



REVISTA

CÁTEDRA

Impact of virtual classrooms in the training of human talent in health at the General Teaching Hospital of Calderón-Ecuador

Impacto de aulas virtuales en la formación de talento humano en salud en el Hospital General Docente de Calderón-Ecuador

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Abstract

An analysis is presented of the impact caused by the new study modality through virtual classrooms in the training of health professionals, who because of the covid-19 pandemic



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suspended their face-to-face academic activity, starting classes through a virtual classroom platform. The period corresponds from March 2020 to June 2021, with the aim of identifying the impact on health training and whether this modality is appropriate in their careers. For this purpose, quantitative research was conducted with the application of an anonymized survey directed to teachers and undergraduate and rotating internship students of Medicine, Obstetrics and Nursing of the cohorts of May 2020-April 2021 and September 2020-August 2021 of the Faculty of Medical Sciences of the Central University of Ecuador and who fulfill their assistance and academic activities in the General Teaching Hospital of Calderón (HGDC). The total population of teachers and students in the reference period was 365 participants and an effective sample of 175 participants was selected. The research provides a series of conclusions and suggestions that can be adopted by Higher Education Institutions (HEI) to improve the training of aspiring health professionals who are currently under this new virtual study modality.

Keywords

Impact, Virtual Classroom, education, research, pandemic, technology

Resumen

Se presenta un análisis del impacto causado por la nueva modalidad de estudio a través de aulas virtuales en la formación de profesionales de la salud, que a raíz de la pandemia por covid-19 suspendieron su actividad académica presencial, iniciando clases a través de una plataforma de aula virtual. El periodo corresponde de marzo 2020 a junio 2021, con el objetivo de identificar el impacto en la formación en salud y si esta modalidad es la adecuada en sus carreras. Para esto se realizó una investigación cuantitativa con la aplicación de una encuesta anonimizada dirigida a docentes y estudiantes de grado y de internado rotativo de Medicina, Obstetricia y Enfermería de las cohortes de mayo 2020- abril 2021 y septiembre 2020-agosto 2021 de la Facultad de Ciencias Médicas de la Universidad Central del Ecuador y que cumplen sus actividades asistenciales y académicas en el Hospital General Docente de Calderón (HGDC). La población total de docentes y estudiantes en el periodo de referencia fue de 365 participantes y se seleccionó una muestra efectiva de 175 participantes. La investigación aporta una serie de conclusiones y sugerencias que pueden ser adoptadas por las Instituciones de Educación Superior (IES) a fin de mejorar la formación de los aspirantes a profesionales de la salud que actualmente se encuentran bajo esta nueva modalidad de estudios virtuales.

Palabras clave

Impacto, Aulas virtuales, educación, investigación, pandemia, tecnología.

1. Introduction

Under the new way of life caused by the worldwide pandemic, the Teaching and Research Unit of the HGDC promotes strategies to improve the teaching activity of the new health professionals. By virtue of this, and considering this new dynamic of virtual education, the question arises as to what has been the transforming impact of Information and Communication Technologies (ICT) in higher education, and with greater emphasis on the training of health professionals who were affected in their theoretical-practical training with the change of study modality (face-to-face to virtual).

On the other hand, the Pan American Health Organization clearly points out that:



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The epidemic of COVID-19 was declared by WHO a public health emergency of international concern on January 30, 2020; which represents a great threat to health systems, especially in countries with medium and low economic resources, since to face this health crisis it is necessary of great economic support and human resources, therefore it was necessary the implementation of prophylactic measures, in order not to saturate health systems such as: the closure of places of agglomeration of people, measures of social isolation and the promotion of social distancing, actions that changed the dynamics of life of the entire population worldwide (Pan American Health Organization-PAHO, 2020, para. 2).

These measures had a direct impact on the entire higher education system, which had to adapt to new study modalities, mainly oriented towards distance education. In this context, virtual learning environments and the incorporation of technologies in education gained more space. As quoted by Bustos (2010), "it is important to reflect on the use of ICTs in the creation of new teaching-learning environments, as well as on their potential capacity to transform training processes in formal education environments" (Bustos and Coll, 2010, p. 14). Those who have chosen distance education are familiar with the entire learning environment through the Internet and virtual platforms as classrooms; the challenge has been for students and faculty who have traditionally carried out their academic activities in person, especially in careers such as Medicine, Obstetrics and Nursing whose direct student-teacher-patient interaction for both theoretical classes and clinical-surgical practical activities are fundamental in the training of future health professionals.

Considering the above background, the General Teaching Hospital of Calderón, being a health center where new professionals are trained, proposed, through the Teaching and Research Unit, to carry out transversal descriptive research, of a quantitative type, supported by the application of a web-based questionnaire of its own elaboration addressed to teachers and undergraduate and graduate students of the Faculty of Medical Sciences. The main objective was to measure the degree of impact of virtual classrooms in the training of human talent in health at the General Teaching Hospital of Calderón in the period March 2020 to June 2021; as well as to identify the percentage of teachers and students who consider that the current process of training through virtual classrooms is adequate.

