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Artículos científicos

Estudio de percepción de estudiantes universitarios sobre su proceso de aprendizaje en tiempos del covid-19

Perception study of university students about their learning process in times of COVID -19

Estudo de percepção de estudantes universitários sobre seu processo de aprendizagem em tempos de covid-19

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Resumen

Los procesos educativos son esenciales para que los estudiantes tengan un aprendizaje significativo que englobe los saberes teóricos, heurísticos y axiológicos de las distintas asignaturas, lo cual será vital para que adquieran las competencias necesarias que aplicarán más adelante en su entorno profesional y laboral. Previo a la pandemia generada por el covid-19, el mayor porcentaje de la matrícula de la Universidad Veracruzana se encontraba en la modalidad escolarizada; sin embargo, a causa del confinamiento, a partir de marzo de 2020, las clases se tuvieron que impartir en una modalidad que la propia institución denominó *mixta*. Esto generó un problema, pues ni profesores ni estudiantes estaban preparados para tal transición, lo cual se agravó debido a la carencia de infraestructura tecnológica adecuada y de competencias para llevar a cabo los nuevos procesos de enseñanza-aprendizaje. Por ese motivo, el objetivo de la presente investigación fue realizar un análisis comparativo, descriptivo y paramétrico sobre el proceso de aprendizaje de los estudiantes de educación

superior en la modalidad presencial y virtual para determinar las acciones que se puedan tomar. El trabajo fue de tipo exploratorio, ya que el tema de análisis no había sido suficientemente estudiado; asimismo, fue explicativo porque se encontraron las causas que permitieron dar una descripción más profunda de la problemática en cuestión. El enfoque de investigación fue de tipo cuantitativo. Entre los resultados más significativos podemos señalar que los estudiantes que tuvieron menos periodos en la modalidad presencial tienen mayor preferencia sobre el regreso a clase presencial; en cambio, aquellos que tuvieron un mayor número de periodos presenciales perciben que deben continuar sus clases bajo la modalidad virtual. Otro resultado fue la preferencia sobre cómo regresar a clase para que el aprendizaje sea significativo. Asimismo, se determinó que existe una asociación entre las dimensiones analizadas, aunque al ser correlaciones débiles o muy débiles no podemos ser concluyentes en la afirmación de la correlación existente; por ende, es arriesgado afirmar que exista una relación entre la modalidad en que los estudiantes toman sus clases y su proceso de aprendizaje.

Palabras clave: aprendizaje, educación superior, educación tradicional, aprendizaje en línea, análisis comparativo.

Abstract

Educational processes are essential for students to have meaningful learning that includes theoretical, heuristic and axiological knowledge of the different subjects, which will be vital for them to acquire the necessary skills that they will use later in their professional and work environment. Prior to the pandemic generated by covid-19, the highest percentage of enrollment at the Universidad Veracruzana was found in the schooled modality; however, due to confinement, as of March 2020, classes had to be taught in a modality that the institution itself called mixed. This left a problem, since neither teachers nor students were prepared for such a transition, which was aggravated due to the lack of adequate technological infrastructure and competences to carry out the new teaching-learning processes. For this reason, the objective of this research was to carry out a comparative, descriptive and parametric analysis of the learning process of higher education students in the face-to-face and virtual modalities to determine the actions that can be do. The work was of an exploratory type, since the subject of analysis had not been sufficiently studied; because it was explanatory because the causes were found that allowed a deeper description of the

problem in question. The research approach was quantitative. Among the most significant results we can point out that students who had fewer periods in the face-to-face modality have a greater preference over returning to face-to-face class; On the other hand, those who had a greater number of face-to-face periods perceived that they should continue their classes in the virtual modality. Another result was the preference on how to return to class so that learning is meaningful. Likewise, it will be concluded that there is an association between the dimensions analyzed, although since they are weak or very weak correlations, we cannot conclude on the sustainability of the existing connection; therefore, it is risky to affirm that there is a relationship between the way in which students take their classes and their learning process.

Keywords: Learning, higher education, traditional education, online learning, comparative analysis.

Resumo

Os processos educativos são essenciais para que os alunos tenham uma aprendizagem significativa que englobe o conhecimento teórico, heurístico e axiológico das diferentes disciplinas, o que será vital para que adquiram as competências necessárias que aplicarão posteriormente no seu ambiente profissional e de trabalho. Antes da pandemia gerada pela covid-19, o maior percentual de matrículas na Universidad Veracruzana era na modalidade escolar; no entanto, devido ao confinamento, a partir de março de 2020, as aulas passaram a ser ministradas em uma modalidade que a própria instituição chamou de mista. Isso gerou um problema, pois nem professores nem alunos estavam preparados para essa transição, que se agravou pela falta de infraestrutura tecnológica e competências adequadas para realizar os novos processos de ensino-aprendizagem. Por isso, o objetivo desta pesquisa foi realizar uma análise comparativa, descritiva e paramétrica do processo de aprendizagem de estudantes do ensino superior nas modalidades presencial e virtual para determinar as ações que podem ser realizadas. O trabalho foi de tipo exploratório, pois o objeto de análise não havia sido suficientemente estudado; Da mesma forma, foi explicativo porque foram encontradas as causas que permitiram uma descrição mais profunda do problema em questão. A abordagem da pesquisa foi quantitativa. Entre os resultados mais significativos podemos destacar que os alunos que tiveram menos períodos na modalidade presencial têm maior preferência ao retorno à aula presencial; Por outro lado, aqueles que tiveram maior número de períodos

presenciais percebem que devem continuar suas aulas na modalidade virtual. Outro resultado foi a preferência sobre como retornar às aulas para que o aprendizado seja significativo. Da mesma forma, foi determinado que existe uma associação entre as dimensões analisadas, embora por serem correlações fracas ou muito fracas, não podemos ser conclusivos em afirmar a correlação existente; portanto, é arriscado afirmar que existe uma relação entre a modalidade em que os alunos fazem suas aulas e seu processo de aprendizagem.

