Knowledge and Uses of Information and Communication Technologies in Dental Teaching*

Conocimiento y usos de las tecnologías de la información y comunicación en docencia odontológica

Conhecimento e usos das tecnologias de informação e comunicação no ensino dentário

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ABSTRACT

Background: Information and communication technologies (ICT) have transformed teaching-learning processes in dental education. Professors are required to know and use them appropriately. *Purpose:* To identify the level of knowledge of ICT that professors at a dental school have and describe their academic uses. *Methods:* A mixed research method was used with an explanatory sequential design (quantitative-qualitative). A previously validated questionnaire was applied to 68 professors to measure their knowledge and uses of ICT. Subsequently, semi-structured interviews were conducted with 15 of them to obtain more relevant perceptions. In the quantitative phase, descriptive statistics and multivariate analyzes were used, while the qualitative information was systematically arranged in content categories. *Results:* 63.2 % of professors reached a basic level of ICT knowledge. Only a statistically significant relationship was found between the level of ICT knowledge and age, since professors under the age of 50 presented better results. Although 66.2 % say they use ICTs more than twice a week in their academic work, their use is limited to recording attendance and grades in the institutional platform, preparing and presenting contents in the learning sessions, looking for scientific information, and communicate with students. *Conclusion:* These findings highlight the need to improve faculty training and to promote educational policies that favor the effective incorporation of ICT in higher education.

Keywords

RESUMEN

Antecedentes: Las tecnologías de la información y la comunicación (TIC) han transformado los procesos de enseñanza-aprendizaje en la educación odontológica. Se requiere de docentes que las conozcan y las usen apropiadamente. *Objetivo:* Identificar el nivel de conocimiento de las TIC que tienen los docentes de una facultad de odontología y describir sus usos académicos. *Métodos:* Se usó un método de investigación mixto, con un diseño secuencial explicativo (cuantitativo-cualitativo). Se aplicó un cuestionario previamente validado a 68 docentes para medir sus conocimientos y usos de las TIC. Después se realizaron entrevistas semiestructuradas a 15 de ellos para obtener algunas percepciones más relevantes. En la fase cuantitativa se utilizaron estadísticas descriptivas y análisis multivariados, mientras que la información cualitativa se ordenó sistemáticamente en categorías de contenido. *Resultados:* El 63,2 % de los docentes alcanzaron un nivel básico de conocimientos en TIC. Solo se encontró una relación estadísticamente significativa entre el nivel de conocimientos en TIC y la edad, ya que los docentes menores de 50 años presentaron mejores resultados. Aunque el 66,2 % de los docentes afirma usar las TIC más de 2 veces por semana en sus labores académicas, su uso se limita a registrar la asistencia y las

notas en la plataforma educativa, preparar y presentar contenidos en las sesiones de aprendizaje, buscar información científica y comunicarse con los alumnos. ***Conclusión:*** Estos hallazgos ponen de manifiesto la necesidad de mejorar las capacitaciones docentes y de promover políticas educativas que favorezcan la incorporación efectiva de las TIC a la educación superior.

Palabras clave

apropiación de las TIC; docencia universitaria; educación odontológica; educación superior; enseñanza universitaria; nivel de conocimiento de las TIC; odontología; tecnologías de la información y la comunicación (TIC); tecnología educativa; usos académicos de las TIC

RESUMO

Antecedentes: As tecnologias da informação e comunicação (TIC) transformaram os processos de ensino-aprendizagem na educação odontológica e os professores precisam conhecê-los e usá-los adequadamente. ***Objetivo:*** Identificar o nível de conhecimento em TIC que os professores de uma faculdade de odontologia possuem e descrever seus usos acadêmicos. ***Métodos:*** Utilizou-se um método misto de pesquisa, com desenho seqüencial explicativo (quantitativo-qualitativo). Um questionário previamente validado foi aplicado a 68 professores, para medir seus conhecimentos e usos das TIC. Posteriormente, foram realizadas 15 entrevistas semiestruturadas para obter percepções mais relevantes. Na fase quantitativa, foram utilizadas estatísticas descritivas e análises multivariadas, enquanto as informações qualitativas foram sistematicamente organizadas em categorias de conteúdo. ***Resultados:*** 63,2 % dos professores atingiram um nível básico de

conhecimento em TIC. Apenas uma relação estatisticamente significante foi encontrada entre o nível de conhecimento em TIC e a idade, uma vez que professores com menos de 50 anos apresentaram melhores resultados. Embora 66,2 % dos professores afirmem usar as TIC mais de duas vezes por semana em seu trabalho acadêmico, seu uso é limitado ao registro de presença e notas na plataforma educacional, preparação e apresentação de conteúdo em sessões de aprendizagem, buscar informações científicas e se comunicar com os alunos. ***Conclusão:*** Esses achados destacam a necessidade de melhorar a formação de professores e promover políticas educacionais que favoreçam a incorporação efetiva das TIC no ensino superior.

Palavras chave

apropriação de TIC; ensino universitário; educação odontológica; educação superior; nível de conhecimento em TIC; odontologia; tecnologia educativa; tecnologias da información e comunicação (TIC); usos acadêmicos das TIC

INTRODUCTION

Information and communication technologies (ICT) are a set of resources and tools that have had a significant impact on the various scenarios, processes and activities of human beings in recent years. In the educational field, these technologies have taken a leading place because they have definitely transformed the teaching-learning processes. The dynamics of interaction of the actors of the educational process are no longer exclusive to the classrooms, but have extended to virtual environments and have changed the way of relating to knowledge, both of the professor and the

student (1).