The study has been proposed in conjunction with our strategic ally, the Faculty of Medical Sciences of the Central University of Ecuador. The results are translated into strategies that are expected to be implemented in order to improve the training of students in the careers of medicine, obstetrics and nursing. The information gathering was carried out from July 1 to 12, 2021 and the final report was presented in August 2021.

The article consists of the following parts: an introduction with a brief description of the research problem, the justification on which the research is based, a description of the methods and materials used where the methodology, scope, sample determination and tools for data collection are described. The results and discussion reflect relevant interpretations of the quantitative cross-sectional descriptive study carried out. Finally, the conclusions are presented as a synthesis of the most significant findings of the study.

1.1 Rationale

Since the beginning of the year 2020, the world has been facing a global pandemic called covid-19, which forced the vast majority of countries to temporarily close their educational



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institutions at all levels. This closure affected approximately 91% of students worldwide, and by April 2020, about 1.6 billion children and young people were out of their educational institutions (UN and SDG4, 2020, para. 2).

Centralizing the problem in Ecuador and particularly in higher education, according to figures from the Secretariat of Higher Education, Science, Technology, and Innovation (SENESCYT), "the country as of October 2020 registered a gross enrollment rate of 733,000 third and fourth level students" (UN for Education, Science and Technology-Senescyt, 2020, p. 3), of which 57% receive public provision of the service, while the remaining 43% attend a private higher education entity. On the other hand, 84% of students attend a university or Polytechnic School-UEP and 16% attend a Technical or Technological Institute (ITT).

The pandemic forced HEIs to change the modality in the provision of education services, making them virtual. This change had direct implications on the quality of the provision of this right, considering that the national education system is in its initial stages of preparation to provide a virtual offer. As cited by UN Education:

Although the health crisis accelerated the migration to the virtual modality, this change was made abruptly, without the possibility of adapting curricular content, adopting appropriate pedagogies, training teachers, and sometimes not even having sufficient technological resources to maintain quality in the provision of the service (ONU para la Educación, Ciencia y Tecnología-Senescyt, 2020, p. 5).

The main impact that the present pandemic had on the national provision of higher education was: "The implementation of technological platforms (IES) for virtual education and access to technological equipment (students)" (ONU para la Educación, Ciencia y Tecnología-Senescyt, 2020, p. 5). The change in the modality of higher education implied access restrictions to a significant proportion of the demand, especially to the population with greater economic vulnerabilities within it. According to figures reported by SENESCYT, it is estimated that 20% of ITT students and 9.37% of students in Production Educational Units (UEP) were restricted in their access because they did not have the minimum technological resources (computers and internet connectivity) to access virtual classes. This implies that around 81,200 students, representing 11.07% of the total number of students enrolled in the higher education system, had to interrupt their studies. "So also, the dropout rate is even higher in rural areas, and affects the female gender more" (ONU para la Educación, Ciencia y Tecnología-Senescyt, 2020, p. 5-6).

Finally, the effects and impacts identified by the health emergency refer to the access and use of technologies, both by students and educational institutions and the substantive processes of the governing body itself. Not to mention that this new virtual education system directly affected the students and faculty who carried out their academic activities in person and who did not have enough time to master and understand the functioning of virtual teaching-learning environments, as well as the academic tools and resources of this type of studies. In a world in constant change and evolution, the incorporation of ICTs in higher education marks the path towards the new "learning society" or "digital society", which transforms or modifies formal education environments and has become a key factor for the emergence of new educational scenarios associated with virtual or online environments.

2. Methods and materials



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The study is a cross-sectional descriptive quantitative study based on primary data collected through the application of a web-based questionnaire of our own elaboration directed to teachers and undergraduate and graduate students of the Faculty of Medical Sciences of the Universidad Central del Ecuador who perform their academic activities in the General Teaching Hospital of Calderón in the period March 2020 to June 2021. To determine the population and details of the sample size calculation, the total population of teachers and students in the reference period was 365 participants (UDI-HGDC, 2020-2021). The sample calculation was based on the simple random probability sampling method and the finite population sampling formula, with a confidence level of 95% and an error level of 5% (Malhotra, 2004, p. 344-348), which determined an effective sample of 175 participants. For data collection, an anonymized web survey form was designed, and the link was sent to the e-mails registered in the databases of teachers and students of the period in question, in the custody of the Teaching and Research Unit of the HGDC.

Due to the scope of the study and the database in the custody of the Teaching Unit of the HGDC, it was considered that the methodology that best fits the analysis requirements is quantitative, the same that seeks to establish the degree of causality between the virtual training action and its impacts on students; this methodology has allowed a more rigorous and accurate statistical analysis (Billorou, et al., 2011, p. 41-42). The study inclusion criteria were for faculty and undergraduate and rotating internship students of Medicine, Obstetrics and Nursing from the cohorts of May 2020- April 2021 and September 2020 to August 2021 who are taking an academic semester at the UCE School of Medicine and who are rotating at the HGDC, during the period of March 2020 to June 2021 (UDI-HGDC, 2020-2021). In the exclusion criteria are undergraduate and rotating internship students who are not part of the March 2020 to June 2021 rotation period at HGDC.

