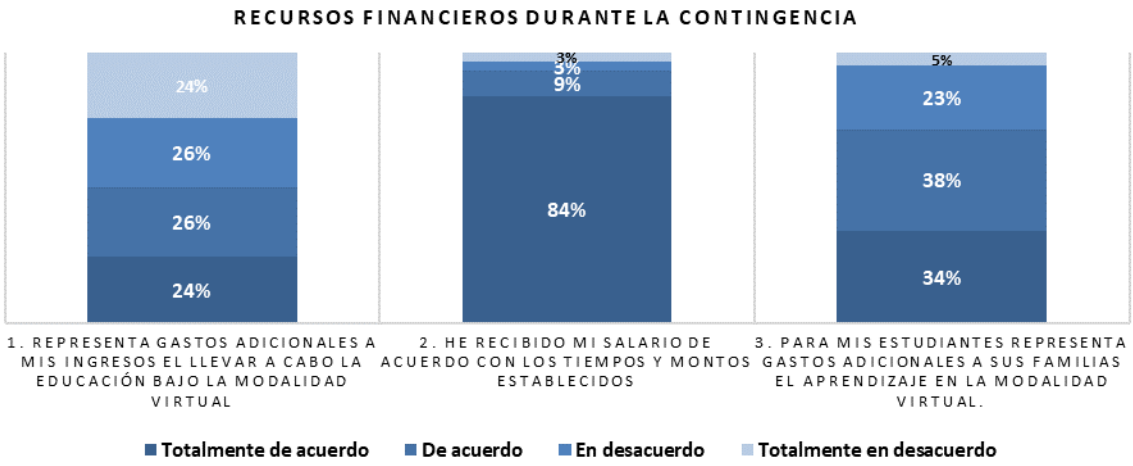


Fuente: Elaboración propia

As can be seen in figure 3, 71% of the teachers believed that the practices of the measures implemented by the educational authorities to favor the learning of students in the virtual mode were correct; 63% considered that the measures were established in adequate times; 65% agreed that the dissemination by the various media was correct. It also stands out —as the teachers' perception— that 26% believe that the UV carried out a diagnosis to identify if the students had the possibility of learning under the virtual modality; This result serves as support to develop institutional policies and to carry out diagnostic and training processes for students, since not all teachers and students have the infrastructure or skills necessary for teaching-learning processes in digital environments. Another important fact was that only 54% of the teachers made a diagnosis at the beginning of the contingency to identify if students had the possibility of learning in this modality, a variable that teachers should consider to be flexible and supportive in these moments of quarantine.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

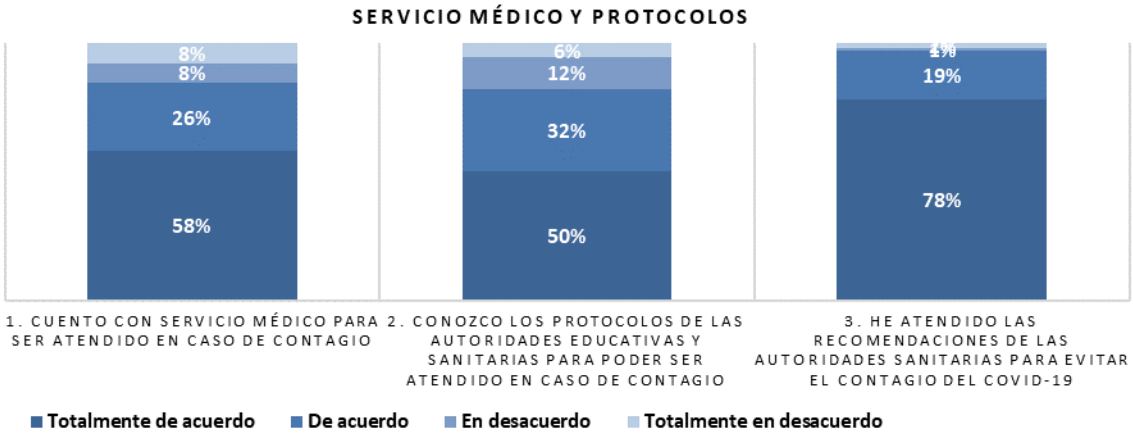
Figura 4. Recursos financieros durante la contingencia



Fuente: Elaboración propia

Regarding the impact of covid-19 on financial aspects, 50% of the teachers mentioned that online education represented additional expenses; A significant fact —and that shows the solidarity of the UV with the professors— is that 94% of them reported that they have received their salary according to the established times and amounts. However, it also stands out that for 72% of teachers this educational modality has meant an increase in additional expenses for students.