Palavras-chave: aprendizagem, ensino superior, ensino tradicional, aprendizagem online, análise comparativa.

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Introduction

In Mexico, as a result of the confinement generated by the covid-19 pandemic, the Universidad Veracruzana (UV) had to abide by the established health instructions, so in mid-March 2020 administrative activities and face-to-face classes were suspended, which began to be taught in the virtual modality. The situation led to more than 88,000 students in formal and non-formal education, 6,253 academics and 12,000 administrators fulfilling their obligations from their homes (Universidad Veracruzana, 2021). However, this new reality showed that many of the aforementioned actors lacked the technological and economic resources and the necessary skills to face the change (Gazca, 2020).

To reduce the aforementioned problem, the UV issued the general provisions for academic work that should be implemented from the September 2020-February 2021 school period. In this sense, the UV leadership determined that "the protection of the health of university students, students and workers all, will be the guiding axis of the decisions and activities of the University. These will be carried out in accordance with the protocol developed by the three university secretariats" (Academic Secretary, 2020a, p. 1).

Said document expressed what should be considered as a mixed modality, that is, a form of pedagogical work that is characterized by the development of an educational experience (subject) with combined interaction, generally face-to-face and non-face-to-face on an exchange basis. Harmony between academics and students. For the academic part, he stressed that teachers should be trained in the management of the institutional platform for virtual classes called Eminus, be technologically enabled in the digital knowledge of teaching, and apply instructional design strategies for their academic planning. However,

there was no information that would allow the Academic Secretary to know if the professors had the aforementioned training and the required technological elements.

As for the students, they were asked that according to the mixed modality they should participate in school activities, tutorials, consultancies, among others, although without knowing if they had technological resources of equipment and connectivity.

For this reason, the need arises to carry out a methodological analysis to determine if the students' learning process has been adequate. To do this, a comparison has been established between what happened before the pandemic with the face-to-face modality and what is currently being carried out in the virtual modality.

Conceptual framework

Theories of education and learning

Currently, the concept of education involves an active process of creating understanding, and not a passive process of storing content. The learner of any educational program must play the role of actor, and not of spectator (Romero-Mayoral et al., 2014). For this reason, educational practices have been based on open technologies and resources to speed up collaborative and flexible learning (González-Zamar et al, 2021).

In this regard, Valdez (2012) mentions that educational theories have been evolving to adapt to the teaching-learning process. For example, in behavioral theory the student is seen as a subject whose performance can be modified from the outside by programming educational materials that seek to cultivate desirable academic behaviors. Cognitive theories, on the other hand, study the internal processes that lead to learning. Constructivism, for its part, tries to explain how prior knowledge serves as a support to generate new knowledge, hence learning is conceived as an active process (Valdez, 2012).

Now, one of the theories that has become relevant in recent times due to the technological resources available is connectivism. According to Siemens (2004), this learning theory proposes that knowledge is contained not only in the bits or data of information that travel from one place to another in the form of content and creations, but also in the way in which these contents and their creators link to each other.

Face-to-face, distance and online education

Face-to-face education is a model where there are two main actors: teachers (senders) and students (receivers), who are physically in one place and at the same time. Traditionally, this system has served the teacher to offer feedback to students when they realize that they have not understood the class (Romero-Mayoral et al., 2014).

In contrast, in distance education, the actors do not need a physical place to carry out the teaching and learning process (Castañeda and Vargas, 2021). Indeed, the student receives support material through different electronic means, so it is he himself who is in charge of his learning in a self-taught way. Here the teacher only acts as a guide.

García (2020, cited in Castañeda and Vargas, 2021) lists the characteristics that teaching must have in order to be called distance learning: different geographical space; self-taught student; HEIs are responsible for planning, designing and building material that will be sent to the student for the teaching process, and there is synchronous and asynchronous communication.

Therefore, virtual education requires a different pedagogical design than face-to-face education, which addresses and enhances the independence of students in the learning process (Canales and Silva, 2020). García (2017) explains that within the characteristics of this model the following can be mentioned: openness, democratization, economy, motivation, privacy, information management and multi-format. This means that distance education is taking advantage over face-to-face education, since by taking place in a totally virtual environment, it has more benefits, such as flexibility and autonomy.

Impact of covid-19 on higher education

Covid-19 was first identified in Wuhan (China) in December 2019, and is the cause of severe acute respiratory syndrome type 2, called Sars-CoV-2 (National Center for Vaccination and Respiratory Diseases, 2021). This disease spread rapidly throughout the world and has generated more than 4.5 million deaths (Hernández Fernández, 2021), which caused teaching activities to take place in virtual mode.

The temporary closure of higher education institutions (IES) emerged as a measure to protect public health, since the congregation of people in the same place could increase the number of infections due to the nature of the disease (Francesc, 2020). For this reason, UNESCO considered that approximately 23.4 million higher education students and 1.4 million teachers in Latin America would be affected by the temporary closure of universities,

which represents about 98% of the population of higher education students and teachers. region of (Francesc, 2020, 2020).

