



Information and Communication Technology Literacy in Medical Studies in Fez Morocco

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How to cite this paper: Otmani, N., Qarmiche, N., Bourkhime, H., Omari, M., Chakri, I., Maiouak, M., El Harch, I., Maamar, S.B., Diagne, B.J., Bahra, N., Tachfouti, N. and El Fakir, S. (2022) Information and Communication Technology Literacy in Medical Studies in Fez Morocco. *Open Access Library Journal*, 9: e9061.

<https://doi.org/10.4236/oalib.1109061>

Received: June 29, 2022

Accepted: August 1, 2022

Published: August 4, 2022

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Abstract

Objective: Our objective is to evaluate the level of knowledge and competencies in the use of ICT tools and the need for training in medical staff in the faculty of medicine and pharmacy of Fez. **Methods:** We conducted a cross-sectional survey from May 2021, in the Faculty of Medicine and Pharmacy of Fez in various doctor's classes: professors, medical residents, interns, and students. The questionnaire was mainly organized into two sections about the level of 1) knowledge and competencies in the use of ICT tools and 2) the perception of importance and the need for training in these tools. Each section was made of 20 questions about the main ICT tools used in medical education Chi2 test was used to test associations between the competency of the use of ICT's tools and the participant's medical classes, the student's study level and gender of the participant. The statistical analysis was carried out by the data analysis SPSS V26. **Results:** The majority of participants had access to computers and to the internet. Most of the participants were familiar with the use of word processing, presentation software, mailing and file management. Nevertheless, most respondents reported low competency levels in database software, data management, programming and the creation of web pages. The need for training was different according to the participant's profile. **Conclusion:** Participants revealed that the use of ICT is a potentially important tool for their education and research. However, more integration of information literacy and ICT training in medical curricula is needed to enhance the better utilization of IT resources available for learning.

Subject Areas

Information Management, Information and Communication: Security, Privacy, and Trust, Information Retrieval

Keywords

Information and Communication Technology, Medical Studies, Literacy, Training

1. Introduction

Information and communication technologies (ICTs) allow greater diffusion of information, interactivity, and asynchronism and can promote individual as well as collective work [1] [2] and then provide a better quality of life [2] [3].

Nowadays, major aspects of human life are connected to the world of ICTs [4] [5]. That will continue to evolve and become more integrated into all facets of our professional and personal environment [6] [7]. Then it is important to follow this technological progress in all areas and incorporate it into teaching methods [8].

ICT can be a valuable tool to bring didactic and pedagogical added value [9] [10], and contribute to the development of innovative training activities [11]. ICT's role in education is becoming increasingly important [7], and it has become more evident than ever during the COVID 19 crisis [12]. It can provide better access to educational resources, improve the quality of learning, improve teacher's productivity [10], and enhances student's participation, collaboration, and communication which can improve their success rate [4]-[10], especially in medicine [4].

According to the recommendations of the International Medical Informatics Association (IMIA), it is necessary not only for IT specialists but also equally important for students of medicine, public health workers and clinicians, to become familiar with ICT educational tools used in their learning and/or practice environments [13]. In medical education, the need to update one's knowledge to meet professional requirements is an ongoing challenge [4] [5] [6]. ICT has enhanced teaching and learning for improving global health education, providing access to health training, promoting collaboration in global health research and building research capacity in low- and middle-income countries [2] [6] [14] [15]. It has also been proven to improve the quality of medical care [3] [6] [16]. Then, it became an integral part of preparing doctors to be sufficiently competent to use informatics resources effectively and efficiently for the best practice of medicine [4] [17].

In recent years, in most developed countries the application of ICT tools is increasingly becoming an absolutely vital component of the learning and teaching environment in many medical colleges [2]. Many governments have integrated them in national strategies [2] [7] [8] [14] [16] [18].

In developing countries, many experiences of implementing different ICT tools in education are reported [7] [16] [19]-[24]. Nevertheless, they still face many challenges in keeping up with recent digital methods and new research techniques, especially in the higher education sector [25] and more particularly in healthcare learning institutions [5]. However, many studies have noticed that medical students are becoming more comfortable with computers, due to the increasing use of this tool before arriving at the university [4] [17].

In Moroccan medical schools, the introduction of ICT into the curriculum is growing [26], as it is a part of the e-reform of undergraduate education currently ongoing [8]. It mainly concerned the implementation of e-learning platforms and access to MOOCs platforms [9]. However, Health services staff still need to develop basic ICT skills, and the current pedagogical systems need to benefit more from the implementation of advanced ICTs [8].