Figura 5. Servicio médico y protocolos

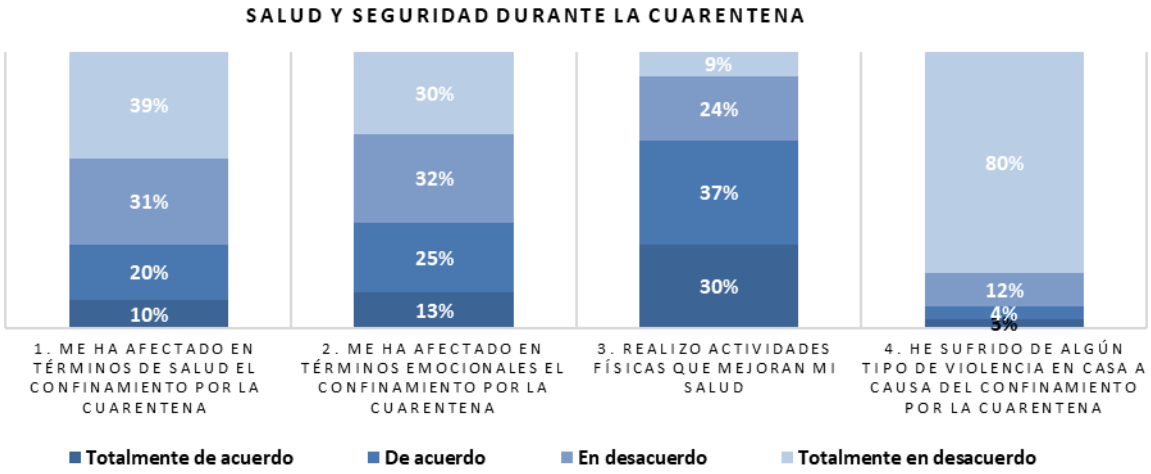


Fuente: Elaboración propia

In the health field, 84% of the teachers answered that they had a medical service to be treated in case of contracting the covid-19 virus. Likewise, 82% mentioned that they had knowledge of the protocols established by the educational and health authorities to be able to be

treated in case of infections. Likewise, it is very positive that 97% of the teachers have followed the recommendations of the health authorities.

Figura 6. Salud y seguridad durante la cuarentena



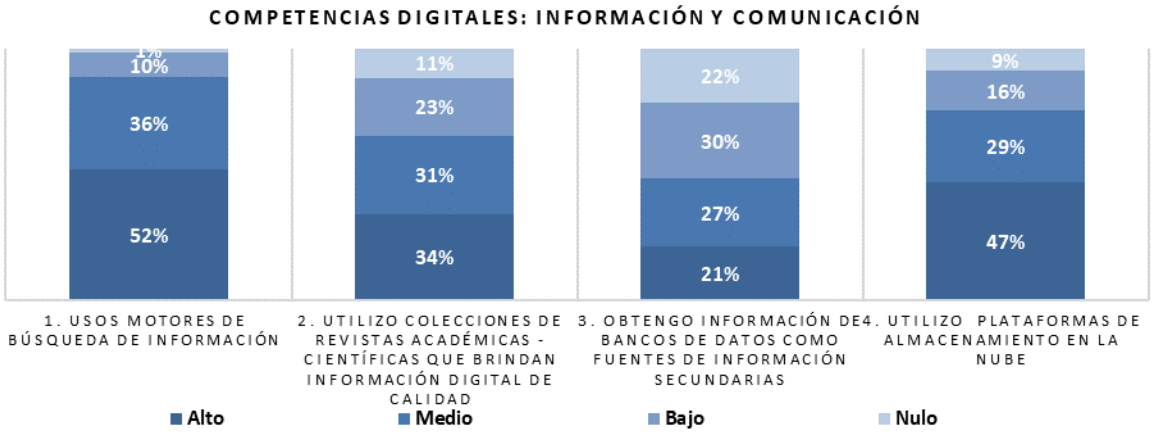
Fuente: Elaboración propia

Regarding health and safety during quarantine, 30% of the teachers responded that they have been affected in terms of health by the confinement established by the health authorities. In fact, 38% considered that they had been affected in emotional terms. Even so, 67% of teachers do physical activities to improve their health. A relevant fact is that 92% have not suffered some type of violence in their homes due to confinement, although 8% have suffered, so a study is recommended to identify the causes and consequences of this situation. An important aspect during the current quarantine has been the role of women in the home, on which 62% answered that their domestic activities have increased.

