Preparing teachers for medical education using ICT: Achievements and challenges of an educational intervention in a National University in Perú.

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SUMMARY

We evaluated an educational intervention using Information and Communication Technologies (ICT) to develop competences in the areas of 1. Pedagogy, 2. Communication, 3. Management and 4. Research, in 65 professors of the Faculty of Medicine of a Public University. Design: Quasi-experimental study according to the Research-Action methodology. Two intervention phases were carried out: Mixed training for teachers for 4 months and then the creation of functional virtual classrooms as a final product. The teaching competences, the quality of the virtual classrooms and the perception of the teachers about the limitations found were evaluated.

It was achieved that 72% and 78% of teachers became competent at an integrative level in Pedagogy and Communication. 85% and 68% were proficient in an explorer level in Management and Research. Even so, only 25% of teachers created and implemented functional virtual classrooms. Important limitations regarding technological conditions and university policies were explored. It is a need of the majority that said work be recognized to integrate them into their teaching activity.

Keywords: Teaching competences, ICT, medical school, application of knowledge, Integration of knowledge, medical education.

INTRODUCTION

Currently more and more universities and centers of studies recognize that ICTs are totally necessary [1, 2] since they affect many aspects of social, personal and work life [3]. Many try to modify the totality of their teaching systems to use them [4]. Despite this, and although that many benefits have already been shown from its use [1, 5], it is still recognized that its use in education still faces difficulties, distancing its current application from its real potentialities [6].

Because the economic aspect is no longer a great limitation, due to the emergence of free software which becomes increasingly operative and provides optimal options for generating learning networks [7], the main role on the application of ICT in education falls mainly on teachers [5].

According to UNESCO, the four competences that a teacher must develop in the management of ICT are[8]: 1.Pedagogical (Ability to use ICT for the planning, development and evaluation of the training action, that is, design learning environments, develop attractive training materials and conditions for an effective pedagogical practice.), 2.Communicative (Ability to express themselves, establish contact and interact in virtual spaces using various digital media, using multiple languages, synchronously and asynchronously), 3. Management (Use of ICT to plan, organize, manage and evaluate efficiently educational processes, at the level of pedagogical practices and institutional development) and 4. Research (which refers to the search for new methods and to select in a relevant, responsible and efficient way the technological tools understanding the principles that govern them, combinations and licenses that protect them). Each of these competences has different levels of achievement starting from the most basic level that is "explorer", then "integrator" and finally, "innovative".

The still persistent problem is that a significant number of teachers still maintain a reluctance to integrate ICT into their respective curricula. Although the causes of this can be diverse and not yet very clear [9], one of the main pillars is that teachers need to feel confident and comfortable using ICT, which requires acquiring skills of web tools in their daily practices [3]. However, acquiring these skills empirically is not enough, a theoretical-

conceptual understanding of teaching-learning processes and innovative models is necessary [4].

The Faculty of Medicine of the National University of San Marcos is the first medical school in Peru and since 2013 has begun to improve the computer infrastructure and the quality of equipment (PC, laptops). However, like most national universities in our country, it has certain limitations at the economic and logistical level, which has led virtual laboratories and classrooms to remain at a basic level [8]. To reverse this defect, the role of the teaching staff is fundamental [5, 6].

During 2014, blended trainings were given to 160 teachers of the Faculty of Medicine in the use of ICT in order to acquire communication, instruction and construction skills in virtual classrooms, achieving that only 12% of them start their work on-line with the free virtual platform "Moodle". It was noted then that the vast majority would require more training and our group assumed the institutional commitment to train those who were motivated. The objective of the present work was to evaluate an educational intervention for the development of teaching competences using ICT in the faculty of medicine of a Public University.

METHODOLOGY

Quasi-experimental study according to the Research-Action methodology [10, 11].
93 teachers from the Faculty of Medicine were summoned; of which, after the information process, only 65 teachers accepted to participate.

We began by conducting a virtual diagnostic survey in Google Forms about the current situation of use of ICT, perception of such use and knowledge of teaching skills. According to its results, the training was organized for the development of competences in 1.Communication (use of social networks, forums, institutional mail), in 2.Pedagogy (planning of the thematic units, didactic presentations, organization of the didactic unit, evaluation online, developing guides for use in practices), in 3. Management (use of processors and information registers, generation of new knowledge and recreation of information) and 4. Research (use of databases, virtual library and managers) of information).