The collected data were anonymized and treated with strict confidentiality and for research purposes only. All the data were measured, and the results made it possible to determine the degree of impact of the virtual classrooms on the training of human talent in health of the sample mentioned above (175 participants).

In order to guarantee the results, for the validation of the reliability or reliability of the test used for the research, it was performed through the Cronbach's Alpha coefficient (α), which allows identifying the absence of measurement errors in a test, or as the precision of its measurement (Ruiz, 2019, para. 2). Instruments with questions that have more than two answers can be evaluated with this test. The Cronbach's α score is a number between 0 and 1. An acceptable reliability score is one that is equal to or greater than 0.7 (QuestionPro, 2019, para. 17).

The reliability for the validation of the measurement instrument designed for the impact assessment of virtual classrooms in the training of human talent in health was performed under the internal consistency reliability method. The reliability results obtained through the SPSS statistical program were as follows.:

Alfa of Cronbach	N of elements
0.770	30

Table 1. Reliability statistics



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Cronbach's Alpha presents a high or acceptable reliability score of 77%, 30 items of the applied research test were analyzed. This result shows that the method, the instrument, and the research sample selected were reliable and the results obtained are guaranteed.

The tabulation and analysis of data was done by using the statistical program SPSS.25 and Excel 2016. Before analyzing the results, it is necessary to identify some key concepts:

Virtual classrooms. - It is the digital environment in which the exchange of knowledge that makes learning possibly takes place. That is, a space where teachers and students share content in real time, and where queries, doubts and evaluations of the participants are addressed (EvolMind, 2022, para. 9-10).

Human talent in health. - The Pan American Health Organization-PAHO clearly states: "They are all the people who carry out actions whose fundamental purpose is to improve health. They are people with different professions and occupations who are trained and work in health, and who belong to various categories of training, work environment and employment status" (PAHO AND WHO, 2017, para. 9).

ICT in education. - ICT in education refers to the set of hardware and software technologies that contribute to educational information processing. According to the definition of César Coll, PhD in Psychology, in his book Psychology of virtual education, ICTs "are instruments used to think, learn, know, represent and transmit to other people and other generations the knowledge and learning acquired" (Santander, 2021, para. 4).

3. Presentation of results

3.1 Analysis by levels

Of the sample under study, 10.29% of the participants were teachers (18), 39.43% were rotating internship students (69) and 50.29% were undergraduate students (88).

3.1.1 Knowledge and use of virtual classrooms

Table 2 shows the results on the level of knowledge and management of virtual classrooms. 64.00% of the participants express that they have a medium level of knowledge in the management of virtual classrooms, 18.29% have a high level of knowledge, 16.57% have a low level of knowledge and 1.14% have no knowledge at all. This variable has a high impact on the training of the future health professional due to the lack of experience in the management of virtual platforms of teachers and students, and their limited interaction with the tutor in clinical-practical situations. When asked if information on the regulations, norms and objectives was given before starting the virtual academic activities, 52.27% considered that it was not enough and was not very clear.

Axis	Criterio	Resultado
Knowledge and management of virtual classrooms	a. High knowledge	18.29%
	b. medium knowledge	64.00%
	c. low knowledge	16.57%
	d. None	1.14%
Total axis 1		100.00%
Information on regulations and standards for virtual activities	a. Sufficient and clear	34.86%
	b. Not enough and not very clear	52.57%
	c. Did not contribute anything	8.00%



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d. No information was provided	4.57%
Total axis 2	100.00%

Table 2. Knowledge and management of virtual classrooms, UDI-HGD

3.1.2 Formative evaluations

Table 3 shows the results of the formative evaluations. The sample under study considers that 45.14% of the evaluations carried out by the teacher during the semester were permanent and 47.43% consider that it was more of an evaluation per unit or module. The most frequent formative evaluations were virtual questionnaires, formative tests, research papers, bibliographic reviews, and case studies.

Axis	Criteria	Result
Timing of the formative evaluation	a. Permanent (individual and group)	45.14%
	b. Per unit or module	47.43%
	c. Only evaluated at the end	6.86%
	d. Not evaluated	0.57%
	Total axis1	100.00%
Most commonly used types of formative evaluations	a. Case studies	14.86%
	b. Portfolios	6.51%
	c. Forums	7.51%
	d. Bibliographic reviews	16.19%
	e. Research papers	17.36%
	f. Formative tests	17.36%
	g. Virtual questionnaires	20.20%
Total axis 2	100.00%	

Table 3. Formative evaluations, UDI-HGDC

3.1.3 Virtual classrooms and teaching-learning tools

Table 4 presents the results of the virtual classes and the most used teaching-learning tools. Regarding the virtual media system as an alternative to continue with the teaching-learning process, 48.57% of the participants consider that it is a moderately effective strategy and 29.14% that it is not very effective, which reflects that there is a challenge for the Central University in relation to the strategies that have been implemented for teaching-learning activities through virtual classrooms. When asked about the most used tools for the fulfillment of the scheduled synchronous hours, 33.20% responded that they were carried out through video calls, 28.74% instant messaging and 16.60% through the use of social networks. In reference to the tools used for virtual meetings between teachers and students, the most used as a resource for teaching-learning activities was Microsoft Teams with 50.94% and Zoom with 45.91%. For the item of access to study material as part of the virtual classroom 26.61% accessed through Teams, 25.72% via WhatsApp, 23.06% through the same platform and 16.41% by email. It is evident that the official virtual platform is not being used adequately.