Frame of reference

The Universidad Veracruzana was founded in 1944 and became autonomous in 1996. It originates from the state of Veracruz and has a presence in five regions: Xalapa, Veracruz, Córdoba-Orizaba, Tuxpan-Poza Rica and Coatzacoalcos-Minatitlán (Academic Secretariat, 13 December 2021). In the Xalapa region is the Faculty of Accounting and Administration, which began activities on February 7, 1949 and was initially called the Faculty of Commerce. The Faculty of Accounting and Administration is one of the largest in the Universidad Veracruzana and has four undergraduate programs: Accounting, Administration, Administrative Computer Systems, and Business Management and Administration.

The object of study is the degree in Administrative Computer Systems, created in 1994. Its academic offer is 160 places per year. Students are trained in the area of design, development, implementation and administration of information systems with administrative and accounting applications. (Facultad de Contaduría y Administración, 2021).

Problem and objective of the research

The problem identified in this research is the learning process of students in the virtual modality due to the general isolation caused by the covid-19 pandemic. In other words, it is considered necessary to analyze whether, under an attitudinal evaluation criterion and the perception of the students, their learning process in the online modality has been significant, or if it is necessary to return to face-to-face classes.

Due to the problem described above, the general objective of the research is stated: to carry out a descriptive and parametric comparative analysis of the learning process of higher education students who have carried out their school career under the face-to-face and virtual modality to determine the actions to follow to improve the learning processes.

Method

The research approach is quantitative, since data collection was used for descriptive and parametric analyzes based on numerical measurement and statistical analysis in order to establish behavior patterns and test theories (Hernández Sampieri et al. ., 2014). For this, first, an instrument was designed that went through the process of delineating the concept to operationalization to identify the variable, the dimensions, the indicators, and the items.

The research was of an exploratory nature, since the topic of analysis had not been sufficiently studied at the UV. Likewise, explanatory research was considered, since the causes were found that allowed a deeper description of the problem in question.

The statistical procedures used were primarily descriptive. The frequencies of categorical variables were used; then the data analysis was implemented through the comparative technique of means and standard deviation; Afterwards, the parametric analysis of correlation of dimensions was carried out with the Pearson method, for which the operationalization process was carried out to identify the concept or variable, the dimensions, the indicators, the items of each indicator and the scale that was used. applied to each of them. Finally, a correlation analysis between variables was carried out using Kendal's Tau-c methodology for non-square tables in order to detect the relationships between them.

The participants were students from the Faculty of Accounting and Administration of the Xalapa region assigned to the administrative computer systems educational program of the generation that joined their studies in August 2018 and 2019. These students were considered because they took their classes both from face-to-face and virtually before and after the pandemic.

Design and validity of the instrument

Before measuring, the object of interest must be delimited. In this regard, Becker (1998) mentions that this is known as conceptualization. The concepts to be measured must be translated into empirical variables that allow the degree of occurrence of the measured concept to be calibrated (Cea, 2012). Each unit of analysis was calculated through a Likert-type scale with the intention of determining the students' attitudes (favorably or unfavorably) about their learning process, where 1 represents the lowest score and 5 the highest. In tables 1, 2, 3, 4 and 5 the five dimensions can be seen with their indicators and items.

Table 1. Dimension face-to-face classes

Indicador	Ítems
Tecnología propia	Durante las clases en la modalidad presencial previo a la pandemia contaba con equipo de cómputo para realizar mis actividades académicas.
	Durante las clases en la modalidad presencial previo a la pandemia contaba con conectividad a internet en mi residencia (hogar, pensión, departamento, entre otros).
	Durante las clases en la modalidad presencial previo a la pandemia contaba con el *software* necesario para realizar mis actividades académicas.
Tecnología en facultad	Durante las clases en la modalidad presencial previo a la pandemia hacía uso de los centros de cómputo para realizar las tareas, proyectos o alguna otra actividad.
	Indique por semana el número de veces que hacía uso de los centros de cómputo previo a la pandemia para realizar las tareas, proyectos o alguna otra actividad.
	Considera que su aprendizaje era mejor en la modalidad presencial previo a la pandemia por el uso tecnológico con el que contaba la Facultad.

Source: self made

Table 2. Virtual classes dimension

Indicador	Ítems
Disponibilidad tecnológica	Inmediatamente que se transitó de las clases de la modalidad presencial a la virtual contaba con equipo de cómputo para realizar las actividades académicas.
	Tuve que adquirir equipo de cómputo para tomar clases en la modalidad virtual.
	Durante las clases en modalidad virtual tuve que adquirir un paquete de internet para poder tomar mis clases en línea.
Uso tecnológico en casa	El pago de la renta del servicio de internet que realizaba mi familia tuvo un incremento, lo que permitió mejorar la conectividad.
	Tuve que realizar el pago de licencias para el uso de *software* en mi equipo de cómputo.
	El equipo de cómputo para tomar mis clases en la modalidad virtual era de uso único.
	El equipo de cómputo para tomar mis clases en la modalidad virtual tenía que compartirlo con otros hermanos o familiares.

Source: self made

Table 3. Learning process dimension

Indicador	Ítems
Comparativo de aprendizaje	Mi aprendizaje era mejor con la modalidad de clases presenciales.
	Mi aprendizaje es mejor con la modalidad de clases virtuales.
	La comprensión de los temas me es más sencillo con clases presenciales que en las clases virtuales.
	Las actividades (tereas, proyectos, trabajo en equipo, entre otros) las realizo mejor en la modalidad de clases presenciales que en la modalidad virtual.
	Invierto mayor tiempo y esfuerzo en las actividades bajo la modalidad virtual que en la modalidad de clases presenciales.
Comparativo de evaluación	Mis calificaciones fueron mejores durante la modalidad de clases presenciales.
	Mis calificaciones son mejores durante la modalidad de clases virtuales.
	Mi reprobación en la modalidad virtual fue mayor que en la modalidad de clases presencial tomando en cuenta el mismo número de periodos en ambas modalidades.
	Prefiero las clases en la modalidad presencial sobre la modalidad de clases virtuales.