As the success of such reform depends on accessibility to the internet and the ICT 'competencies of the users [8], it is important to assess the knowledge acquired and attitudes that they have towards their use [4]. Therefore, a new evaluation of the ICTs use in medical schools presents the first step to optimizing the change.

Then, our objective is to evaluate the level of knowledge and competency in the use of ICT tools and the need for training in medical staff in the faculty of medicine and pharmacy and dental medicine of Fez, Morocco.

2. Methods

We conducted a cross-sectional study from May 2021 in the Faculty of Medicine and Pharmacy and dental medicine of Fez among various medical staff classes: professors, medical resident's interns, and students. The sample calculation was based on an overall prevalence of computer literacy, and the literature search of 80%, according to its epidemiology [2] [3] [6] [11] [16] [20]. An error rate (α) of 5% and 95% Confidence Interval (CI) were considered, resulting in a final sample consisting of 240 subjects.

To collect data, we used an anonymous questionnaire which was mainly organized into two sections about A) the level of knowledge and competency in the use of ICT tools and B) the perception of importance and the need for training in these tools. Each section was made of 20 questions about the main ICT tools used in medical education including the following items: 1) the general use of computers and the supports software such as Microsoft Office, 2) programming and creation of websites, 3) data management, 4) E-learning, and 5) scientific research. The questionnaire was sent electronically to the participants to be filled in.

Frequencies were used to characterize the respondent's competency in the use of the ICTs. The Chi2 test was used in univariate analysis to test associations between the competency of the use of ICT's tools and the participants' medical class, the student's study level and the gender of the participant. The statistical analysis was carried out by the data analysis software SPSS V26. The level of sta-

tistical significance for tests was set at 0.05.

3. Results

A total of 276 persons answered the questionnaire. About 52.5% of them are women, and 69% are students. Almost all participants had computers (95%) and access to the internet (98%). About one-quarter of participants had prior training in some ICT tools. 21% of those training were about literature research, and 88% were conducted by our faculty. More descriptive results are shown in **Table 1**.

Our study has shown that the mastery level of the ICT tools differs according to the tool concerned. It was generally high in word processing, presentation software, E-mail management and file management. It was also high in data management and videoconference. It was average for the LMS software, online interaction tools, spreadsheet and literature research in our study. The competency level was the worst for the medical data analysis, data management, and for programmatic and website creation.

The competency level was average for the LMS software, online interaction tools, spreadsheet and literature research in our study. A little less than one-third of participants had a great competency level in using the LMS. (**Table 2**)

Medical students in general and first-year medical students in particular ($p < 0.001$) felt more confident with the use of the learning management system platform. The professors, the “resident”, and the sixth-year medical students are less confident ($p < 0.001$). Also, students seem to master programming more than professors and “resident” ($p = 0.04$). In contrast, the professors, and the “residents” utilize bibliographic referencing software more than students ($p = 0.022$). The use of other ICT tools has no significant association with the participant’s profile or the level of study. (not shown in the table).

We also observed that the men are more confident and competent in using twelve of the twenty ICT tools questioned (p ranged between $p < 0.001$ (for “the file management”, “installation of new devices”, “installation of new software”, and “website creation”) and $p = 0.041$ (for “video montage”). The details of the results are shown in **Table 2**.

The second section was about the perception of the need for ICT tool training for each participant’ classes. **Figure 1** showed that, for the four participants’ medical classes, the most needed tools are literature research (perceived as very important to know by 100% of Professors to 66% of medical interns), presentation software (perceived as very important to know by 93% of Professors to 68% of students), word processing (perceived as very important to know by 86% of Professors to 67% of students), and file management (perceived as very important to know by 73% of Professors to 50% of medical residents). Professors were also very interested in spreadsheet software (86% of them), and statistical analysis software (80% of them).

When asked, “What is the most appropriate method for learning to use ICTs”, about three-quarters of participants suggested organizing workshops to improve the use of ICT in medical school. The classroom was the least recommended

Table 1. Description of sociodemographic characteristics and the computer and internet access.