Axis	Criteria	Result
Virtual teaching alternative	a. Effective	14.29%
	b. Moderately effective	48.57%



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	c. Not very effective	29.14%
	d. Deficient	8.00%
	Total axis 1	100.00%
Most used tools for synchronous classes	a. Telephone tutoring	7.69%
	b. Video calls	33.20%
	c. Instant messaging	28.74%
	d. Social networks	16.60%
	e. None	13.77%
	Total axis 2	100.00%
Most used tools for virtual meetings	a. Zoom	45.91%
	b. Microsoft Teams	50.94%
	c. Skype	0.63%
	d. WebEx	0.31%
	e. Google HangOuts	1.89%
	f. Uberconference	0.31%
	Total axis 3	100.00%
Means of access to study material	a. Electronic mail	16.41%
	b. WhatsApp	25.72%
	c. Chats	4.88%
	d. Social networks	3.33%
	e. Teams	26.61%
	f. Same virtual platform	23.06%
	Total axis 4	100.00%

Table 4. Virtual classrooms and teaching-learning tools, UDI-HGDC

3.1.4 Schedule, attendance and class times

We inquired about the chronogram, attendance and class schedules, as shown in Table 5. In reference to virtual classes during the semester, for 58.29% of the respondents, 75.00% of the classes have been completed and only 26.29% considered that the schedule was completed 100%. This indicates that the schedule of virtual classes should be strategically planned in order to avoid learning gaps in the students. In the analysis of attendance to virtual classes, 53.71% of those surveyed indicated that attendance should not be considered as a parameter for the final grade, since there are connectivity problems to the synchronous classes scheduled by the teacher. Regarding compliance with the virtual class schedules uploaded to the system, 50.86% of those surveyed consider that compliance was moderately satisfactory, 25.71% that it was satisfactorily complied with and 15.43% that compliance was deficient.

Axis	Criteria	Result
Schedule of classes	a. At 100 percent	26.29%
	b. At 75 percent	58.29%



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	c. At 50 percent	13.71%
	d. At 25 percent	1.71%
	Total axis 1	100.00%
Class attendance	a. Attendance should not be considered	53.71%
	b. A minimum of 25% attendance should be considered	14.86%
	c. A minimum of 50% attendance should be considered	18.86%
	d. A minimum of 75% attendance should be considered	12.57%
	Total axis 2	100.00%
Class schedules	a. Satisfactorily	25.71%
	b. Moderately satisfactory	50.86%
	c. Deficiently	15.43%
	d. Never fulfilled	8.00%
	Total axis 3	100.00%

Table 5. Schedule, attendance and class times, UDI-HGDC

3.1.5 Motivation, knowledge assimilation and discussions

The results on motivation, knowledge assimilation and debates generated in the virtual classes are presented in Table 6. From the results, 37.71% of the participants consider that the planning of the virtual activities designed by the teacher motivated them to perform analysis and synthesis, for 34.29% the activities motivated them to search for information, as the most relevant data. An interesting and at the same time worrying fact is that this new virtual experience for 56.00% of the respondents has not allowed the students a better personal development, they have participated with fear in the classes and have presented an inadequate assimilation of knowledge. Regarding the frequency of debates generated through virtual classes on a specific topic, 58.86% considered that they were infrequent, 22.29% stated that they rarely occurred and for 18.29% the debates were frequent. A relevant fact determined by the study is that 56.00% of those surveyed consider that virtual learning sessions, being expository, almost always generate fatigue in students.

Axis	Criteria	Result
Virtual lesson planning that motivates the student to search for:	a. Information	34.29%
	b. Analysis y synthesis	37.71%
	c. Evaluation and decision making	12.00%



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	d. Reflection from their own experience	8.57%
	e. None	7.43%
Total axis 1		100.00%
New virtual experience has enhanced their personal development	a. True	16.00%
	b. False	56.00%
	c. Indifferent	28.00%
Total axis 2		100.00%
Frequency of discussions in virtual classes	a. Frequent	18.29%
	b. Infrequent	58.86%
	c. Rarely occur	22.29%
	d. Never occur	0.57%
Total axis 3		100.00%

Table 6. Motivation, knowledge assimilation and discussions, UDI-HGDC

3.1.6 General Criteria

Figure 1 shows that more than 50.00% of the respondents have a high degree of lack of knowledge not solved in a virtual way regarding: clinical practices, patient observation, doctor-patient relationship, and performance of procedures.