Today's student, usually considered a "digital native" for Prensky (2) or a "resident" of the network for White *et al.* (3), learn in a different way, since all learning processes are mediated by technology. Connectivism would be the most appropriate educational theory to understand this digital age in which some traditional paradigms are being changed since training is carried out through educational processes of continuous student participation, mediated by digital resources and accompanied by the professor (4).

Currently, the profile of the student and the professor is markedly different from that of the late 20th century. Gisbert *et al.* believe that this generation of university students is characterized by a marked digital literacy, a permanent need to be connected, immediacy, multitasking ability (doing several actions simultaneously), their social character and their experiential learning. In addition, beyond the name chosen to define this generation, students will also arrive to college knowing and using some ICT tools, but without having acquired the necessary skills to apply them in their learning (5). On the other hand, the current university model requires professors with a new technological and pedagogical profile, who use ICT for their academic and research tasks (6).

To classify the level of knowledge and skills that professors have in ICT, various approaches have been tried. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) promotes three approaches for the development of teaching competencies in ICT: basic notions of ICT, knowledge deepening, and knowledge generation (7). Based on these approaches, Prendes tried to unify criteria on the indicators to measure ICT competencies in university professors and

establishes three levels of mastery, which are cumulative (8). This model offers the possibility of giving the professor not only a vision about the state of their ICT skills, but also guides them in terms of a training itinerary, with a view to the continuous improvement of institutions in terms of educational quality (8,9).

Multiple studies have been carried out to measure the level of knowledge, appropriation, and uses of ICT among college professors as useful tools to improve and complement the teaching-learning processes. Most of the instruments used are aimed at evaluating professors' self-perception, beliefs, and attitudes towards their knowledge of ICT and its pedagogical uses (10-18). In contrast, Durán *et al.* designed and validated an instrument to evaluate and certify the ICT skills of university teaching staff, directly evaluating professors' ICT knowledge, as well as attitudes towards its academic uses (19).

Specifically, in the case of contemporary dental education, the demand for the use of technology has increased substantially. The integration of ICT in teaching-learning processes is becoming more and more common worldwide and in Latin America. Currently, face-to-face theoretical classes are held with the use of audiovisual presentations, complemented with online learning environments through educational platforms and the search for digital scientific information. Also, for preclinical practical learning, innovative resources are used such as laboratories with haptic (simulation of tactile, auditory and visual sensations) simulators accompanied by virtual reality environments or 3D environments, and for clinical practical learning, multiple state-of-the-art technological resources, instruments, and biomaterials are used (16,20 -22). The professor is then expected to have the basic knowledge in most audiovisual, computer, and telematic tools as part

of their continuous training (23,24). However, will university professors be properly trained to face the challenge of an education that makes continuous use of ICT?

At the dental school of a private university in Lima (Peru) it is perceived most of the professors know and use some technological tools in a very basic way and, in the field of academic management, there is no clear policy of transversal integration of ICTs to the curriculum or professor training. Therefore, the purpose of this study was to identify the level of ICT knowledge professors at a private dental school in Lima have and describe its uses in academic practice, during the 2017-I semester.

MATERIALS Y METHODS

The present study was carried out using mixed methods with an explanatory sequential design divided into two phases, one quantitative and the other qualitative. For the quantitative phase, a descriptive and cross-sectional type of design was used. In the qualitative phase, an intrinsic case study design was used, since it sought to understand in depth the social and educational reality of the research participants (25,26). Both sequential phases were related through a methodological triangulation, which seeks to combine two or more theories, data sources or research methods in the study of a singular phenomenon (27).

For the quantitative phase, a questionnaire was designed based on the instrument created by Durán *et al.* (19). The questionnaire consisted of two large parts: a first part with 42 items that corresponds to an objective test of optimal performance that aims to establish the level of ICT knowledge of

professors and a second part with 23 items that seeks to investigate the uses academics that professors give to the various ICT they know and have available through a frequency Likert scale (28). Each of the 42 items in the first part of the questionnaire measures a level of ICT mastery, as proposed by Prendes, thus evaluating the three levels of ICT knowledge of professors according to the following criteria:

- Level 1: competences related to knowledge bases that underpin the use of ICT.
- Level 2: precise skills to design, implement, and evaluate actions with ICT.
- Level 3: competencies that are relevant for the professor to reflectively and critically analyze the action carried out with ICT, either individually or in collective contexts (8).

Once the instrument was designed, an internal validation was carried out through evaluation by 5 experts in educational technology, who suggested some changes. After collecting the observations, the instrument was subjected to a pilot test, applying it to 9 professors who work in another dental school to determine its reliability. A Cronbach's alpha coefficient of 0.87 was obtained and it was not necessary to remove any of the 65 elements evaluated.

The statistically established sample for the quantitative phase consisted of 68 professors from a dental school of a private university in Lima (Peru), from different academic areas, who wanted to participate in the study and who signed the informed consent. These professors were given the questionnaire in printed form during a training session. The questionnaire was self-administered by each professor, simultaneously and in absolute silence, in a maximum time of 30 minutes. The researchers were present to resolve all the concerns that arose during the application of the instrument.