Source: self made

Table 4. Teaching process dimension

Indicador	Ítems
Comparativo proceso enseñanza presencial	Los profesores cuentan con las competencias necesarias para la impartición de las clases bajo la modalidad presencial
	Los profesores contaban en el aula con los elementos tecnológicos para la impartición de las clases presenciales
	Los profesores contaban en los centros de cómputo con los elementos tecnológicos para la impartición de las clases presenciales
	La forma de evaluación era mejor bajo la modalidad de clases presenciales
Comparativo proceso enseñanza virtual	Los profesores cuentan con las competencias necesarias para la impartición de las clases en la modalidad virtual
	Los profesores cuentan con los elementos tecnológicos para la impartición de las clases en la modalidad virtual
	La plataforma de EMINUS es adecuada para la impartición de las clases virtuales
	Los contenidos de la plataforma de EMINUS elaborada por los profesores era la adecuada para mi aprendizaje en línea
	Las actividades síncronas (en tiempo real por vídeo conferencia) fueron adecuadas durante las clases virtuales
	Las actividades asíncronas (no en tiempo real que se encuentran en plataforma) fueron adecuadas durante las clases virtuales
	La forma de evaluación era mejor bajo la modalidad de clases virtuales
	Prefiero que el profesor de la clase en la modalidad presencial sobre la modalidad virtual

Source: self made

Table 5. Social dimension

Indicador	Ítems
Salud	Algún miembro de la familia se enfermó a causa del covid-19.
	Di positivo en alguna prueba de covid-19 que me fue aplicada.
	Los miembros de la familia contamos con algún tipo de servicio médico para ser atendidos en caso de ser contagiados por el covid-19.
	Cuento con una dosis de la vacuna del covid-19.
	Cuento con las dos dosis de la vacuna del covid-19.
Financieros	Los ingresos financieros de la familia se vieron afectados a causa de la pandemia por el covid-19.
	Tuve que darme de baja temporal de algún periodo por problemas a causa de la pandemia del covid-19
Educativos	Tuve que dar de baja algunas experiencias educativas por no poderlas cursar a causa de la pandemia por el covid-19.
	Tuve que laborar para apoyar a mi familia económicamente por disminución de los ingresos a causa de la pandemia del covid-19.

Source: self made

However, some scientific research has methodological flaws, which is largely due to the non-validation of the instruments used. This validation is considered, due to the scope of its scientific rigor, a type of study with its characteristics and procedures (López Fernández et al., 2019). For this research, Cronbach's alpha was used as a validation method, an index used to calculate the internal consistency type of a scale. In a pilot test with 30 students, a Cronbach's alpha result of .801 was obtained, which —according to George and Mallery (2003)— shows that the instrument has good consistency and is reliable.

Table 6. Reliability statistic for the student instrument

	Estadísticos	
Alfa de Cronbach	Alfa de Cronbach basada en elementos estandarizados	N.º de elementos
.801	.812	43

Source: self made with SPSS

Population, study subjects and units of analysis

In an investigation, the population is the set of people or objects about which you want to know something (López, 2004). In this case, the population identified were the students of the Faculty of Accounting and Administration, Xalapa region, of the educational program of administrative computer systems of the UV, enrollments S18 (they began face-to-face classes in August 2018) and S19 (they began face-to-face classes in August 2019). The students took classes under the face-to-face modality and later in the virtual modality.

According to the information provided by the Faculty's Academic Secretary, the enrollment behavior can be seen in Table 7 (population of 233 students).

Table 7. Population

Generación	Ago-18 ene-19	Feb-jul 2019	Ago-19 ene-20	Feb-jul 2020	Ago-20 ene-21	Feb-jul 2021	Ago-21 ene-22
	Modalidad presencial				Modalidad virtual		
Matrícula S18	160	157	155	150	137	131	121
			Modalidad presencial		Modalidad virtual		
Matrícula S19	0	0	164	160	144	124	112
Total	160	157	319	310	281	255	233

Source: self made

To determine the sample, the formula was used to calculate the finite population at convenience with the following formula:

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

With a population of 233 students, a confidence level of 95% and a maximum estimated error of 5%, a sample of 145 students was obtained to whom the instrument was applied. Based on the stratified calculation in Table 8, the number of surveys that were applied for each enrollment can be seen.

Table 8. Sampling

Matrícula	Estudiantes Ago 21- Ene 22	Porcentaje	Muestra	Valor correspondiente
S18	121	52 %	145	75
S19	112	48 %		70
Total	233	100 %		145

Source: self made

After the validation of the instrument, it was applied digitally from October 6 to 19, 2021 using the Google Forms tool. A total of 145 responses were obtained based on the calculation of the sample and with the corresponding percentages of each generation.

Results

The descriptive results are shown below. Tables 9 and 10 illustrate the sociodemographic characterization of the learners who participated in the study. It stands out that 55% are men and 45% women; 52% belong to the S18 generation and 48 % to the S19. The average age is 21 years, while the average number of periods completed face-to-face is 2.64, and virtual 3.27.