		Percentage (%)
Sex (n = 276)	Woman	52.5
	Man	47.5
Profile (n = 275)	Professor	5.4
	Student	69.4
	Interne	5.4
	Medical resident	19.6
Study level (n = 191)	1st year student	34.5
	2nd year student	15.2
	3rd year student	13.1
	4th year student	12.0
	5th year student	12.0
	6th year student	13.1
Do you own a computer? (n = 276)	I have a desktop computer	1.4
	I have a laptop computer	93.8
	No	4.71
Frequency of internet access (n = 276)	Full-time	78.9
	From time to time	19.5
	Rarely	1.4
Internet access site (n = 276)	From your house	93.4
	Elsewhere	6.5
Have you ever received an ICT training (n = 108)	Yes	25.9
	No	74.1
If so, what was the form of training (n = 26)	Classroom	71.4
	Workshop	17.9
If so, what was the mode of training (n = 26)	Face-to-face	78.6
	Online	7.1
If so, where was the site of training (n = 26)	FMPDF*	88.5
	Elsewhere	11.5
Topic of the training (n = 26)	Google Apps	17.2
	Literature research	21.4
	E-learning & LMS	10.7

*: Faculty of medicine and pharmacy and dental medicine of Fez.

Table 2. Level of mastery of ICT tools by gender.

		Total	Sex		p-value
			Femme	Homme	
GENERAL USE OF COMPUTER AND SUPPORT SOFTWARE					
File management (n = 275)	Good	45.8	35.9	58.2	<0.001
	Moderate	41.8	47.7	34.4	
	Low	11.6	15.0	7.4	
	Do not know	0.7	1.30	0.0	
Email management (n = 108)	Good	40.7	44.4	35.6	0.67
	Moderate	43.5	41.3	46.7	
	Low	14.8	12.7	17.8	
	Do not know	0.9	1.6	0.00	
Connecting and installing new hardware (n = 275)	Good	34.2	18.3	54.1	<0.001
	Moderate	36	43.8	26.2	
	Low	23.3	28.8	16.4	
	Do not know	6.5	9.2	3.3	
Installing new software (n = 275)	Good	29.5	12.4	50.8	<0.001
	Moderate	33.5	35.3	31.1	
	Low	26.5	37.3	13	
	Do not know	10.5	15.0	4.90	
Word processing (n = 275)	Good	61.1	61.4	60.7	0.99
	Moderate	31.3	30.7	32.0	
	Low	5.8	5.9	5.7	
	Do not know	1.8	2.00	1.60	
Presentation software (n = 275)	Good	60.7	54.90	68.00	0.013
	Moderate	29.8	35.90	22.10	
	Low	8.4	9.20	7.40	
	Do not know	1.1	0.00	2.50	
Spreadsheet software (n = 274)	Good	20.1	17.10	23.80	0.18
	Moderate	33.2	31.60	35.20	
	Low	37.6	39.50	35.20	
	Do not know	9.1	11.80	5.70	
Picture processing (n = 107)	Good	10.3	45.50	54.50	0.013
	Moderate	29.9	21.00	42.20	
	Low	36.4	48.40	20.00	
	Do not know	23.4	22.60	24.40	
Video montage (n = 108)	Good	12	9.50	15.60	0.041
	Moderate	25.9	22.20	31.10	

Continued

	Low	31.5	27.00	37.80	
	Do not know	30.6	41.30	15.60	
SCIENTIFIC RESEARCH					
Literature research (n = 275)	Good	17.5	17.00	18.00	0.48
	Moderate	48.7	49.70	47.50	
	Low	23.6	25.50	21.30	
	Do not know	10.2	7.80	13.10	
Bibliographic referencing (n = 275)	Good	5.5	3.90	7.40	0.16
	Moderate	12	11.10	13.10	
	Low	26.2	22.90	30.30	
	Do not know	56.4	62.10	49.20	
PROGRAMMING AND CREATION OF WEBSITES					
Website creation (n = 274)	Good	4	0.70	8.20	<0.001
	Moderate	11.7	7.20	17.20	
	Low	26.6	30.30	22.10	
	Do not know	57.7	61.80	52.50	
Database software (n = 273)	Good	5.5	2.00	9.90	0.013
	Moderate	15	13.20	17.40	
	Low	31.1	35.50	25.60	
	Do not know	48.4	49.30	47.10	
Blog creation (n = 275)	Good	8.4	3.30	14.80	0.002
	Moderate	13.8	11.80	16.40	
	Low	28.4	28.80	27.90	
	Do not know	49.5	56.20	41.00	
Introduction to programming (n = 275)	Good	5.5	3.30	8.20	0.001
	Moderate	12.7	12.40	13.10	
	Low	28.4	20.90	37.70	
	Do not know	53.5	63.40	41.00	
DATA MANAGEMENT & DATA ANALYSIS					
Statistical analysis (n = 108)	Good	2.8	1.60	4.40	0.59
	Moderate	12	9.50	15.60	
	Low	17.6	17.50	17.80	
	Do not know	67.6	71.40	62.20	
Data management (n = 275)	Good	6.9	3.90	10.70	0.1
	Moderate	20	18.30	22.10	
	Low	37.8	39.20	36.10	
	Do not know	35.3	38.60	31.10	