The first part of the questionnaire was scored giving a score equal to 1 to each item answered with correction, to later give a result of the level of knowledge in ICT of each participant (70 % of each level). In this way, to obtain Level 1, the professor had to correctly answer 11 of the 16 items of that level; To obtain Level 2, they had to pass level 1 and hit 11 points of the 16 items in level 2; and for Level 3, the first two levels had to be surpassed and 7 points obtained out of 10 items of level 3. The data obtained in the questionnaires were recorded and analyzed using the IBM® SPSS® Statistics 24 software, using descriptive statistics: averages, means, medians and percentages. In addition, bivariate and multivariate analyzes were used to study the relationship between the variables.

To carry out the qualitative phase, the most outstanding quantitative results were analyzed, and an interview guide was designed to find out the perceptions and opinions of the professors about their perspectives regarding the incorporation of ICT into academic practice. This interview guide had a total of 8 open questions and was applied through semi-structured interviews to a total of 15 professors, using an intentional non-probabilistic sampling method, in which professors from different academic areas and from all cycles were sought, to find the greatest representativeness and depth of analysis. Each interview was conducted personally and audio-recorded in a private and quiet place, to guarantee the comfort of the professor, after signing the informed consent.

Data obtained from the interviews were transcribed and systematically reduced and arranged into content categories. Later, through triangulation, it was possible to obtain an explanation of the quantitative results and enrich the research process, giving greater relevance to the findings.

RESULTS AND DISCUSSION

Sample description

Table 1 shows that the 68 professors have a similar distribution in terms of sex. Most are in the 40-49 age range, and nearly all are dental surgeons. In addition, the average experience as a university professor is 10 years, 69.1 % have an academic master's degree and a little more than half have a specialist degree, which indicates a regular preparation in postgraduate studies.

TABLE 1
SAMPLE DESCRIPTION

Variable	Frequency	Percentage
Sex		
Female	31	45,6
Male	37	54,4
Age		
30 a 39 years	24	35,3
40 a 49 years	29	42,6
50 a 59 years	11	16,2
60 a 69 years	2	2,9
70 a 79 years	2	2,9
Major		
Dentist surgeon	63	92,6
Chemistry-pharmaceutics	1	1,5
Education	4	5,9
Teaching experience		
1 a 5 years	13	19,1
6 a 10 years	30	44,1
11 a 15 years	16	23,5
16 a 20 years	6	8,8
21 or more years	3	4,4
Degree level		
Specialist	35	55,1
Master's	47	69,1
Doctor	10	14,7

ICT knowledge level of professors

The results indicate that 63.2 % of professors reached level 1 of ICT knowledge, followed by level 2 with 33.8 %. No professor reached level 3 and 2 professors (2.9 %) failed to reach level 1 (figure 1).

FIGURE 1
ICT KNOWLEDGE LEVEL OF PROFESSORS
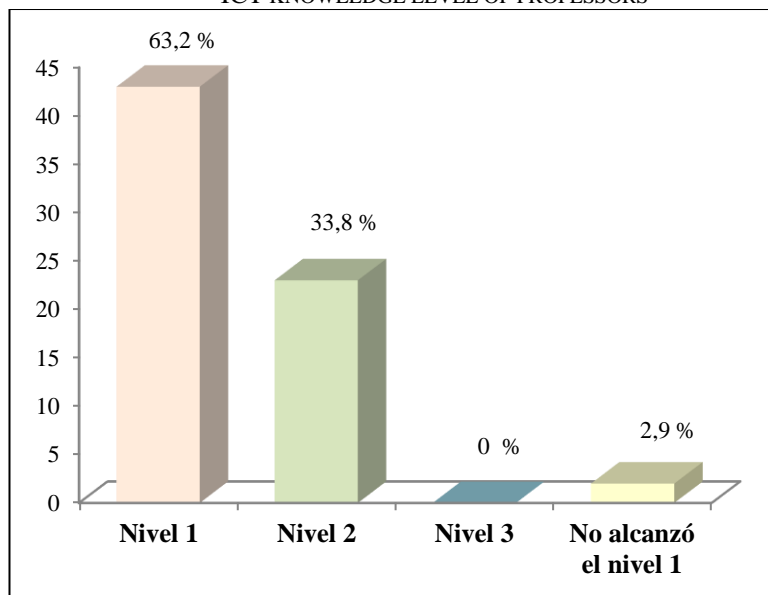
This finding indicates that most professors surveyed have a basic level of knowledge of ICT, which could have an impact on educational planning processes, preparation of support materials and communication with students, among others. This result reaffirms what was stated by Tapasco *et al.* (29) and Tapia *et al.* (17), who state that one of the challenges of higher teaching is the incorporation of ICT in professor training for the exercise of new competences in the academic task. Tejada *et al.* (30) point out that the professor's digital competences should be oriented towards knowing how to use and adequately incorporate ICT in daily academic teaching-learning activities.

Particularly in the area of health sciences, professionals who wish to teach in a specific discipline must have various competencies, in addition to being experts in their specialty. In this way it is expected that, being members of a faculty, they perform multiple roles such as teaching, managing and serving the institution and the community. Scarbecz *et al.* (31) explain that health sciences professors must develop a large number of diverse skills and abilities such as public speaking,

managing conflicts, teamwork, designing new didactic approaches, demonstrating social skills, being assertive and using ICT in educational processes.