Table 9. Frequency of categorical variables

Variable		N	%	Variable		N	%
Generación	S18	75	52	Edad	19	7	5
	S19	70	48		20	33	23
Total		145	100		21	51	35
Sexo	Hombre	80	55		22	18	12
	Mujer	65	45		23	24	17
Total		145	100		> 23	12	8

Source: self made

Table 10. Descriptive of quantitative variables

Variable demográfica	N	Mínimo	Máximo	Media	Desviación estándar
Edad	145	19	38	21.56	2.15
Periodos cursados presencial	145	1	6	2.64	1.37
Periodos cursados virtual	145	1	5	3.27	0.72

Source: self made

Technique comparison of means and standard deviations

Table 11 identifies the conditions of face-to-face classes and the use of ICT prior to confinement due to the covid-19 pandemic. It can be seen that the results of the means and standard deviations of the two generations are very similar. However, it stands out that the average is higher in the S19 generation than in the S18 generation with respect to the fact that more students had computer equipment and connectivity for their face-to-face classes. It is observed that the students of the S19 generation consider that their learning was better in the face-to-face modality, before the pandemic, due to the technological use that the faculty had. In the indicator on the use of computer centers to carry out tasks or projects, the S19 generation used it more than the S18 generation.

Table 11. Comparison of averages. Dimension ICT face-to-face classes

	Matrícula S18		Matrícula S19		Total	
Elementos / ítems	Media	Desv estándar	Media	Desv estándar	Media	Desv estándar
Durante las clases en la modalidad presencial previo a la pandemia contaba con equipo de cómputo para realizar mis actividades académicas.	3.68	1.22	3.93	1.01	3.75	1.16
Durante las clases en la modalidad presencial previo a la pandemia contaba con conectividad a internet en mi residencia (hogar, pensión, departamento, entre otros).	3.49	1.33	3.91	1.11	3.71	1.24
Durante las clases en la modalidad presencial previo a la pandemia contaba con el *software* necesario para realizar mis actividades académicas.	3.31	1.26	3.56	1.15	3.43	1.20
Durante las clases en la modalidad presencial previo a la pandemia hacía uso de los centros de cómputo para realizar las tareas, proyectos o alguna otra actividad encargada por los profesores.	3.47	1.14	3.61	1.22	3.56	1.18
Considera que su aprendizaje era mejor en la modalidad presencial previo a la pandemia por el uso tecnológico con el que contaba la facultad.	3.68	1.24	3.93	1.15	3.75	1.24

Source: self made

Continuing with the analysis, table 12 shows the conditions of the virtual class dimension and how students cope with confinement due to the pandemic with the support of ICT. It is seen that in most of the indicators the S19 generation has higher averages; however, it is seen that more of the members of the S18 generation had to purchase internet packages to be able to take their classes online compared to the S19 generation. One piece of data that stands out is that the students of the S19 generation had to acquire a greater number of computers to take their classes online compared to the S18 generation, although a greater number of S19 students already had them. Finally, in the indicator on the usefulness of the computer equipment, the students of the S19 generation had to share more of the equipment

with their siblings or relatives than those of the S18 generation, which was for their exclusive use.

Table 12. Comparison of averages. ICT virtual classes dimension

	Matrícula S18		Matrícula S19		Total	
Elementos / ítems	Media	Desv estándar	Media	Desv estándar	Media	Desv estándar
Inmediatamente que se transitó de las clases de la modalidad presencial a la virtual contaba con equipo de cómputo para realizar las actividades académicas.	3.60	1.24	3.70	1.15	3.60	1.24
Tuve que adquirir equipo de cómputo para tomar clases en la modalidad virtual.	2.64	1.34	3.09	1.42	2.89	1.40
Durante las clases en modalidad virtual tuve que adquirir un paquete de internet para poder tomar mis clases en línea.	3.04	1.42	2.97	1.49	3.03	1.46
El pago de la renta del servicio de internet que realizaba mi familia tuvo un incremento lo que permitió mejorar la conectividad.	3.04	1.38	3.16	1.18	3.08	1.29
Tuve que realizar el pago de licencias para el uso de *software* en mi equipo de cómputo.	2.59	1.13	2.53	1.24	2.60	1.20
El equipo de cómputo para tomar mis clases en la modalidad virtual era de uso único.	3.25	1.30	3.26	1.35	3.20	1.33
El equipo de cómputo para tomar mis clases en la modalidad virtual tenía que compartirlo con otros hermanos o familiares.	2.88	1.47	3.11	1.47	3.00	1.46

Source: self made

Regarding the learning process dimension, it can be seen that the S19 generation considers that their learning is better with the face-to-face class modality compared to the S18 generation; the S18 generation mentions that their learning is better with the virtual class modality, so the preference of the modality of one generation and another can be clearly identified. An analogous result occurs with respect to the grades obtained: the S19 generation mentions that their grades were better under the face-to-face class modality, but not so for the S18 generation, which mentions that their grades have been better in the virtual modality. Finally, in this analysis, the students of the S19 generation have a greater preference for taking face-to-face classes than the S18 generation.

Table 13. Comparison of averages. Learning process dimension

	Matrícula S18		Matrícula S19		Total	
Elementos / ítems	Media	Desv estándar	Media	Desv estándar	Media	Desv estándar
Mi aprendizaje era mejor con la modalidad de clases presenciales.	3.64	1.25	4.01	1.10	3.86	1.19
Mi aprendizaje es mejor con la modalidad de clases virtuales.	2.89	1.23	2.54	1.21	2.68	1.22
La comprensión de los temas me es más sencillo con clases presenciales que en las clases virtuales.	3.68	1.19	3.87	1.10	3.79	1.14
Las actividades (tereas, proyectos, trabajo en equipo, entre otros) las realizo mejor en la modalidad de clases presenciales que en la modalidad virtual.	3.45	1.31	3.69	1.26	3.54	1.26
Invierto mayor tiempo y esfuerzo en las actividades bajo la modalidad virtual que en la modalidad de clases presenciales.	3.40	1.26	3.29	1.38	3.35	1.30
Mis calificaciones fueron mejores durante la modalidad de clases presenciales.	3.11	1.11	3.59	1.06	3.35	1.07
Mis calificaciones son mejores durante la modalidad de clases virtuales.	3.39	1.14	2.83	1.06	3.13	1.11
Mi reprobación en la modalidad virtual fue mayor que en la modalidad de clases presencial tomando en cuenta el mismo número de periodos en ambas modalidades.	2.76	1.32	2.81	1.32	2.76	1.29
Prefiero las clases en la modalidad presencial sobre la modalidad de clases virtuales.	3.29	1.27	3.74	1.30	3.49	1.29