Continued

E-LEARNING					
LMS (n = 275)	Good	20.4	14.40	27.90	0.038
	Moderate	36	38.60	32.80	
	Low	25.1	25.50	24.60	
	Do not know	18.5	21.60	14.80	
Videoconference (n = 107)	Good	30.8	33.90	26.70	0.75
	Moderate	40.2	38.70	42.20	
	Low	24.3	24.20	24.40	
	Do not know	4.7	3.20	6.70	
Online interaction tools (n = 274)	Good	27.7	19.70	37.70	0.003
	Moderate	32.1	31.60	32.80	
	Low	28.1	34.20	20.50	
	Do not know	12	14.50	9.00	

method (28% of participants). More study methods are shown in **Figure 2**.

4. Discussion

Our study has shown that the majority of participants had their own computers and had access to the internet. This finding has been demonstrated by other studies [2] [3] [8] [9] [11] [16] [24] [27] [28] [29].

The level of mastery of ICT tools was very heterogeneous and varied between 61% of persons that had a good level of competency in word processing and 67% of participants who did not have any knowledge of statistical analysis.

Studies in developed countries such as China [2] and Australia [30], indicated that the level of computer literacy was high. That can be argued that the current students are “digital natives”. However, ICT was less used in education than ever else [29]. In developing countries [6] [11] [16] [20], the frequency of computer skills generally exceeds 50%. This frequency was lesser in poor areas than in poor African countries [31] [32]. The use of ICT among medical students is still low [6]-[16]. The curricula for ICT use in health research fields remain considerably insufficient in developing countries compared to developed countries. This difference in perception of ICT literacy can also be explained by the lack of a common definition of a good level, and by the variety of ICT tools that can be included in medical studies [2]-[16].

The mastery level of the ICT tools differs according to the tool concerned. In our context, the competency level was high in word processing, presentation software, Email management and file management, as they are used in daily activities. It was also high in data management and videoconference.

According to the literature, the mastered ICT skills was mostly the emails management [6] [16] [20] [26] [29] [33] [34], text messaging [3] [11] [24] [29]