This gap between the basic professional skills of the professor and the educational expectations, makes continuous training necessary so that all professors at a school have all the basic competencies that are required to practice teaching today. In this sense, the basic level obtained by the majority of the professors surveyed shows the need to improve the professor training program and technological innovation. To reinforce the impact of professor training activities, they must be specific, adapted to the needs of each professor, in methodological and pedagogical aspects, and must be accompanied by personalized advice.

Although this study was conducted in 2017, its results are making more sense in the current context of the COVID-19 pandemic in which it is being published. Due to the abrupt worldwide spread of the coronavirus disease in 2020, most countries opted for the confinement of the population for several months and various educational measures were taken, such as the closure of university campuses. Specifically, in some Latin American countries and especially in Peru, universities have had to quickly adapt to virtuality and university academic semesters have been developed remotely, through distance education through the use of educational platforms and applications to perform video conferencing such as Google Meets®, Microsoft Classroom®, Blackboard® and Zoom®. University professors have had to be quickly trained in the use of virtual classrooms and other digital tools, which is definitely a great challenge due to the short time and great difficulty that this type of education generates (32,33).

On the other hand, when relating the level of knowledge in ICT with age, sex, academic degree, and time of academic experience of the professors, only a statistically significant relationship with age was found. Table 2 indicates the age factor does have to do with mastery and knowledge of ICT, since professors under 50 years of age obtained the best results. When correlating both variables using the Chi-square test, a significance level of 0.016 (less than 0.05) was obtained, which indicates an association between both variables (Table 3).

TABLE 2
RELATIONSHIP BETWEEN THE LEVEL OF ICT KNOWLEDGE AND THE AGE OF THE INSTRUCTOR

Variable		Instructor's age intervals					Total
		30 a 39	40 a 49	50 a 59	60 a 69	70 a 79	
ICT knowledge level	Level 1	13	17	9	2	2	43
	Level 2	11	12	0	0	0	23
	Did not reach level 1	0	0	2	0	0	2
Total		24	29	11	2	2	68

TABLE 3
CHI-SQUARE TEST

Text	Value	d.f.	Significance (bilateral)
Pearson's Chi-square	18, 816a	8	**0,016**
Likelihood ratio	20,513	8	0,009
Linear association	0,532	1	0,466
No. Valid cases	68		

10 cells (66,7%) ----- have expected a count less than 5. The minimum expected count is 0.06.

This result is similar to that of Vera *et al.* (13), who indicate that the age factor behaves in a particular way, since as it increases there is a decrease in the domain and attitude towards ICT. Likewise, Cabrera *et al.* (34) found that the younger the professor is perceived to have a greater mastery of ICT, and at an older age their knowledge decreases in relation to its use. For his part, Orantes (35) indicates that there is a significant difference in terms of the mastery of ICT in professors over 41 years of age. In contrast, some studies have not found significant differences

between the ICT knowledge of university professors and age, such as that of Espinosa *et al.* (11), Jedege (36) and Hernández *et al.* (37), who conclude that age is a variable that does not influence the self-perceived degree of integration of ICT in university teaching.

In this regard, in the interview with some professors, the majority think that age does have to do with the knowledge and uses of technologies in academic practice. Some express that very old professors usually do not handle technologies well and are even afraid to use them so as not to look bad with their students or with their colleagues. This is due to some limitations, both physical and mental, typical of aging. In addition, they are professors who usually find it difficult to adapt to educational and technological changes. A professor comments the following on this issue:

> I think we do not know all the scope that the use of technologies can bring today. Students would like to identify with a professor who is up-to-date and who explores the use of technologies to complement classes. I think that age has a bit to do with it, since it limits the visual part, mental speed and makes it difficult to learn technologies.

A few professors interviewed think that age does not influence when using technologies in academic practice, arguing that they know professors over 60 who are constantly trained and updated to be at the same level as the new generations of learning. A professor thinks the following:

> I think age does not influence wanting to do things well, it depends on each person wanting to learn and do things well.

This finding shows the need to emphasize that professor training must be differentiated, evaluating the entry level of professors and then designing programs according to the particular needs of each age group, considering that the majority are "digital immigrants" (2) or "visitors" of the network (3) and the way of learning and communicating differs considerably with respect to their students. In this way, it will be possible to motivate professors in their academic tasks, considering that they have valuable experience for the training of students and that, by improving their level of knowledge in ICT, they will be able to achieve the integration of these into their academic practice.

Uses of ICT in teaching practice

97.1 % of the professors answered that they do use ICT in their academic practice. Regarding the frequency of ICT use, 32.4 % of professors say they use them daily, 33.8 % use them 2 times or more a week, 23.5 % use them only once a week. the week and 10.3 % never use them. This result is similar to those published by Lagunes *et al.* (38), Martínez (39) and Martínez *et al.* (40), who indicate that the vast majority of professors resort to technological means as an alternative support for teaching their classes, recognizing their great utility and possibilities to enrich their teaching work. No statistically significant relationship was found between the frequency of use of ICT in teaching practice with the variables age, sex, and ICT knowledge level.

Professors were asked about how they had learned to use ICT. 45.5 % responded they had learned in training provided by the university where they work, 24.8 % learned with the help of a family member or friend, 19.8 % did it in free virtual courses and online tutorials and 9.9 % learned in technology centers.