Source: self made

Continuing with the descriptive methodology in the dimension of the teaching process, the result that stands out is that the students of the S18 generation mention in greater quantity that the professors had in the computer centers the technological elements for teaching face-to-face classes. It can be seen that the S19 students continue to have a greater preference for face-to-face classes than those of the S18 generation, since they comment that the form of evaluation is better under the face-to-face modality. However, the S18 generation establishes that teachers have the necessary skills to teach classes in the virtual modality, a situation that is not shared by the S19 generation, whose average is lower. Again, the S19

generation has a greater preference for face-to-face classes, since they comment that they prefer the class teacher in the face-to-face modality over the virtual modality.

Table 14. Comparison of averages. Teaching process dimension

	Matrícula S18		Matrícula S19		Total	
Elementos / ítems	Media	Desv estándar	Media	Desv estándar	Media	Desv estándar
Los profesores cuentan con las competencias necesarias para la impartición de las clases bajo la modalidad presencial.	3.53	1.08	3.69	0.86	3.55	1.01
Los profesores contaban en el aula con los elementos tecnológicos para la impartición de las clases presenciales.	3.56	0.95	3.47	1.11	3.52	1.01
Los profesores contaban en los centros de cómputo con los elementos tecnológicos para la impartición de las clases presenciales.	3.75	0.89	3.67	0.99	3.68	0.95
La forma de evaluación era mejor bajo la modalidad de clases presenciales.	3.09	1.07	3.44	1.04	3.31	1.05
Los profesores cuentan con las competencias necesarias para la impartición de las clases en la modalidad virtual.	3.28	0.98	3.04	0.98	3.15	0.99
Los profesores cuentan con los elementos tecnológicos para la impartición de las clases en la modalidad virtual.	3.36	0.94	3.27	0.98	3.33	0.95
La plataforma de Eminus 3 o 4 es adecuada para la impartición de las clases virtuales.	3.04	1.26	3.17	1.18	3.09	1.25
Los contenidos de la plataforma de Eminus elaborada por los profesores era la adecuada para mi aprendizaje en línea.	3.32	1.03	3.36	1.02	3.37	1.02
Las actividades síncronas (en tiempo real por vídeo conferencia) fueron adecuadas durante las clases virtuales.	3.57	0.89	3.34	1.03	3.45	0.95
Las actividades asíncronas (no en tiempo real que se encuentran en plataforma) fueron adecuadas durante las clases virtuales.	3.36	1.00	3.24	1.12	3.30	1.05

La forma de evaluación era mejor bajo la modalidad de clases virtuales.	3.19	1.11	3.03	1.17	3.11	1.13
Prefiero que el profesor de la clase en la modalidad presencial sobre la modalidad virtual.	3.43	1.26	3.64	1.26	3.52	1.25

Source: self made

Concluding with the social dimension, the students of the S18 generation had a greater number of family members sick with covid-19 than those of the S19 generation. In the same sense, the S18 students were infected in greater quantity of covid-19 than those of the S19. One piece of data that stands out was that the financial income of families in both generations was affected by the pandemic. Fortunately, the lowest value of the averages was the benchmark for temporary casualties. Finally, within the highest indicators, it can be seen that both generations are already vaccinated with one or two doses, which can guarantee attendance at face-to-face classes.

Table 15. Comparison of averages. Social dimension

	Matrícula S18		Matrícula S19		Total	
Elementos / ítems	Media	Desv estándar	Media	Desv estándar	Media	Desv estándar
Algún miembro de la familia se enfermó a causa del covid-19.	1.65	0.48	1.44	0.50	1.54	0.50
Di positivo en alguna prueba de covid-19 que me fue aplicada.	1.28	0.45	1.14	0.35	1.21	0.41
Los miembros de la familia contamos con algún tipo de servicio médico para ser atendidos en caso de ser contagiados por el covid-19.	1.41	0.50	1.34	0.48	1.38	0.49
Los ingresos financieros de la familia se vieron afectados a causa de la pandemia por el covid-19.	1.79	0.41	1.86	0.35	1.82	0.39
Tuve que darme de baja temporal de algún periodo escolar por problemas a causa de la pandemia del covid-19.	1.05	0.23	1.09	0.28	1.07	0.26
Tuve que dar de baja algunas experiencias educativas por no poderlas cursar a causa de la pandemia por el covid-19.	1.43	0.50	1.31	0.47	1.38	0.49
Tuve que laborar para apoyar a mi familia económicamente por disminución de los ingresos a	1.65	0.48	1.53	0.50	1.59	0.49

causa de la pandemia del covid-19.						
Cuento con una dosis de la vacuna para el covid-19.	1.79	0.41	1.84	0.37	1.82	0.38
Cuento con las dos dosis de la vacuna para el covid-19.	1.51	0.50	1.76	0.43	1.62	0.49

Source: self made

Now, continuing with the statistical analysis of comparison between both generations, it can be seen in table 16 that generation S19 has the highest values in the dimension of face-to-face ICT classes with respect to generation S18; for this reason, the preference of S19 students to take the classes under the face-to-face modality is confirmed.

