Original Article

Perception of the use of Information and Communication Technologies in undergraduate medical students

Percepção do uso das Tecnologias da Informação e Comunicação em estudantes de graduação em medicina

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ABSTRACT | INTRODUCTION: Information and communication technologies enhance collaboration between students and health personnel worldwide to generate globalized health research and to improve the implementation of public health measures. **OBJECTIVE:** To evaluate the perception of information and communication technologies of medical students from a private university in the city of Medellín-Colombia. **METHODOLOGY:** Descriptive observational study that included pre-med and first-semester medical students who gave their consent. Variables such as sociodemographic, academic, information, and communication technologies skills and perception were included in the study. The information was collected through a survey made in Microsoft Forms®; absolute and relative frequencies were used for the analysis. **RESULTS:** 69 students participated in the study, of which 69.5% (48) were women; the average age was 17 years. Regarding access to electronic devices, it was found that 98.5% (68) had a cell phone, while 94.2% (65) had their own computer, and 100% (69) had internet access at home. **CONCLUSION**: Students perceive that due to the pandemic, the use of the Internet for academic activities increased, which impacted the time that was dedicated to digital entertainment activities; furthermore, they perceive that the trend in the use of information and communication technologies leads to a dehumanization of society.

Keywords: Education. High Education. Perception. Degree. Technologies of Information and Communication. Technology in Education.

RESUMO | INTRODUÇÃO: As tecnologias de informação e comunicação aumentam a colaboração entre estudantes e profissionais de saúde no mundo inteiro, para gerar pesquisas globalizadas em saúde e melhorar a implementação de medidas de saúde pública. **OBJETIVO:** Avaliar a percepção dos estudantes de medicina de uma universidade privada da cidade de Medellín-Colômbia sobre as tecnologias de informação e comunicação. **METODOLOGIA:** Trata-se de um estudo observacional descritivo, que incluiu estudantes do programa de pré-medicina e do primeiro semestre do curso de medicina que deram seu consentimento. Variáveis como habilidades sociodemográficas, acadêmicas, de tecnologias da informação e comunicação e percepção foram incluídas no estudo. As informações foram coletadas por meio de uma pesquisa feita no Microsoft Forms®; frequências absolutas e relativas foram utilizadas para a análise. **RESULTADOS:** Participaram do estudo 69 alunos, dos quais 69,5% (48) eram mulheres e a média de idade foi de 17 anos. Em relação ao acesso a dispositivos eletrônicos, verificou-se que 98,5% (68) possuíam celular, enquanto 94,2% (65) possuíam computador próprio e 100% (69) possuíam acesso à internet em casa. **CONCLUSÃO:** Os alunos percebem que devido à pandemia, o uso da Internet para atividades acadêmicas aumentou, o que impactou o tempo que foi dedicado às atividades de entretenimento digital. Além disso, percebem que a tendência no uso das tecnologias de informação e comunicação leva a uma desumanização da sociedade.

Palavras-chave: Educação. Ensino Superior. Percepção. Licenciatura. Tecnologias de Informação e Comunicação. Tecnologia na Educação.

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Introduction

In the early 1990s, the term e-Health began to be used to refer to the application of information and communication technologies (ICT) in the health field.[1] Currently, from the technological point of view, a series of components can be defined that encompass it, such as Telematic Health, Health Informatics, Telehealth, Health 2.0, mHealth, and the one on which this project focuses, e-Learning or distance learning, which is understood as education mediated by information and communication technologies.[2]

Since its implementation, ICTs have had the quality of enhancing collaboration between health personnel worldwide and students in this area, allowing to improve the implementation of public health measures in different countries and boosting research capacity, reducing the cultural gap produced by different socioeconomic levels and purchasing power in different countries.[3]

In recent years, it has been identified that virtuality in education offers a more flexible model of teaching and learning; good teaching and student practices are enablers of educational processes using new technologies. In higher education contexts, teachers find themselves in the classroom with digital natives students who demand ICT-mediated learning environments, who have grown up under its influence and impact and have given them the power to share, create, inform and communicate, becoming an essential element in their lives. Therefore, the teacher must have a broad theoretical and practical digital competence, as well as the student, who, without ICT skills, will not be able to take advantage of the knowledge that his teacher tries to transmit. This is why ICT training is now more necessary than ever.[4,5] The author Larrauri (2011)[6] mentions five ICT competencies that every health professional or student should have, which are: efficient use of ICT, access to information and communication, information and knowledge management, knowledge generation, and knowledge dissemination.[1]