The most frequent academic uses in the professors surveyed were: use of the educational platform to manage the courses, preparation of didactic materials, presentation of content in the classroom, search for information, and communication with students.

Course management through the educational platform. The results on the use of the educational platform offered by the university (Blackboard®) indicate that the majority of professors use it for basic course management activities such as registering students' attendance at learning sessions and registering notes. In contrast, the least use of this tool was to upload support materials (figure 2).

FIGURE 2
COURSE MANAGEMENT THROUGH THE EDUCATIONAL PLATFORM
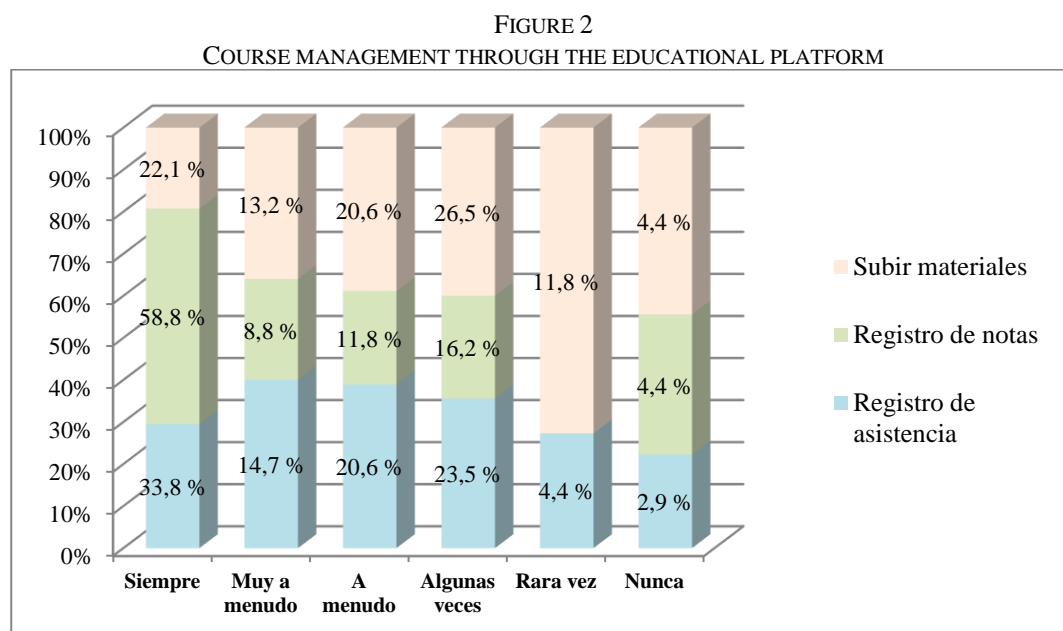
These results are similar to those reported by Espinosa *et al.* (11), who explain that, despite the great variety of tools that this platform has, very few are used by professors. With a marked difference are the studies by Caicedo *et al.* (41) and Jaramillo *et al.* (42), who show a wide use of educational platforms by professors to publish content, record grades, manage class lists and design evaluations.

Based on the above, it can be deduced that professors regularly use Blackboard® only in actions that are mandatory, while, apparently, they are reluctant to carry out other complementary activities, such as uploading and sharing content and support materials with their students as syllabi, guides, readings, web links or classes in PowerPoint®. Among the possible reasons for this, the professors interviewed refer not having a sufficient command of the educational platform, training on these technological tools, fear among older professors of spoiling their work due to the lack of digital skills and not uploading theoretical classes in PowerPoint® for fear that students may plagiarize them. In this regard, a professor thinks the following:

> I think that professors do not use all the tools that Blackboard offers just because of ignorance. I am convinced that if professors knew them better and were better trained, you would use them well.

Preparation of teaching materials. One of the main uses that professors give to ICT is the development of teaching and support materials for their class sessions. Word processors (Word®, WordPad®, Word® online, etc.) were the most used to develop teaching materials, followed by programs to create visual presentations (PowerPoint®, Prezi®, PowToon®, etc.). Photo editing and video editing programs were the least used (figure 3).