Table 16. Comparison of the means of the dimensions by generation

Generación		Dimensión *clases presenciales TIC*	Dimensión *clases virtuales TIC*	Dimensión *proceso de aprendizaje*	Dimensión *proceso de enseñanza*	Dimensión *social*
S18	Media	3.51	3.01	3.29	3.37	1.51
	Desv Estándar	0.07	0.12	0.07	0.13	0.09
S19	Media	3.77	3.12	3.37	3.36	1.48
	Desv Estándar	0.08	0.14	0.12	0.11	0.08
Total	Media	3.64	3.06	3.33	3.37	1.49
	Desv Estándar	0.03	0.10	0.09	0.10	0.08

Source: self made

We conclude in this section by mentioning that 24% of the S18 generation have a preference for returning to face-to-face classes, 39% for virtual classes and 37% for the hybrid modality. On the other hand, 46% of the S19 generation have a preference for the face-to-face modality, 23% for the virtual one and 31% for the hybrid one.

Table 17. Comparison of results expressed as a percentage of enrollments S18 and S19

Dimensión *social*						
Matrícula			S18		S19	
Indicador			Sí	No	Sí	No
Algún miembro de la familia se enfermó a causa del covid-19.			65%	35%	44%	56%
Mi aprendizaje es mejor en la modalidad presencial que en la virtual.			60%	40%	76%	24%
Mis profesores están mejor capacitados para dar clases presenciales que virtuales.			79%	21%	74%	26%
El contar con herramientas tecnológicas es un factor que me apoyó a mejorar mi aprendizaje bajo la modalidad virtual.			89%	11%	86%	14%
Matrícula	S18			S19		
Indicador	Presencial	Virtual	Hibrida	Presencial	Virtual	Hibrida
Para mi correcto aprendizaje prefiero tomar clases bajo la modalidad	24 %	39 %	37 %	46 %	23 %	31 %

Source: self made

Correlations between dimensions

To carry out the correlation between dimensions, the items that belong to each dimension were grouped to register them as variables in the SPSS software. The Pearson correlation coefficient method was used, calculated from the scores obtained in a sample of two variables, for which the resulting scores of one variable were related to the scores of the other (Hernández Sampieri et al., 2014). Based on the results obtained from the dimensions, the linkage level is identified (table 18).

Table 18. Result of the correlations between the dimensions

		Dimensión *clases presenciales TIC*	Dimensión *clases virtuales TIC*	Dimensión *proceso aprendizaje*	Dimensión *proceso enseñanza*
Dimensión *clases presenciales TIC*	Correlación de Pearson	1	.200*	.344**	.116
	Sig.(bilateral)		.016	.000	.163
	N	145	145	145	145
Dimensión *clases virtuales TIC*	Correlación de Pearson	.200*	1	.333**	-.018
	Sig.(bilateral)	.016		.000	.834
	N	145	145	145	145
Dimensión *proceso aprendizaje*	Correlación de Pearson	.344**	.333**	1	.007
	Sig.(bilateral)	.000	.000		.933
	N	145	145	145	145
Dimensión *proceso enseñanza*	Correlación de Pearson	.116	-.018	.007	1
	Sig.(bilateral)	.163	.834	.933	
	N	145	145	145	145
*. La correlación es significativa en el nivel 0.05 (bilateral)					
**. La correlación es significativa en el nivel 0.01 (bilateral)					

Source: self made with SPSS

Interpreting table 18, we can mention that in terms of the ICT face-to-face classes dimension with the ICT virtual classes dimension, there is a very weak positive correlation, with a sig value (bilateral) 0.016, so there is 95% confidence that the correlation is true. However, being a very weak positive correlation, it cannot be concluded that there is a link between both dimensions. In other words, having technology in some type of class does not mean a preference for taking studies in one of them.

As for the ICT face-to-face classes dimension with the learning process dimension, its correlation is weak positive, its sig value (bilateral) 0.000 is less than 0.01, so there is 99% confidence that the correlation is true. In this case, the correlation is greater than that of the previously analyzed dimensions, so having technology when taking face-to-face classes can be related to their learning process.

Regarding the ICT virtual classes dimension with the learning process dimension, its correlation is weak positive, its sig value (bilateral) 0.000 is less than 0.01, there is 99%

confidence that the correlation is true. The result is very similar to that of the previous analysis, so having technology in virtual classes can be related to their learning process.

Due to what was previously stated, we can mention that there are significant positive correlations (weak or very weak) between the dimensions of face-to-face ICT classes and virtual ICT classes with the dimension of the learning process, and given their sig value (bilateral), these correlations have 99% of confidence that they are true, for this reason we can point out the possibility that there may be a relationship between the modality in which students take their classes with respect to their learning process, with the technological aspect being an important factor.

Correlations between variables

The variables that are intended to be analyzed by means of the correlation are of the ordinal type, for which the Kendal Tau-c methodology is used. The first analysis was for students enrolled in S18 to determine if there is an association between the number of periods they attended in person and considering that their learning is better under the virtual modality. For this, the following hypotheses were formulated:

H0: There is no significant relationship between the number of periods taken in person and considering that learning is better in the virtual modality.

H1: There is a significant relationship between the number of periods taken in person and considering that learning is better in the virtual modality.