The intervention consisted of two phases: First, a theoretical-practical training using virtual classrooms for the application, monitoring and qualitative-quantitative evaluation of the activities to develop skills according to UNESCO 2008 [12]. The evaluation classified the achievement of each competence in three levels. (Table 1)

Table 1: Competencies and levels evaluated during the intervention

Comp.	Level	Definition
Communication	Explorer	Use of email and participation in social networks
	Integrator	Participation in 4 asynchronous and 4 synchronic forums is added, with answers supported by bibliographic sources
	Innovative	The collaborative work in educational networks is added
Pedagogy	Explorer	Use of ICT for preparation of teaching material
	Integrator	Planning of learning sessions, structure of academic units designed with web 2.0 tools, application of knowledge through tasks.
	Innovative	It is added: tasks in electronic format and preparation of the repository of its didactic material, online evaluation.
Management	Explorer	Organization of your virtual classroom, registration system, evaluation and delivery of tasks
	Integrator	Coordination with the administration of the platform for the management of the course
	Innovative	Course design and course management are added as teacher and administrator
Research	Explorer	Search and selection of information
	Integrator	It is added: critical analysis of the information, use of information managers: Zotero version 4.0 and Mendelev
	Innovative	The participation in social networks with researchers is added to the previous ones

The fulfillment of all the programmed activities and the delivery of the products designed as evidence of performance were valued in percentages, the maximum performance was 100%. A competent level was considered from a score of 80%.

The second phase was that each trained teacher had to create fully functional virtual classrooms. The evaluation was through a checklist that included: ethics in the development of communication (respect for the authorship of information sources), pedagogy (planning of learning sessions, structure of thematic units, activities designed for participation face-to-face and virtual), communication (chats, forums, instructions for online evaluation) and the management of its virtual classrooms both in the administrative sphere and in the academic field, as well as the formative research based on the selection and management of the information.

RESULTS

All the teachers who agreed to participate completed the training program (n = 65). The majority were men (66%), doctors (55%), nutritionists, medical technologists, pharmacists, nurses and obstetricians. It is noteworthy that 21% of all trained teachers were over 61 years old, followed by 43% who was between 51 and 60 years, and finally those under 50 years were only 31%.

From the virtual diagnostic survey done in Google forms, it was found that the most developed areas of competence were pedagogical, so 75% of teachers said that they did use ICTs in their classes and almost half of them used one of the Moodle or Chamilo virtual classroom platforms. In the area of communication, the social network they used the most was Facebook and only 3% used their institutional mail (Table 2).

Based on these data, training was designed for the development of teacher competencies following the guidelines proposed by UNESCO.

Table 2- Situation of the use of ICT before the intervention

Areas of competence	Yes N°	Yes (%)	Do not N°	Do not (%)
Pedagogical				
Use of ICT in their classes	49	(75)	16	(25)
Use of virtual classrooms (Moodle, Chamilo)	30	(46)	35	(54)
Communication				
Use of the web in classes				
Virtual library	33	(51)	32	(49)
Institutional mail	02	(3)	63	(97)
Use of social network in classes (Facebook, Twitter)	30	(46)	33	(54)
Use of the social network with web 2.0 (Slideshare, Wikis and Scribd)	19	(29)	46	(71)
Managemen declared in the syllable	46	(71)	19	(29)
Investigation				
Uses Databases and Virtual library	33	(51)	32	(49)

Four training groups were formed with teachers from different health professions. The face-to-face workshops were organized and taught in a simulation laboratory in the Pharmacology unit. In addition, the following didactic materials were developed: **1.** Guide to use the main web 2.0 tools in ICT, for communication in the learning process. **2.** Three web 2.0 tool guides: "*Information managers", "Databases and scientific information"* and "*Develop your virtual classroom in Moodle version 2.54* ". **3.** Pedagogical videos of virtual classroom management distributed on a YouTube channel. **4.** Information bank in university pedagogy, academic management in virtual environments, innovation in education using ICTs, and evaluation by competences.

Figure 1: Training for the development of ICT competence

Once the educational program was completed, it was found that teachers acquired a high efficiency using ICT in Communication and Pedagogy competences, with the majority reaching the "Integrating" level. The "Explorer" level prevailed in Management and Research competencies. The "Innovative" level was evidently less achieved in all the evaluated competences (Fig.2).

Two months later, during the second phase of training. Only 16 teachers (25%), the majority of females (n = 14) completed the task of creating functional virtual classrooms and using them in their teaching activity.