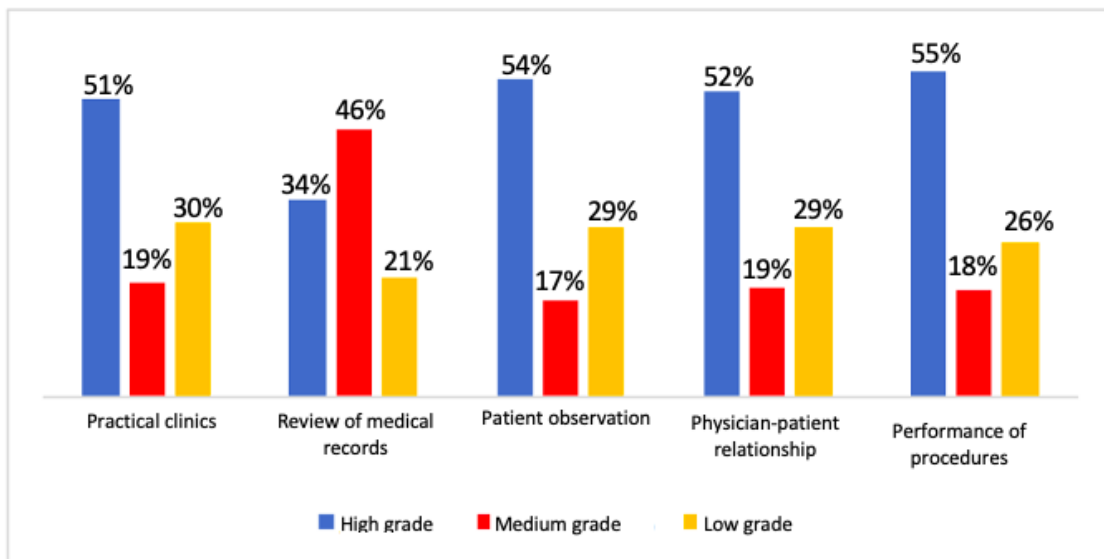


Figure 1. Degree of ignorance not solved in a virtual way, UDI-HGDC

In the training of students through virtual classrooms, more than 53.00% consider the following to be threats to a medium degree: technical problems due to connection, equipment and/or programs, the study environment, group socialization processes and teacher-student communication, as shown in Figure 2.



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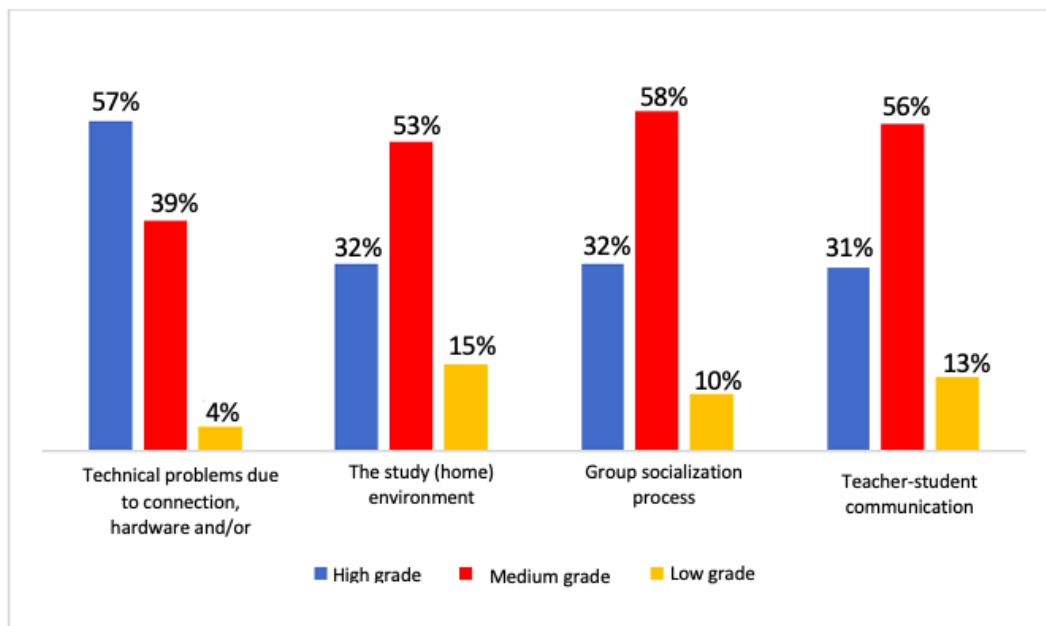


Figure 2. Degree of threats in the training of students by virtual means, UDI-HGDC

Figure 3 shows that an average of 56.00% of the respondents consider that virtual classrooms have allowed them to a medium degree: to encourage reading, greater access to information, access to updated academic resources and new evaluation techniques.