FIGURE 3
USE OF ICTS TO PREPARE TEACHING MATERIALS
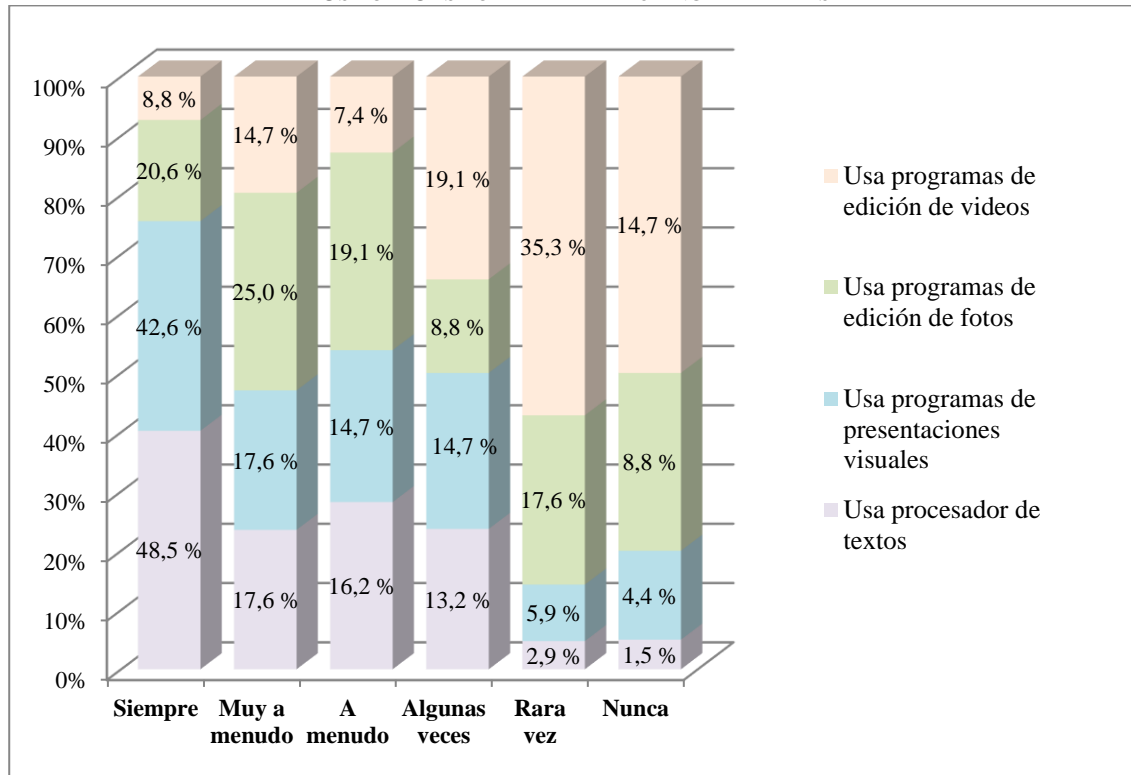
This result is similar to that of Espinosa *et al.* (11), since the applications most used by the professors who studied were word processors (87 %) and the production of slides (80.6 %). In the same way, Jaramillo *et al.* (42) report that 91.45 % of professors.

Presentation of content in the classroom. University professors usually make use of various technological equipment to present information or content from their courses during learning sessions. In the career of dentistry this action is essential, since most courses are theoretical-practical, and the theoretical contents require important audiovisual support so that they are more easily understood by students.

Most of the professors make use of technological equipment to present the contents in the learning sessions (computers, laptops, tablets, multimedia projector, etc.). These contents are mostly visual presentations (in PowerPoint®, Prezi®, etc.), and less frequently professors complement the sessions with videos (figure 4).

FIGURE 4
USE OF ICTs FOR PRESENTATION OF CONTENT IN THE CLASSROOM
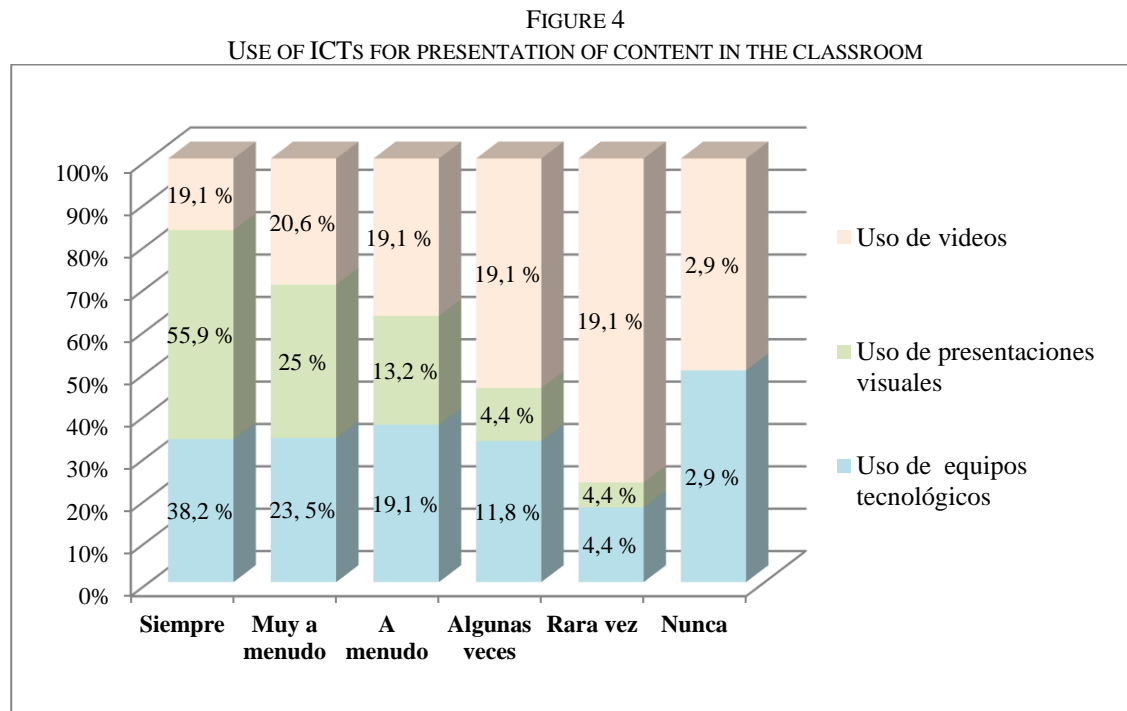
Regarding this finding, Jaramillo *et al.* (42) report that the majority of professors present information in the classroom in order to support their own teaching tasks. This presentation of information involves socializing content, exercises, guides, graphics or products through ICT and other visual aids such as the multimedia projector. In addition, it has been reported that professors encourage their students to present information to their peers in the classroom through the use of ICT. The most used tool to present information in the classroom is PowerPoint®, followed by other tools such as Excel® or Word®, in which they present exercises or examples (17,38,41).