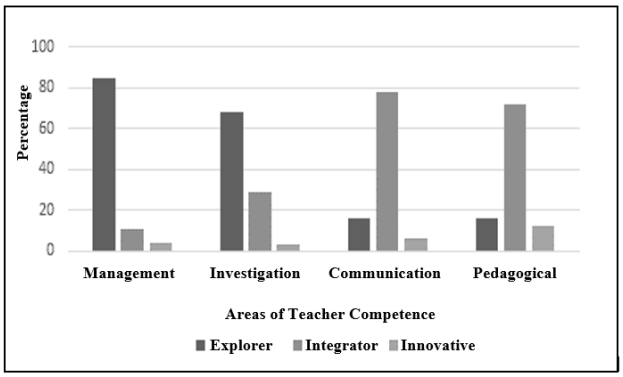

Figure 2: Proportion of teachers who achieved competences using ICT (n = 65)

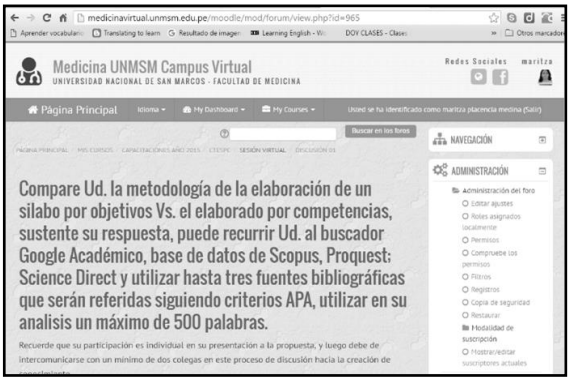

Figure 3: Example of functional virtual classroom created by teachers

At the end of the educational intervention, most of the participating teachers were satisfied with their skills towards the application of ICT in university teaching. However, we also find troubling limitations about the unavailability of audiovisual media in classrooms so that what was learned could not be applied, and the fact that the university does not consider the hours of work invested in the preparation of the virtual classroom (Table 3).

Table 3. Benefits and limitations on the use of ICT in teachers after the intervention

Main benefits	(%)
Satisfied with the application of ICT in university teaching	95
Achievement of teaching competences using ICT	63
Optimization of time and less use of stationery in the teaching activity	51
Main limitations	
Lack of audiovisual media in their classroom (Internet and computers)	68
Demotivation due to lack of recognition of academic / administrative hours by the university.	56
Problems in the network service	52

DISCUSSION

Since 2013, the Faculty of Medicine of the National University of San Marcos has made several structural computer reforms, enabling virtual courses using ICT in teaching-learning processes. This work follows these guidelines encouraged by the need and interest of the professors to improve their techno-pedagogical skills.

Initially, the participation of all the teachers of the Faculty of Medicine was sought. Thus, 93 teachers attended the pre-initial phases of this training. 28 (30%) were withdrawn early, and 65 (70%) were finally left. These teachers fulfilled all the phases of the study, noting some of their previous knowledge in Technological, Communication skills, and somewhat less in Management and Research. After the completion of the intervention, the significant improvement of some competences was achieved, although in other competences it was not so much. The causes of this are analyzed critically below.

The majority of participants (55%), were physicians with age ranges between: 51-70 years, arguing in this, that the success or not 11 , 13 , of the integration of ICT in teaching-learning processes, depends on the age because this population segment takes more time to learn, makes more mistakes and needs more help. As it has been reported by Suárez-Rodriguez, who found an association between a lesser mastery of technological competences and being older (≥ 46 years) [13].

However, other authors [14] argue that older adults are not reluctant to learn new technologies that are complicated or inaccessible and that, conversely, are able to learn new things while their memory, attention span and self-esteem remain healthy and viable, arguing that the new technologies will help them to organize their daily activities solving some of their needs, optimizing active aging. Another important factor, however, is that some stereotypes of older adults are still valid, and this is the reason why this segment of the population has had limited access to technological resources and has undergone inadequate virtual training [14, 15].

It is noted that certain results attributed to age, such as the initial dropout of participation and low performance in certain skills as seen in this study, should actually be studied from contextual points of view such as considering the limited innovative spirit of the environment, the existence of sub-optimal training, lack of academic recognition, resistance to change, among others.

Developing this intervention, we understand that in order to transcend this resistance to the new and unknown, one must be tolerant, give continuous support and have patience. Working with university teachers is a great challenge, especially due to the fact that they have to unlearn to learn new ways of teaching [16], to generate a transdisciplinarity between their specializations and computer science [17,18] and also to generate learning communities with collective work [19].

Regarding gender, there is some evidence that it influences the degree of use of ICT in educational environments, and that males often using it more [14,20]. However, in our study, those who completed the course and the second phase of creation and application of virtual classrooms were women (14 of 16 teachers).