Dimension 4. Digital skills. Currently, technologies are present in all areas of our life and using them in academic environments has become very important, so this dimension was intended to assess digital communication, information and content creation skills. This dimension also includes the use and implementation of digital tools to share and collaborate on files, as well as the use of specialized software depending on the needs of the activities of the teaching-learning process.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Figura 7. Salud y seguridad durante la cuarentena

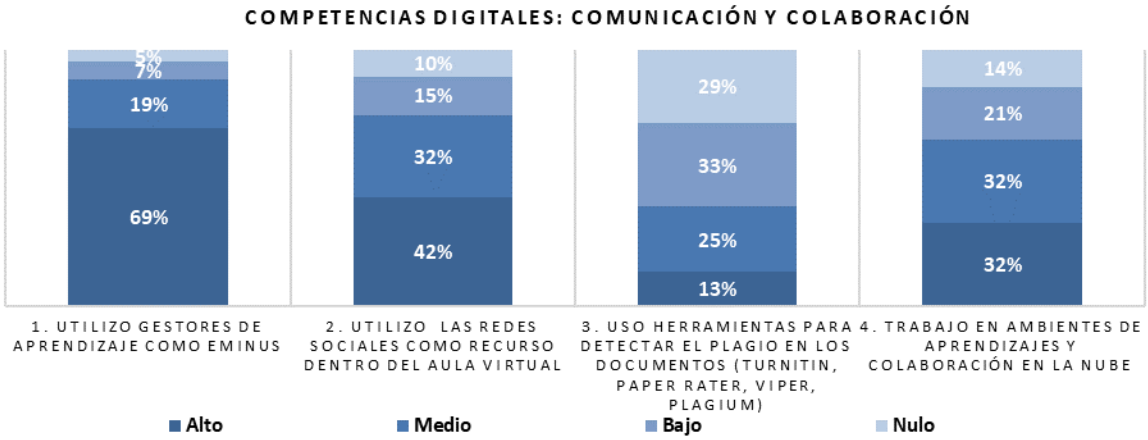


Fuente: Elaboración propia

Regarding digital skills in the field of information and communication, 89% of teachers use general information search engines (Google, Yahoo, Bing, Ask, among others) to support teaching-learning processes in virtual mode ; 66% use collections of academic and scientific journals that provide quality digital information (Scopus, Scielo, JCR, Redalyc); This constitutes an area of opportunity, since the information provided to students must be based on refereed research, which guarantees better projects. In this sense, 48% of the professors responded that they obtain information from national or international databases as secondary information sources for academic or research activities (Inegi, Banxico, Bancomext, among others). Finally, regarding this criterion, 75% use cloud storage platforms (Dropbox, Google Drive, iCloud, among others) to promote online teaching-learning processes.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Figura 8. Competencias digitales: comunicación y colaboración



Fuente: Elaboración propia

In figure 8 it can be seen that 88% of teachers use learning managers such as Eminus to support teaching-learning processes in virtual mode; 75% use social networks as a teaching resource, while 38% use tools to detect plagiarism in student documents (eg, Turnitin, Paper Rater, Viper, Plagium, among others). This low percentage shows that there is an area of opportunity to enhance anti-plagiarism skills. Likewise, 65% mentioned that they work in cloud learning and collaboration environments to support their online education process. Finally, 86% of teachers use digital platforms for group work with messaging (Skype, Zoom, Line, WhatsApp, Telegram messenger, among others), while 73% use software for multimedia presentations and 69% create and edit multimedia content (audios , videos, images, texts).