Information search. Another important aspect to investigate was the search for scientific digital information through databases and academic repositories. It was found that it is increasingly common among professors to use ICT to access digital sources of information (figure 5).

FIGURE 5
USE OF ICTs FOR INFORMATION SEARCH
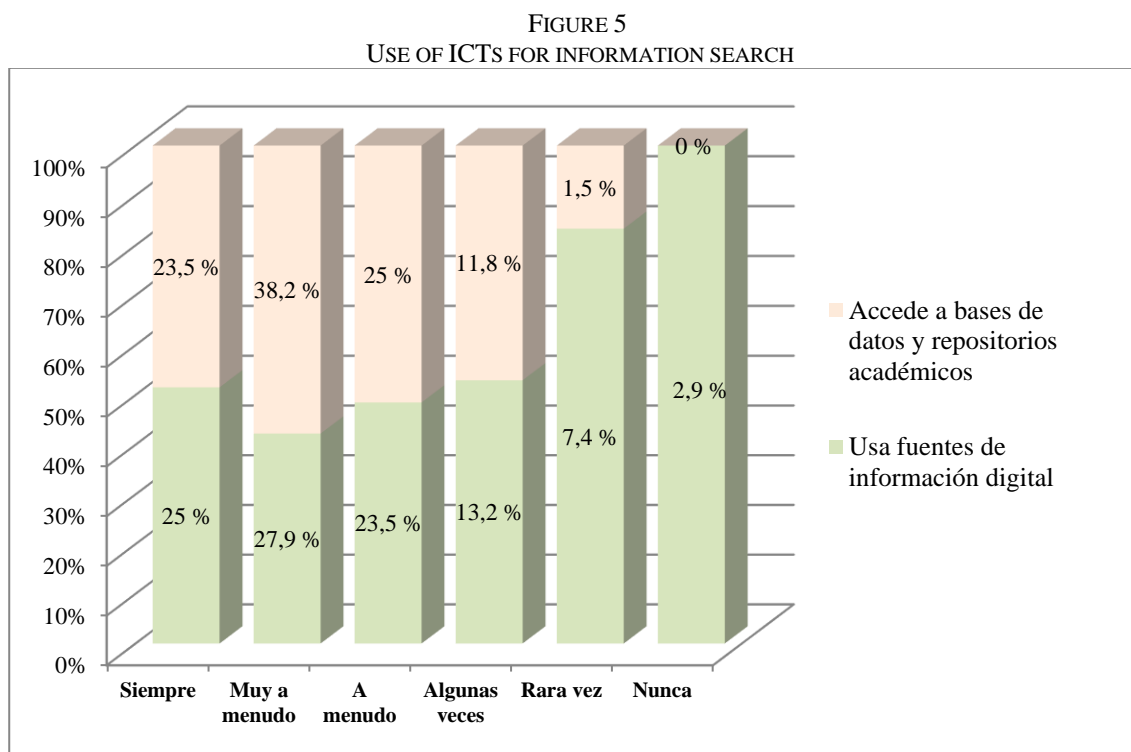
Orantes (35) indicates that professors are proficient in the use of international research networks in 37 % and that of virtual library databases in 32 %. In the study by Jaramillo *et al.* (42), 75.21 % of the professors surveyed search the Internet for material to support the study topics of their learning environments and 31.62% encourage their students to do so. The Internet is the most common source of information for professors and students.

Most of the professors interviewed know and use academic and scientific databases. They usually use search engines like Google Scholar® and PubMed®, or scientific bases like SciELO®,

Medline®, Cochrane® and LiLACS®. However, they do not use them constantly because in some cases they do not have time or do not know how to download the articles. Sometimes they do not have access to some databases with full contents such as EBSCO® and Hinari®, as they have a registration fee. On this point, a professor thinks the following:

> I generally search PubMed or browse to find the open access article. 97% of the searches are done in English. Professors do not make a correct search for information due to ignorance and it depends on wanting to do so.

One of the main objectives of the use of ICT in university teaching is undoubtedly to ensure that the student has greater autonomy in the learning process and in knowledge management, in the joint construction of knowledge and access to a great diversity of information sources (43). The rapid search for information on the internet has been one of the greatest benefits that technology has given to education and, therefore, it should be the most frequent use by both professors and students. Universities must then improve and repower virtual libraries, access to indexed journals and free access to wireless networks in order to allow the continuous search for relevant information for each educational context, from any digital device.

Communication with students. Regarding the use of ICT to communicate with students, the use of email was found to be more frequent compared to social networks (figure 6). These results are similar to studies such as that of Martínez *et al.* (40), in which it is observed that email is an extremely important communication tool between professors and students. In addition, a greater need to use faster and more effective means of communication such as social networks is beginning

to be observed, as is the case in the study by Evaristo *et al.* (17), who explain that in the academic field these tools are used over 69 %, with Facebook® being the most used social network.