It could be seen that before the intervention, although the majority of teachers said they used technological resources for communication purposes, less than 50% used them for pedagogical reasons. This in comparison with the students who use them familiarly in their homes, classrooms or anywhere [21, 22] , shows that the teacher must be continuously trained in order to minimize that technological gap, especially when the new applications of the so-called "web 3.0" (intelligent-semantic web, which uses databases, computer systems as intelligent assistants for teachers) are beginning to appear [23,24].

According to several studies [14,25], the acquisition of competences should begin by training teachers, not only in the technological and pedagogical aspects, but also in achieving self-confidence in the use of ICT in the classroom. In our study, participants already had some degree of technological competence, however their results at the end of the intervention were not as expected. The lack of self-confidence in the use of ICT is a barrier to the effective integration of these technologies in the classroom. It is still necessary to investigate more the real needs, personal and contextual factors of the teaching staff and the frequency of use of the computer at home, an important differentiating factor to predict who, because they possess greater technological mastery, would quickly reach ICT competences [15, 26, 27].

A group of teachers of the present study managed to reach a high level of pedagogical competences and communication at an integrative level. However, the maximum expected level, which was the innovative level, was only achieved by less than 5% of teachers. The causes probably fall on the time factor, because in addition to the intervention they had to participate in the different traditional academic activities.

After the educational intervention, great satisfaction was shown for having improved their teaching skills in the use of ICT, for less use of paper, optimization of time and acquisition of teaching-learning skills, highly desirable. However, they pointed out several contextual limitations to put it into practice: that a greater institutional commitment was necessary, recognition of this work in the academic load since it was a more difficult task than preparing a class in person and planning required more time. Also the needs of more infrastructure and network facilities.

The final findings found in our study are not particular or exclusive to our context; in several countries where there was an attempt to massify the use of ICT [26, 27], in teaching-learning processes, the result was the same or even lower: Insufficient use and scarce transforming potential of ICT in higher education and resistance to change. According to Kirkup and Kirkwood [28], advances in the use of ICT in higher education have been gradual, rather than revolutionary. An analysis carried out on previous studies of learning carried out during 10 years at Open University, UK [29] concluded that the current impact of ICT in teaching and learning is positive, as in our study.

All this forces us to rethink the results and the purpose of ICT as a subsystem of education in which there must be other factors that slow down its propagation. It is curious to note that other studies show that when most teachers adopt ICT, these had already been previously accepted by the directors of educational institutions [24, 25, 30]. Teachers of higher education are not usually resistant to ICT employment; what happens is that certain contextual factors (department culture, value practices, priorities) influence its use [31]. Although the impact of ICT in education has not been as extensive as in other areas, the difficulties that arise can be corrected, especially if, as in our case, the university authorities begin to take the first big step: to incorporate into the academic load the hours devoted to the design and implementation of teaching with ICT and integrate these technologies into the respective curricula.

Our goal is that students can access to the great benefits offered by ICT [19] with trained teachers to provide these tools in the interactive educational process. With the present intervention we learned that generating transdisciplinarity is a slow transit, which implies willingness, interest, freedom and above all the will of the actors to build it [18]. However, once the problem was recognized, it was comforting to be able to open up a group of

university educators with different educational visions and missions, but with only one objective: to improve university education by being proficient in the use of ICT, aiming to find new ways to develop spaces for open, reflective and self-critical dialogue[16] and also motivating academic authorities to be propellers of this massive use of ICT with transparency, democracy and above all with respect and truthfulness.

This research was the beginning of an educational proposal in teachers to strengthen the competencies in the use of ICT in the Faculty of Medicine of the National University of San Marcos, currently the use of ICT in undergraduate and postgraduate courses has already been opened. Getting more and more teachers to join this initiative is a challenge that becomes evident

CONCLUSIONS

Teachers of the Faculty of Medicine trained with ICT, managed to develop their skills, mainly, in pedagogy and communication which will facilitate them to improve their teaching activity.
Although in the post-intervention perception, ICTs were considered as important tools in the teaching-learning process of higher education, there were also important limitations related to the age of the teachers, persistent stigmas and the fact that the university does not consider the hours of work invested in the preparation of teaching methodologies with ICT.

RECOMMENDATIONS

1. It is necessary to continue with the continuous training so that these tools are used by the majority of teachers of the Faculty of Medicine.
2. Establish policies for the recognition of virtual education in academic and administrative teaching activities.
3. High-speed computer networks should be implemented in laboratories and classrooms throughout the Faculty of Medicine in order to ensure the use of virtual classrooms.

GRATEFULNESS

- To the authorities of the Faculty for the implementation of virtual simulation laboratories that facilitated this study.
-All the teachers participating in this investigation.
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