In the current context, according to Instituto Internacional de la UNESCO para la Educación Superior en América Latina y el Caribe (2020)[7], 90% of the student population has been affected by the spread of the SARS-CoV2 virus. That is why entities such as the one mentioned above are supporting countries in their efforts to mitigate the immediate impact of school closures by facilitating the continuity of education for everyone through remote learning. To this end, measures have been taken such as the introduction or expansion of existing distance education modalities, the use of online platforms, social networks, and encouragement to school administrators to use ICT tools and employ existing applications as a means of communication between teachers, students, and families.[5,8]

In this sense, education in times of pandemic has allowed the paradigm shift of educational systems, where on-site classes have moved to the virtual modality, leading to the intensive use of these platforms, causing, in turn, questions and doubts about their correct use.[9]

The current education model is abruptly transformed every day; therefore, both teachers and students must be prepared to face new challenges in a highly competitive environment.

This study aimed to evaluate the perception of information and communication technologies of medical students at a private university in the city of Medellin, Colombia.

Methods

A mixed approach study was conducted, which included a descriptive quantitative component and a qualitative component through focus groups and semi-structured interviews. The study population consisted of pre-medical and first-semester medical students at a private university in the city of Medellin, Colombia, enrolled in the second academic period of the year 2020. A non-probabilistic sampling of consecutive cases was performed.

For the quantitative component, information was collected from primary sources through a virtual survey using Microsoft Forms®, which was designed

by the researchers and included sociodemographic, academic, ICT competencies, and ICT perception aspects. For the semi-structured interviews of the qualitative component, a guide instrument was designed with the purpose of inquiring about ICT aspects in terms of use and perception, which was applied in focus groups conducted by Microsoft Teams®. Previously we conducted coding iterations to generate key conservation and biodiversity themes embodied in the instrument used. First, we reviewed all the research questions, purposes, and resources for the study and generated a list of questions for the next phase of the analysis. These questions were asked during a Teams meeting, the mediation was made by a co-investigator, and the recordings were transcripts for the analysis. The students gave consent to participate freely in the focal groups. The virtual survey using Microsoft Forms was sent to a total of 124 students (84 students in the first semester and 40 in the pre-medical program). Sixty-nine pre-medical and first-semester students participated.

Data analysis was performed in Microsoft Excel®, using relative frequencies and absolute values for qualitative variables and measures of central tendency for quantitative variables. The data from the interviews and focus groups were analyzed manually using analysis notes that made it possible to organize and classify the information collected according to categories and subcategories. The categories for the semi-structured survey used in the focal group were obtained by a questionary modified by the authors from the reading data collected.

This research had the ethical endorsement of the institution, and according to Resolution 008430 of the Ministry of Health in Colombia, it was classified as research without risk. Likewise, the autonomy of the participants was respected to guarantee their freedom to participate in the study. Finally, their voluntary participation was provided with informed consent.

Results

Sixty-nine pre-medical or first-semester students participated, of which 69.5% (48) were female; the average age was 17 years.

Regarding previous training in ICT, 81% (56) of the students responded that they had not had any, while 77% (53) would be willing to take a course on ICT. Regarding access to devices and networks, see Table 1.

Table 1. Characterization of access to electronic devices and networks

Variable	Access	% (n)
Cell phone	Yes	99 (68)
	No	1 (1)
Own computer	Yes	94.2 (65)
	No	5.8 (4)
Home Internet	Yes	100 (69)
	No	-

Soucer: The authors (2022).

Regarding the perception that students had about computers, 61% agreed that "Computers are responsible for many of the good things we have" See Table 2.