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

Table 19. Symmetric measures face-to-face periods vs. best virtual tuition S18 learning

		Valor	Error estándar asintótico[a]	T aproximada[b]	Significación aproximada
Ordinal por ordinal	Tau-c de Kendall	.095	.089	1.072	.284
N.º de casos válidos		75			
a. No se presupone la hipótesis nula.					
b. Utilización del error estándar asintótico que presupone la hipótesis nula.					

Source: self made with SPSS

According to the results of table 19, the p-value sig. (approximation) = .284 > .05, so H0 is accepted, since it is established that there is no association between the number of periods completed in person and considering that learning is better in the virtual modality. It

can be seen that the correlation coefficient value t = .095, which is interpreted as a negligible correlation between the variables, so it cannot be ensured that there is a relationship between the variables.

Now, the analysis is carried out for the students of enrollment S19: the questioning and the hypotheses are similar. If the following p-value is < 0.05 H0 is rejected; otherwise it is accepted.

Table 20. Symmetric measures face-to-face periods vs. best virtual tuition S19 learning

		Valor	Error estándar asintótico[a]	T aproximada[b]	Significación aproximada
Ordinal por ordinal	Tau-c de Kendall	.040	.107	.371	.711
N.º de casos válidos		70			
a. No se presupone la hipótesis nula.					
b. Utilización del error estándar asintótico que presupone la hipótesis nula.					

Source: self made with SPSS

In table 20 it can be seen that the p-value sig. (approximation) = .711 > .05, which implies accepting H0, so it is concluded that there is no association between the number of periods completed in person and considering that learning is better in the virtual modality. This is evidenced by the correlation coefficient value t = .040, which is interpreted as a negligible correlation between the variables.

Discussion

The purpose of this research was to distinguish and describe those perceptions that influence the learning activities of university students due to the covid-19 pandemic. When carrying out an analysis of educational research in times of covid-19, we agree with Cevallos et al. (2021) when they affirm the need for the methods implemented during the pandemic to leave a lasting mark. Therefore, the development of virtual learning at a higher level will continue to accelerate and it would be a serious mistake not to learn from the experience to improve learning at a higher level. However, at the basic and upper secondary levels, virtual methods should be considered to adapt the community to learning based on innovation with technological support, although this situation is a paradox given the lack of infrastructure at the aforementioned levels. In the same sense, it is necessary to return to face-to-face

educational activities, considering social and economic situations as a primary component that complements the ability to educate remotely.

There are coincidences in the results of similar investigations, as stated by Vásquez (2020) when stating that virtual education has a greater acceptance at the international level, since its main advantage is ease of access and the possibility of having a greater number of students. . However, this requires that the scheduled activities be adequate in quantity and quality, since otherwise the academic will not carry out a correct evaluation of the activities. In addition, it should be noted that the pandemic has increased the digital gap that exists among apprentices, since not all of them have the appropriate equipment and connectivity to take their courses online.

Castillo Ontiveros *et al*. (2021) They gather information to try to understand experiences and perceptions that students show regarding the new online teaching modality. In their research, the authors noticed three axes of discussion, which coincide with this research: circumstances of the study environment, difficulties that this represents and disagreements in the teaching strategies in this new modality. Within the environment axis of the learning process, they deduced that by not experiencing face-to-face education, an unmotivated state of mind is created that has repercussions when attending online classes.

On the other hand, it is recognized that home study brings complications regarding lack of privacy. Likewise, in the axis of learning processes there are difficulties with respect to materials, methods and involvement of students and teachers. Finally, in the axis of emotional effects, online classes increase emotions that are detrimental to learning processes (Castillo Ontiveros et al., 2021). Therefore, the results invite us to discuss the importance of training teachers and students in the virtual modality. (Rivera Cabrera *et al*., 2010).

Conclusions

Based on the results obtained, it can be concluded that the students consider that their learning process was better in the face-to-face modality, since they believe that their teachers are better trained for these spaces, although it should be noted that the S18 generation is inclined towards the face-to-face modality. virtual.

Likewise, it was perceived that there is an association between the dimensions analyzed; however, being weak or very weak correlations, it is risky to affirm that there is a

significant relationship between the modality in which students take their classes with respect to their learning process, even considering that the technological aspect is an important factor.

Regarding the correlational analysis between variables on the periods completed and their learning, it can be affirmed that there is no association between the number of periods completed in person and whether learning is better in person or online.

Another very evident aspect during the first year of the pandemic was the number of withdrawals from educational experiences that students had to undergo. Specifically, almost four out of ten students had to cancel at least one educational experience. In addition, six out of ten students had to work to financially support their family, which prevented them from attending synchronous activities.

Undoubtedly, these elements affected the students' learning process, so the decision to withdraw temporarily was the most appropriate, which is reflected in the enrollment data for each school period. For example, for the S18 enrollment, the average dropout when they took their face-to-face classes was 2.1% and from the time they took virtual classes, the percentage per period increased to 7%. In fact, for the S19 generation, the average percentages of casualties were higher, since during the face-to-face modality it was 2.4% and once the virtual modality was incorporated it was 11.2 %.

With the study carried out, it is recommended that the most recent generations join the face-to-face modality as soon as possible, since the interaction between them is important to strengthen interpersonal relationships and consolidate socialization and team problem solving, which It certainly improves the learning process. On the other hand, the generations that are in the last periods could continue with their online classes, since they have stated that they do not see negative effects on their learning process and that their grades have even improved.

Future lines of research

It is necessary to carry out an investigation focused on the perception of teachers regarding the teaching process under the virtual modality and how it was affected as a result of the pandemic. Likewise, it is convenient to analyze this phenomenon in different contexts and to train UV academics in the hybrid modality, since in this way they can take advantage of the infrastructure resources that the institution currently has.

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Adquisición de fondos	No aplica