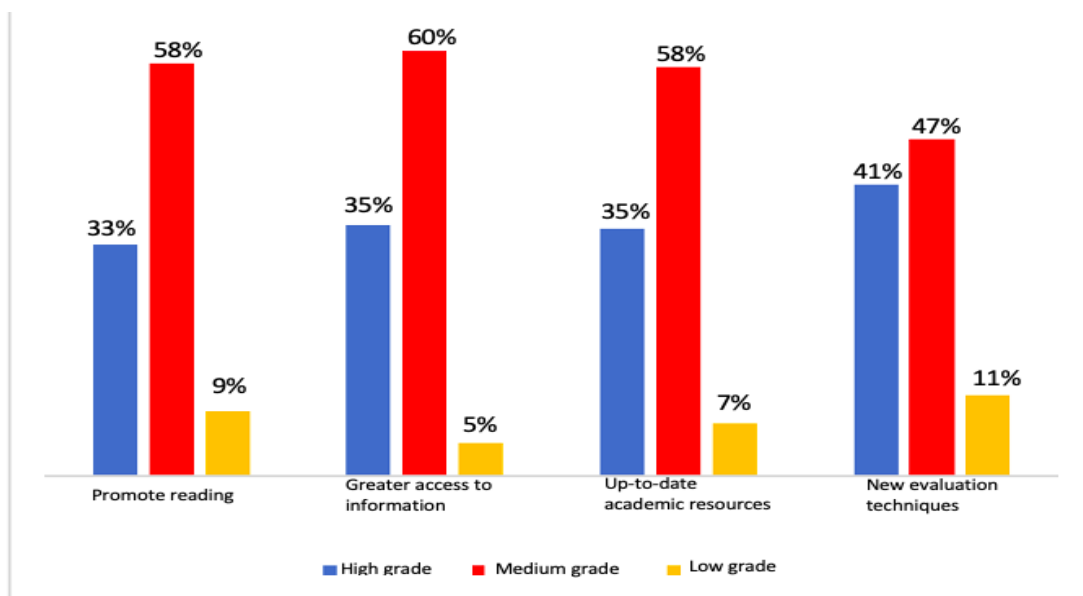


Figure 3. Degree to which virtual classrooms have enabled new learning, UDI-HGDC



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3.2 Bivariate Analysis

3.2.1 Continuity of studies through the virtual system

Four levels have been identified for the continuity of studies through virtuality: (1) 16.67% of women and 22.39% of men surveyed considered that the University should manage free access to virtual platforms; (2) 3.7% of women and 2.99% of men stated that the hours of virtual classes and meetings should be increased; (3) 17.59% of women and 10.44% of men considered that the current system should be maintained until the health emergency has been overcome; and (4) 62.04% of women and 64.18% of men considered that the current system should be maintained until the health emergency has been overcome. 59% of women and 10.44% of men considered that the current system should be maintained until the health emergency has been overcome; and (4) 62.04% of women and 64.18% of men stated that it should be sought, under programming and biosecurity norms, to integrate the student to hospital internships (Ref. Figure 4).

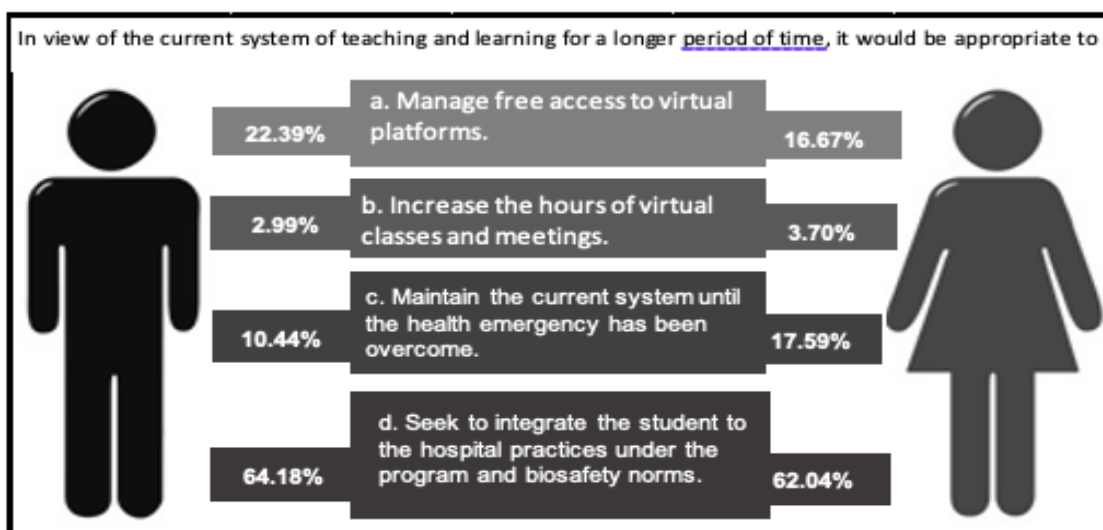


Figure 4. Continuity of studies through the virtual system for a longer period of time., UDI-HGDC

3.2.2 Alternative studies through the virtual system

In reference to the alternative of studying through the virtual system, Figure 5 shows that 11.11% of women and 19.40% of men surveyed consider that the virtual media system as an alternative to continue the teaching-learning process is an effective strategy; 50.00% of women and 46.27% of men stated that it is a moderately effective strategy; 30.56% of women and 26.87% of men consider it to be a not very effective strategy; and 8.33% of women and 7.46% of men stated that it is a deficient strategy. These results indicate that there is no real attachment to the consideration of continuing with the teaching-learning process through the virtual media system, especially when careers such as medicine, nursing and obstetrics are learned in practice and face-to-face.