Correlational analysis of data

Nonparametric inferential statistics was used for the correlational analysis of data, since the variables to be analyzed were ordinal. Therefore, Kendall's Tau-b methodologies were used for square tables and Kendall's Tau-b for non-square tables. The first case consisted in analyzing whether there was any association between the academic degrees that the teachers had and the skills to be able to teach online classes. The hypotheses were the following:

- H_0: There is no significant relationship between the academic degrees that teachers have and their skills to teach online.
- H1: There is a significant relationship between the academic degrees that teachers have and their skills to teach online.

If the follow. p-value is <0.05, H0 is rejected; otherwise it is accepted.

Kendall's Tau-b method.

Tabla 8. Correlación profesor competencias-grados

Correlaciones				
			Competencias	**Grado académico**
Tau_b de Kendall	**Competencias**	Coeficiente de correlación	1.000	.057
		Sig. (bilateral)	.	.152
		N	511	511
	Grado académico	Coeficiente de correlación	.057	1.000
		Sig. (bilateral)	.152	.
		N	511	511

Fuente: Elaboración propia SPSS

According to the p-value "sig. (bilateral) "= .152> .05, which implies accepting the H0 concluding that there is no significant association between the variables academic degrees that teachers have and skills to teach online. This is evidenced by the value of the correlation coefficient t = .057, which is interpreted as a very low positive correlation between the variables.

The second case consisted of analyzing whether there was any association between the training in educational technology taken by the teachers and the skills to be able to teach online. The hypotheses were the following:

- H_0: There is no significant relationship between the technology training that teachers have taken and their competencies to teach online.
- H1: There is a significant relationship between the technology training that teachers have taken and their skills to teach online.

If the follow. p-value is <0.05, H0 is rejected; otherwise it is accepted.

Kendall's Tau-b method.

Tabla 9. Correlación profesor competencias-capacitación

Correlaciones				
			Competencias	**Capacitación**
Tau_b de Kendall	**Competencias**	Coeficiente de correlación	1.000	.493
		Sig. (bilateral)	.	.001
		N	511	511
	Capacitación	Coeficiente de correlación	.493	1.000
		Sig. (bilateral)	.001	.
		N	511	511

Fuente: Elaboración propia SPSS

According to the p-value "sig. (bilateral) "= .001 <.05, which implies rejecting the H0 concluding that there is a highly significant association between the variables training in educational technology that teachers have and their skills to teach online. This is evidenced by the value of the correlation coefficient t = .0.493, which is interpreted as a moderate positive correlation between the variables.

The third case consisted of analyzing whether there was any association between the type of recruitment that teachers had and the skills to be able to teach online. The hypotheses were the following:

- H_0: There is no significant relationship between the type of recruitment that teachers have and their skills to teach online.
- H1: There is a significant relationship between the type of hiring that teachers have and their skills to teach online classes.

If the follow. p-value is <0.05, H0 is rejected; otherwise it is accepted.

Kendall's Tau-c method.

Tabla 10. Correlación profesor tipo de contratación-competencias dar clases en línea medidas simétricas

Medidas simétricas					
		Valor	Error estándar asintótico[a]	T aproximada [b]	Significación aproximada
Ordinal por ordinal	Tau-c de Kendall	-.014	.036	-.378	.705
N de casos válidos		511			

Fuente: Elaboración propia SPSS

According to the p-value "sig. (approximation) "= .705> .05, which implies accepting the H0 concluding that there is no significant association between the variables academic degrees available to teachers and their skills to teach online. This is evidenced by the value of the correlation coefficient t =.-014, which is interpreted as a very low negative correlation between the variables.

The fourth case consisted of analyzing whether there was any association between the age of the teachers and the skills to be able to teach online. The ages were grouped ordinally in the ranges of 20 to 30 years, 31 to 40 years, 41 to 50 years, 51 to 60 years and older than 60 years.

The hypotheses were the following:

- H_0: There is no significant relationship between the age of teachers and their skills to teach online.
- H1: There is a significant relationship between the age of teachers and their skills to teach online.

If the follow. p-value is <0.05, H0 is rejected; otherwise it is accepted.

Kendall's Tau-c method.

Tabla 11. Correlación profesor tipo de contratación-competencias dar clases en línea medidas simétricas

Medidas simétricas					
		Valor	Error estándar asintótico[a]	T aproximada[b]	Significación aproximada
Ordinal por ordinal	Tau-c de Kendall	-.142	.035	-4.066	.000
N de casos válidos		511			

Fuente: Elaboración propia SPSS

According to the p-value "sig. (approximation) "= .000 <.05, which implies not accepting the H0, concluding that there is a highly significant association between the variables age of the teachers and their skills to teach online. This is evidenced by the value of the correlation coefficient t = -.142, which is interpreted as a very low negative correlation between the variables.