Table 2. Perception about computers

Position regarding the statement	% (n)				
	1	2	3	4	5
Computers make me uncomfortable because I don't understand them.	42 (29)	38 (26)	14 (10)	3 (2)	3 (2)
Computers are responsible for many of the good things we have.	0 (0)	7 (5)	14 (10)	61 (42)	17 (12)
There are limitless possibilities for computer applications that have not yet been thought of.	0 (0)	3 (2)	16 (11)	51 (35)	30 (21)
Computers are leading us into a bright new era.	3 (2)	7 (5)	29 (20)	49 (34)	12 (8)
Computers are difficult to understand and frustrating to work with.	32 (22)	39 (27)	20 (14)	7 (5)	1 (1)

1 Totally disagree
2 Disagree
3 Unsure
4 Agree
5 Totally Agree

About the perception that students had about computers and human life, 62% affirmed that "Life will be easier and faster with computers" See Table 3.

Table 3. Computers and human life (to be continued)

Position regarding the statement	% (n)				
	1	2	3	4	5
Computers will never replace human life.	1 (1)	10 (7)	20 (14)	45 (31)	23 (16)
People are becoming slaves to computers.	0 (0)	14 (10)	25 (17)	41 (28)	20 (14)
Soon our lives will be controlled by computers.	4 (3)	32 (22)	26 (18)	33 (23)	4 (3)
Excessive use of computers can be harmful to humans.	0 (0)	6 (4)	10 (7)	43 (30)	41 (28)
Computers can dehumanize society.	0 (0)	12 (8)	17 (12)	42 (29)	29 (20)
The use of computers is raising our standard of living.	6 (4)	19 (13)	33 (23)	35 (24)	7 (5)
Computers are turning people into numbers.	7 (5)	32 (22)	32 (22)	20 (14)	9 (6)

Table 3. Computers and human life (conclusion)

Position regarding the statement	% (n)				
	1	2	3	4	5
Soon our world will be completely run by computers.	6 (4)	36 (25)	32 (22)	16 (11)	10 (7)
Life will be easier and faster with computers.	1 (1)	12 (8)	19 (13)	62 (43)	6 (4)

1 Totally disagree
2 Disagree
3 Unsure
4 Agree
5 Totally Agree

Regarding computers and work, students chose to agree that "Computers eliminate a lot of tedious work" and "Computers are fast and efficient, which means gaining information" both options with 62%. See Table 4.

Table 4. Computers and work

Position regarding the statement	% (n)				
	1	2	3	4	5
Computers can eliminate much of the tedious work.	3 (2)	3 (2)	3(2=	62 (43)	29 (20)
Computers are reducing the importance of a lot of man-made work.	0 (0)	10 (7)	9 (6)	55 (38)	26 (18)
Computers are fast and efficient, which means information gain.	0 (0)	3 (2)	7 (5)	62 (43)	28 (19)
Computers will replace the need to work with humans.	13 (9)	28 (19)	33 (23)	19 (13)	7 (5)

1 Totally disagree
2 Disagree
3 Unsure
4 Agree
5 Totally Agree

Regarding the use of the internet before and after the quarantine by Covid-19, after the quarantine 98.6% (68) of the students chose the option of using it at least once a day, while 89.9% (62) chose this same option for before the quarantine. See Table 5.

Table 5. Internet use before and after the quarantine

Variable	Answer options	Before	After
		% (n)	% (n)
How often do you use the Internet?	At least once a day	89.9 (62)	98.6 (68)
	At least twice a week	10.1 (7)	-
	At least twice a month	-	1.4 (1)
What are the most frequent places you use the Internet?	Home	85.5 (59)	98.6 (68)
	Work	8.7 (6)	-
	Public wireless network	5.8 (4)	1.4 (1)
What do you use the Internet for?	Obtaining information	43.5 (30)	56.5 (39)
	Communication	21.7 (15)	26.1 (18)
	Participation in virtual communities	2.9 (2)	11.6 (8)
	Entertainment activities	31.9 (22)	5.8 (4)

Soucer: The authors (2022).

When asked about the type of information they searched for on the Internet, the students answered that most of the time, they used it for academic consultations and study, with 66.7% (46) and 85.5% (59) before and after quarantine, respectively. Regarding the means of communication, 75.4% (52) answered that chat was the most used after quarantine and e-mail only 20.3% (14) before quarantine, compared to 58% (40) and 40.6% (28) respectively, after quarantine.