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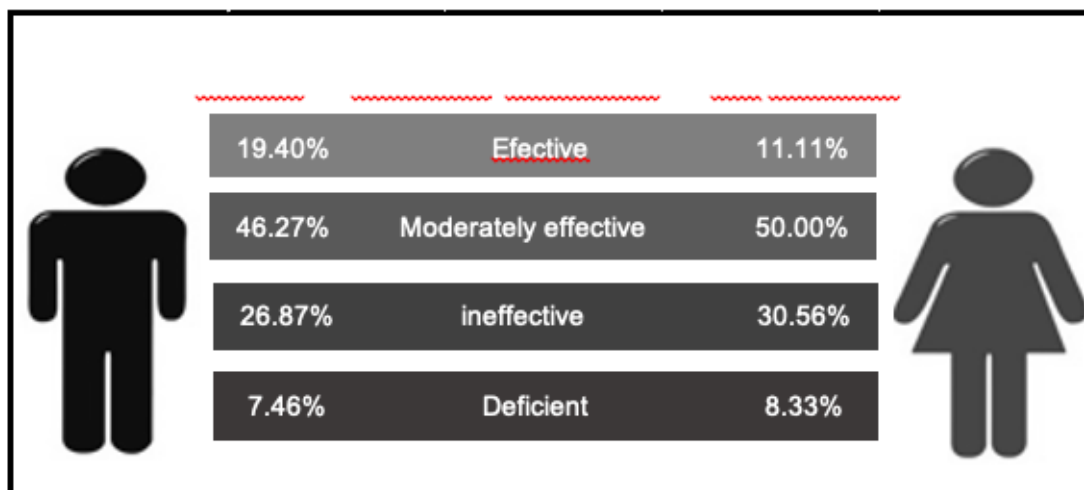


Figure 5. Virtual media system as a strategy and alternative to continue with the teaching-learning process., UDI-HGDC

3.2.3 Grading of virtual classes during the academic term

In Figure 6 on the rating of virtual classes in the academic period, 3.70% of women and 5.97% of men surveyed rated the development of virtual classes in the academic period as excellent; 26.85% of women and 19.40% of men rated them as very good; 57.41% of women and 64.18% of men rated them as good; and 12.04% of women and 10.45% of men rated them as bad. These results indicate that the development of virtual classes was not as well received by both students and teachers and emphasize once again that health careers are learned in practice and in a face-to-face setting.

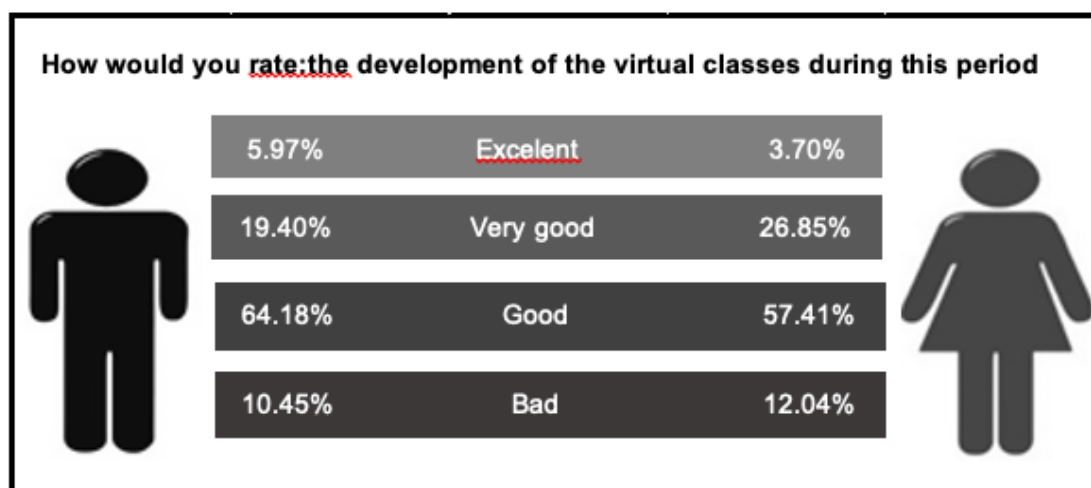


Figura 6. Calificación del desarrollo de las clases virtuales en el periodo académico, UDI-HGDC

4. Discussion

Teaching presents a challenge when it comes to finding new dynamics and ways of transmitting knowledge to others, especially in times when information is almost immediate and the dynamics of socialization have changed (CGFGlobal, 2016, para. 1). A large part of university students, despite their relative normality, have difficulties in their



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academic preparation on a regular basis. "Difficulties are expressed in demotivation for certain subjects or study programs; also due to inadequate school-family environments or spaces, disorganization of autonomous schedules, weakness in handling study techniques, among others" (Barreno-Freire et al., 2022, p. 75-97).

Virtual education is one of the new teaching methods today and uses technology to educate remotely, eliminating the barriers of distance and, why not, time. Virtual education, also known as online teaching, refers to the development of the teaching-learning dynamic that is carried out virtually. That is, there is an educational format where teachers and students can interact differently from the face-to-face space and is supported by ICTs, as it makes use of the tools offered by the Internet and other technologies to provide appropriate and high-quality educational environments (CGFGlobal, 2016, para. 4-5).