The fifth case consisted of analyzing whether there was any association between the teacher's age and health effects due to covid-19. The hypotheses were the following:

- H_0: There is no significant relationship between the age of the teachers and their health problems.
- H1: There is a significant relationship between the teachers' age and their health problems.

If the follow. p-value is <0.05, H0 is rejected; otherwise it is accepted.

Kendall's Tau-c method.

Tabla 12. Correlación profesor edad-afectación de salud a causa de la covid-19

Medidas simétricas					
		Valor	Error estándar asintótico[a]	T aproximada[b]	Significación aproximada
Ordinal por ordinal	Tau-c de Kendall	.094	.037	2.534	.011
N de casos válidos		511			

Fuente: Elaboración propia SPSS

According to the p-value "sig. (bilateral) "= .011 <.05, which implies rejecting the H0 concluding that there is a highly significant association between the age variables and the health effects that covid-19 is causing them due to quarantine. This is evidenced by the value of the correlation coefficient t = 0.094, which is interpreted as a low positive correlation between the variables.

In conclusion, some variables analyzed are related and most of the correlations are very low. This means that we cannot be conclusive in the statements of the existing correlations, since the Kendall correlation is a test of hypothesis and measure of correlation through the indices.

Discussion

Undoubtedly, it is important to mention that the present research has its limitations, since the students' perception was not considered as to whether the teachers had the skills and tools to teach online classes. Therefore, it is necessary to develop a similar study to compare both results. Even so, a valuable aspect of this research has to do with the design of the instrument, to which validation techniques by expert judgment and Cronbach's alpha were applied with very favorable results. This means that in a social phenomenon, the established dimensions can be measured with less uncertainty.

In this sense, when conducting non-parametric inferential statistical studies on the correlation of variables, it was possible to determine the hypotheses about the relationship between the training of teachers and their age to teach online classes. With this analysis, better decisions can be made about the actions implemented to improve the digital skills of teachers. In the same way, the descriptive results of the research themselves represent a strength for the authorities to

plan in the short term how activities should be designed and implemented in this context of a pandemic. The inconveniences that teachers have had to face in terms of physical and emotional health must also be addressed, as it is not yet possible to predict when the restrictions of this quarantine period will be lifted.

Conclusions

The health contingency caused by covid-19 has changed our lives. The ways in which countries and citizens should conduct themselves are totally different. This situation modified the economy, the environment, society, the way of coexistence and education. No country or educational institution was prepared for such a situation; However, the most important thing is to try to focus on rescuing the areas of opportunity that have arisen so that the immediate future can be planned with as little uncertainty as possible. For this reason, a conclusion based on a SWOT analysis (strengths, opportunities, weaknesses and threats) of this diagnosis is presented below.

As strengths, it can be noted that the teachers have technological infrastructure, skills and have taken courses in educational technology to teach online classes. Likewise, there is a robust Eminus learning manager platform whose acceptance is very favorable by teachers.

As an opportunity, without a doubt, the development of proposals that allow a gradual transition towards online education should be mentioned, not thinking about complete educational programs at first, but with subjects that can be taught under this modality, which would reduce the presence physics in educational spaces. The study showed that the UV has not carried out an exhaustive diagnosis on the capacity of teachers to work in the virtual modality.

As a weakness, we can unfortunately point out that due to this unplanned situation, some teachers who were not prepared to work fully in a virtual way have had to face a way of instruction that requires mastery of other codes and skills. This disability can be very damaging, as it could negatively affect students' perception of online education.

Finally, the threats detected have to do with the risks to the physical and emotional integrity of the teachers as a result of the confinement. In fact, if this period were to be extended unlimitedly, it would bring with it significant problems. Therefore, it is time to do an academic planning thinking about mixing the online modality with the face-to-face one, as this could reduce the mobility rates in the faculties and avoid all kinds of risks for the academic and student community. In summary, the results of this investigation will be delivered to the UV authorities so that they have information that allows them to make correct decisions.

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