Qualitative data from the focus groups by category are presented below.

Category. Technology-mediated humanization/dehumanization

When the student participants were asked about the role of computers in the dehumanization of society, they stated:

S1: *"I am not going to deny that; they are replacing the work of the human being. In the future, what the human being is really going to do is not be in action but manipulating a computer because, speaking from the medical point of view, a computer will monitor the patient very well and tell his oxygen saturation and heart rate, but it will limit that human warmth that I personally feel is very necessary and fundamental".*

Category. Technology dependence

When asked about how dependent they are on ICT, the students replied:

S3: *"Well, yes, I do think it is something indispensable. Computers are tools for searching for information and research, so I think they are indispensable in education as well as in all areas".*
S7: *"To be honest, nowadays, considering that we are studying, I am practically using the Internet almost all day long, but mostly reading and studying, obviously".*

Category. Positive and negative conceptions about the use of ICTs

When reference was made to personal conceptions towards ICT, students stated:

S7: *"We can find many things that are negative, but at the moment, let's say that for what we need it for, I think it is very important and very useful, especially because of the great possibility it gives us to access everything we need".*

S2: *"Something that I see as something a bit negative is that unfortunately, especially in the situation we are facing with Covid, and so on, people are very dependent on virtuality and connection".*

S10: *"All the tools that have been evidenced during this pandemic have been very positive. The University has somehow thought about the student's needs and has tried to solve them".*

Category. Teacher-student relationship

Regarding the relationship with teachers, students stated:

S1: *"In general, let's say it has been acceptable/good, but I feel that, although it is too much to ask, there is a lack of contact. The teacher who is teaching the class does not know if we are there, so there is a distrust because the teacher thinks: man, maybe I am just giving a class to my screen or to my computer".*

S3: *"In terms of communication, the quality of the internet affects a lot, and as for the classes, it is different when you are on-site because you have the teacher in front of you and you can't pick up your cell phone because he is looking at you, but being behind a screen increases the distractions because you feel tired, you stand up, and you miss the class".*

Category. Internet and quality

When asked about the main difficulties when using ICT, the students replied:

S1: *"Well, the biggest problem we found is the connection. Although I am close, I am outside Medellin, then sometimes the connection has been like a challenge because, maybe you are on an important topic, and the connection drops, and the Wi-Fi goes out. Then we found that the main challenge and the most complicated thing concerning the virtual aspect is precisely the internet connection".*

S5: *"These difficulties are mostly personal because, for example, my internet connection is almost always down, and sometimes when I was in pre-medical school, it slowed down my study pace because I missed the class and I had to listen to it again, so that's what it is".*

Category. Use of social networks in personal and academic life

When students were asked about the use of social networks, they stated:

S4: *"Both in education and work, for the personal area because it helps us to connect, to research, and to inquire more about things. It is a resource you can take everywhere, and with just one click, you can have a lot of information at hand, so I think it is very useful in daily life".*

S9: *"For example, on the cell phone, I was always in contact with the teachers, and if I had any questions, they would answer them. I imagine that it is more complicated on-site. I think that would be all".*

S1: *"Well, I think that before entering the university, the type of information I was looking for was not academic, it was like general culture or books or movies for recreational purposes, I was looking for information like curious facts or videos, but now I think that in the university the type of information is very academic, such as scientific articles, magazine articles".*

S1: *"Let's say that Instagram, TikTok, Twitter, and Youtube have changed the platform a lot, they have become very interesting tools, they are explaining the topics in a way that the words they use are closer to what we are used to because the language of medicine is very technical".*

Discussion

The digital era has changed the perception of how medicine can be taught, learned, and studied, impacting academic quality, resource optimization and program profitability.[10] The presence of digitalization has become a challenge in all areas of daily life, especially in higher education.[11]

In the present study, 69.5% were women, similar to the data reported by Luján-Piedrahita (2020)[12], in which 74.6% were female in the same higher education institution, however, in different academic years. In the work carried out by Bossolasco et al. (2020)[13] in two Argentine public universities, Universidad Nacional de Tucumán (UNT) and Universidad Nacional de Río Cuarto (UNRC), 63% of the participants were women in UNT, while in UNRC 73% were men.