FIGURE 6.
USE OF ICTS FOR COMMUNICATION WITH STUDENTS
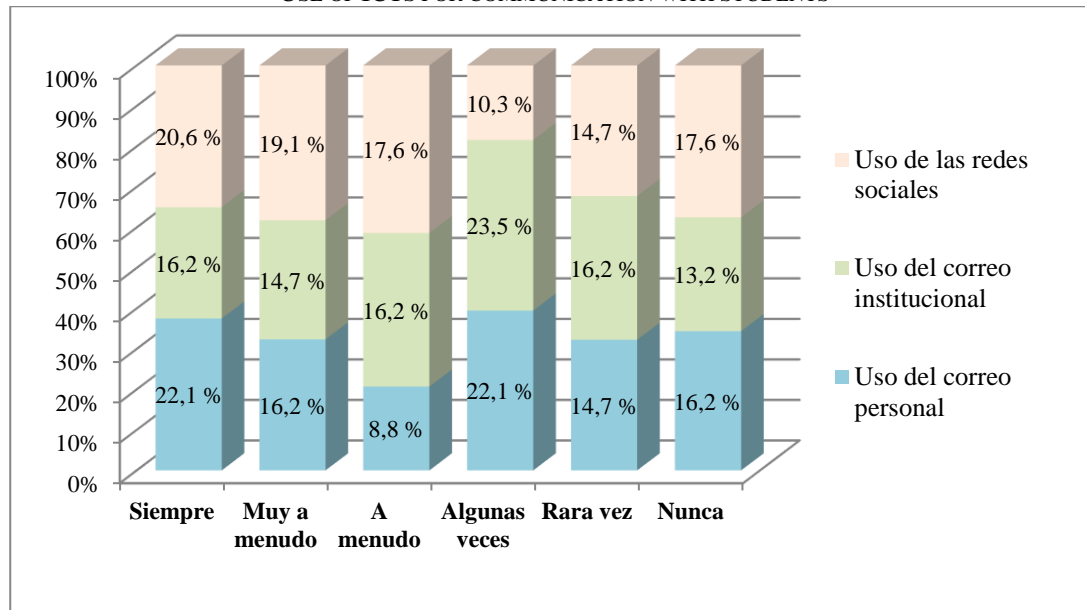
An interesting finding is that professors make use of personal rather than institutional mail to communicate with their students. The reasons given by the professors interviewed for using personal mail more is that they have constant access and can easily follow it through their cell phones, although they recognize that institutional mail should be better used so that there is official evidence of communications. In this regard, a professor thinks the following:

> I use personal email because it is an advantage, since I constantly check my email and receive alerts on my cell phone, I am aware of the messages that students send me.

Most of the professors interviewed indicated that they use social networks to communicate with

their students by creating closed groups for each course. The reasons for preferring social networks were the accessibility and speed of this means of communication, despite recognizing that in order to use them it is necessary to previously give instructions to students about the academic objectives of their use. The most used social networks were Facebook® and WhatsApp®. In this regard, a professor said the following:

> I usually communicate on WhatsApp because it is free for most students. It is an almost instantaneous communication and as soon as you publish it is already known that they have received it.

Social networks, in the context of web 2.0, can be very useful as a means of communication between professors and students, since their roots and fascination with students are an enormous didactic possibility. An example of this is that its use in Latin American universities is increasingly notorious and could be used to comment on assignments, send material, search for information or as an immediate communication resource.

CONCLUSIONS

In this study it was found that the majority of dental professors reached a basic level of knowledge in ICT, which implies a low development of technological and digital competences. In addition, a statistical relationship was found between the level of knowledge in ICT and age, observing that professors over 50 years of age reached the lowest levels of knowledge.

Regarding the use of ICTs in academic practice, most professors report using them more frequently than twice a week, without finding a statistical association between frequency of use, age and sex. There is also no statistical relationship between the level of ICT knowledge of professors and the frequency of its use. The most frequent academic uses of ICT were: course management, development of teaching materials, presentation of content in the classroom, information search and communication with students. In this way, it is clear that almost all professors use ICT with some frequency in their teaching practice, with which it can be inferred that they recognize the importance of these tools for improving educational quality and innovation, and that there is indeed a positive attitude towards its didactic use.

It is therefore necessary to promote professor training to improve teaching processes, the quality of learning and educational innovation. In this way, the university professor can become a guide that accompanies the student in their learning processes and knowledge construction, and in this framework, it is expected that they use ICT to develop methodological and pedagogical strategies appropriate to their environment.

RECOMMENDATIONS

It is recommended that universities and different faculties promote the integration of ICT through the improvement of management and planning processes, resources and infrastructure, the appropriation of technological resources by professors and students, and the creation of an institutional digital culture, as part of the pedagogical and academic innovation process. In addition, it is suggested to promote continuous training and the use of ICT by professors, through

the design of continuous training sessions in person or at a distance, considering the particular characteristics of the professors of each faculty. It is essential that the training of professors be both in digital tools and in pedagogical management, in such a way that comprehensive skills are developed that favor teaching performance at all levels.

Finally, it is advisable to carry out more studies on knowledge and uses of ICT both in professors and university students, applying the instrument that was created and validated in this study. In this way, it will be possible to evaluate the level of ICT knowledge of higher education actors and promote specific measures within the framework of continuous improvement and technological innovation of each particular situation.

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