As cited by Gómez (2021) in his article on Virtual Education in Pandemic Times, educational subjects, in times of pandemic, are not in equal conditions to access virtual education: geographic location, economic and technological resources, training and experience in the use of information and communication technology, among others.

The results show that virtual education is increasing educational and digital inequalities, endangering equal educational opportunities; it is also established that virtual education becomes a privilege of those who have favorable social, technological and economic conditions, to the detriment of those groups that do not have technological access (p. 21).

For Francesc, director of UNESCO's International Institute for Higher Education in Latin America and the Caribbean, expresses that in the entire education sector the impact is yet to be evaluated, but in Higher Education the transition to emergency distance education has been accompanied by other manifestations no less important for the different actors, although probably not very visible and documented. Other impacts occur in the pedagogical, socioemotional, financial, labor, academic mobility, among others (Francesc, 2020).

In the Ecuadorian environment, the declaration of the health emergency by covid-19, made the governing body of Higher Education-SENESCYT have to take a series of measures to ensure access and permanence of students, including the immediate closure of face-to-face, the notification that all students, faculty and administrative staff had to study and work from home, the expansion of the internet bandwidth of public higher education institutions and implement virtual platforms for teaching. "Regarding the access processes, they were suspended because it could not be guaranteed that all applicants would have equal conditions in the use of technological means required for that process" (ONU para la Educación, Ciencia y Tecnología-Senescyt, 2020, p. 5-6).

It is also important to mention that:

The effects of COVID-19 on higher education are not exclusively manifested in the immediate term. The quantification of these effects a posteriori is not a complex exercise; however, the nature of an unprecedented crisis at world level makes it difficult to predict them prior to their occurrence. In the Ecuadorian context, it is observed that issues such as unemployment and inadequate employment, and the decrease in the provision of complementary services may have an impact on a decrease in access and permanence in a HEI, as well as increase gaps in terms of gender and urban/rural population that were already observed prior to the pandemic; in particular with those linked



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to access to technology (UN Education, Science and Technology-Senescyt, 2020, p. 7).

In terms of methodology and applicability of the research, it is important to consider the limitation for the collection of information; in many cases, web surveys are not accepted due to the boom of information received by e-mail and social networks. Since this is internal research of the General Teaching Hospital of Calderón, a presentation of the study was made to teachers and students in order to encourage their participation. It is urged that higher education institutions (academia) in conjunction with SENESCYT conduct studies and research to strengthen virtual education and that access to this form of education is not limited by technology.

Finally, it is important to reconsider whether in cases of health emergencies such as a pandemic, how convenient it is that health careers should take virtual classrooms as an alternative, especially considering and as the study has shown that students of health careers are not familiar with these virtual study environments and for HEIs the challenge has been how to solve the practical part that is a component of learning purely face-to-face and the *raison d'être* of these careers.

5. Conclusions

In terms of knowledge and management of virtual classrooms, it is essential for the University to provide teachers and students with guidelines for their use and management before the beginning of the academic period. It is important to mention that all university students handle administrative virtual environments (online enrollment, subject selection, grade verification, digital certificates and the like), but not virtual teaching-learning environments (MOOCs and Web 3.0 tools), which is the domain of those who have opted for distance or online education. University students in the modern digital era have greater access to social, educational, virtual and related networks; and therefore, to more information and knowledge; however, there are still low digital competencies to know how to use technological tools for teaching-learning, virtual environments and information discrimination.

One aspect to take into account is that teachers are responsible for developing technological competencies in students and being the managers of knowledge; however, the results showed that teachers of the School of Medicine who perform their academic activities in the General Teaching Hospital of Calderon lack greater interaction with technological devices and there is a strong generational transition and adaptation to new digital educational environments (traditional teacher to digital teacher).

At the level of knowledge assimilation and debates, it became evident that this teaching-learning strategy should be reinforced, and students and teachers should be motivated to debates with more argumentation. It is important then, together with the teachers, to design new strategies so that synchronous classes are more dynamic and participatory; and that digital educational tools and resources are used as reinforcement of the face-to-face classes given to medical, obstetrics and nursing students who, by regulation, cannot be accredited under the distance or online modality.

It is important that teachers and students are constantly trained in the use of virtual teaching-learning platforms and tools in both public and private higher education institutions. In addition, it is necessary to provide facilities to teachers so that they have technological equipment with connectivity and are those who promulgate the use of these



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digital tools, all this in order to strengthen the higher education system that in health careers cannot be solved only through virtuality.

The different studies carried out regarding the use of Information and Communication Technologies in education indicate that the fundamental characteristic is not to place information and knowledge within everyone's reach, but to provide interactive, multimedia and communicational educational environments for the student, in order to achieve the learning of a certain subject (Rodríguez and Avella, 2012). These virtual environments must be socialized with students and teachers, especially when contingencies, such as the one caused by the pandemic, forced the students of medicine, obstetrics and nursing of the Universidad Central del Ecuador to face a new teaching-learning model through virtuality.

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