In the study conducted by Luna et al. (2013)[14] on psychology students, 50% stated that they have ever taken computer courses, and 69% are willing to take computer courses. In the present study regarding previous ICT training, 81% replied not having had any, while 77% would be willing to take a course on these.

Knowledge is just a click away; the world has changed very fast, and the Internet and ICTs are part of our daily lives and of a youth that has grown up immersed in these technologies.[15] The pandemic will go down in history with a before and an after. The responsiveness of students and teachers to the crisis remains a challenge for medical education programs since it is not only important to guide towards an online academic survival but the transcendental of future professional practice.[16]

In the study by Bossolasco et al. (2020)[13], 100% of the participants had some technological device that allowed them to access and/or process information in digital format, while in the present study, 99% and 94.2% stated that they had their own cell phone or computer, respectively. In both studies, the cell phone was the main device used. While in the study conducted by Santos et al. (2021)[17] in the Dominican Republic during the pandemic, 57.4% of the students used computers and telephones, 29.7% used only a telephone, and 11.9% only a computer.

Regarding connectivity, in the study by Bossolasco et al. (2020)[13], participants from UNRC and UNT, 96.6% and 86.5%, respectively, had accessibility at home, while in the present study, 100% had it. In the study conducted by Santos et al. (2021)[17] in relation to internet accessibility, 46.5% of the students contracted personal mobile data plans for virtual classes, 26.8% had broadband internet at home, and 12.9% shared mobile data plans with family members or neighbors.

Regarding the perception of students on connectivity aspects, in the study by Santos et al. (2021)[17], a student states: "I feel a little suffocated because the signal is bad and the internet does not work well, and I feel bad because I share the PC I use with another person, so I get behind in my homework" (Student). In the present study, one of the participants mentions: *"Well, the biggest problem we found is the connection, although I am close; I am outside Medellin then sometimes the connection has been like a challenge because, maybe you are in an important topic and the connection drops, the Wi-Fi goes out, then we found that the main challenge and the most complicated thing with respect to the virtual aspect is precisely the internet connection".*

In the study conducted by Luna et al. (2013)[14], psychology students stated that they totally agree with the statement "Computers will never replace human life" with 35%, compared to 23% of medical students for this same statement and rating.

Regarding the statement "Computers can dehumanize society" in the present study, 42% of the participants state that they agree, similar to the data reported by Luna et al. (2013)[14], with 41% for this same circumstance.

In the present study in relation to the teaching-learning processes using ICT in the middle of the pandemic, one of the students affirms: *"All the tools that have been evidenced during this pandemic have been very positive. The University has somehow thought about the student's needs and has tried to solve them"* (S10). In the study of Santos et al. (2021)[17], one of the students states that: *"I feel good since it is a good method that they have incorporated so that we students do not lose the semester due to this pandemic that is affecting us".* (Student)

Conclusions

Students perceive that because of the pandemic, the use of the Internet for academic activities increased, which impacted the time that was dedicated to digital entertainment activities and that the trend of the use of information and communication technologies leads to a dehumanization of society.

It can be highlighted that when talking about internet accessibility, this can be limited by social problems, it is identified that the public and private origin of the institutions can generate variations in the resources that students have to develop good teaching and learning processes.

Conflict of interest

No financial, legal or political conflict involving third parties (government, companies and private foundations, etc.) has been declared for any aspect of the work submitted (including, but not limited to grants and financing, participation in advisory board, study design, manuscript preparation, statistical analysis, etc.).

Authors' contributions

Martinez-Sanchez LM, Luna-Gomez IF, and Giraldo-Ospina GA participated in conceptualization, formal analysis, research, methodology, project management, supervision, validation, visualization, writing - original draft, proofreading, and editing. Chica-Lopez JI participated in conceptualization, formal analysis, research, methodology, project management, resources, and writing - original draft, review, and edition. Rubiano-Varela MP and Perez-Arias S participated in the formal analysis, research, methodology, design, and writing - proofreading and editing.

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