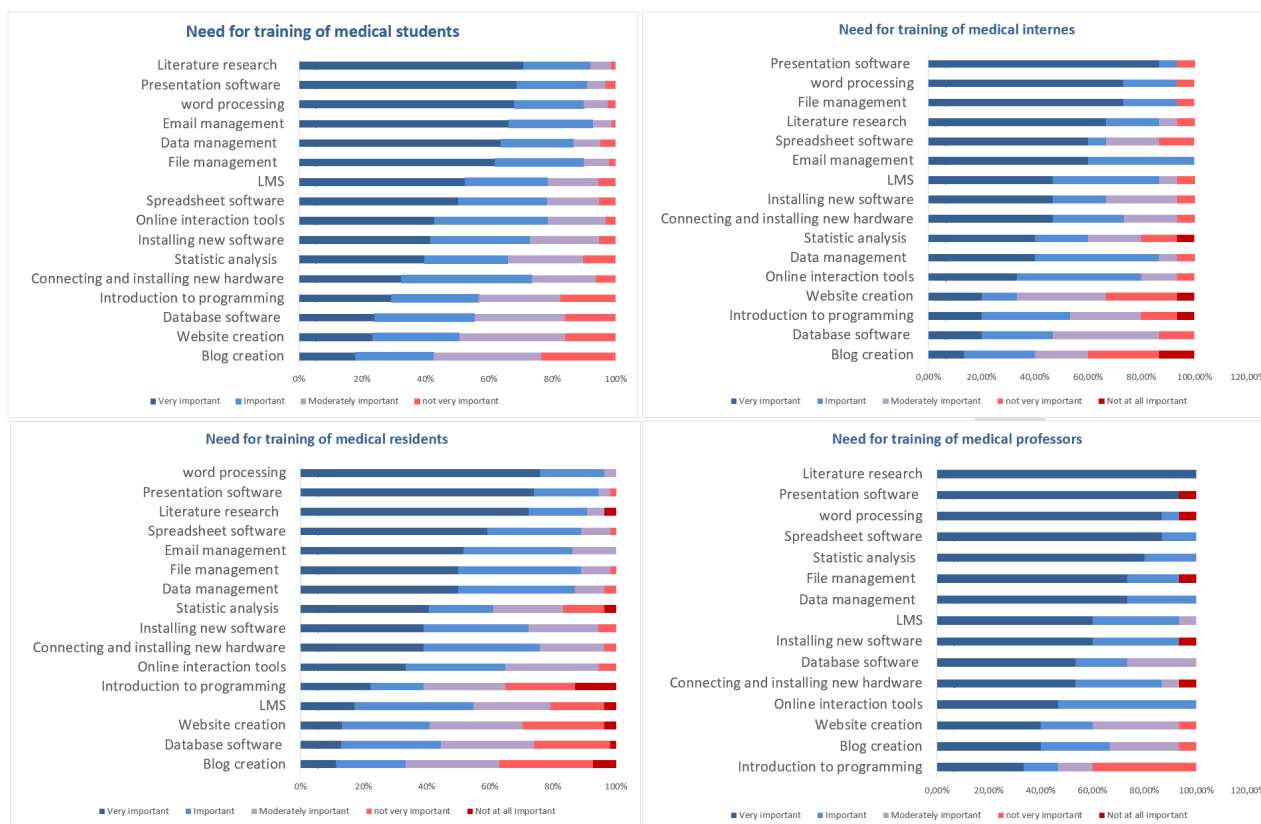


Figure 1. The need for training of ICT tools by profile.

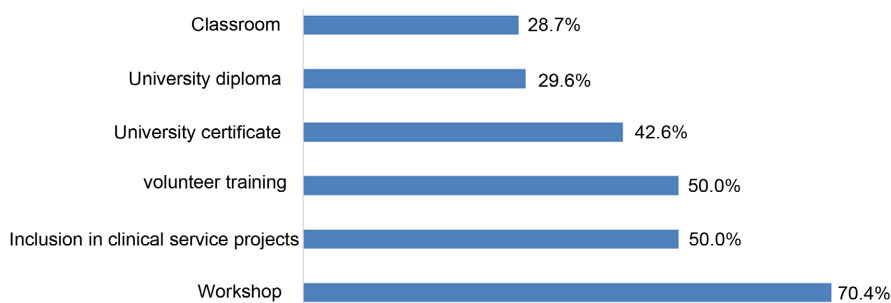


Figure 2. The suggestion of the most appropriate method for learning to use ICT.

[35], word processing [6] [16] [20] [26] [29] [36], presenting software [20] [26] [29]. Also, studies that investigated the use of ICTs were mainly focused on the literature and data search [3] [6] [11] [16] [20] [24] [26] [28] [29] [33] [36]. They demonstrated, as in our study, that less than half of the participants considered that their bibliographic research competency is good [9] [11] [17] [20] [34] [36]. However, in some studies [2] [6], smaller proportions of students reported adequate skills in the usage of the internet. In contrast, in Uganda, 94% of the health sciences students reported using ICT for research and training purposes [2]. This result is consistent with those of previous studies [3] [16] [26] [28] [29]. Searching in medical journals is a useful method of learning and research. However, some skills are needed for physicians today to gather medical

information from specialized electronic databases and for their quality assessment [4] [6] [8] [20] [28] [29].

Our study and others [28] [33] described the competency in file management as good. As well, the data management [20] and data analysis software [2] [14] [15] were among the main ICT tools used in education. However, in our study, these skills were among the least mastered tools.

The competency level was average for the LMS software, online interaction tools, spreadsheet and literature research in our study. A little less than one-third of participants had a great competency level in using the LMS. This proportion was higher in other studies [16] [20] [29]. The spreadsheet [6] [16] was less mastered in the literature [16]. The database software [16], and the website design [6] [16] [22] were the least mastered ICT in the literature as well as in our study.

On the other hand, in several studies, men seem to be more confident and competent in using ICT tools, and have a higher attitude toward learning ICT based skills [4] [8] [10] [20] [37]. However, Iran's study [24] found no statistically significant difference between men and women in computer and internet use. □

In our study, we also noticed that students in the first year of medical studies, and students in general were more confident with the use of the learning management system platform. That can be explained by the fact that young people are more interested in different computer tools independently of their medical studies. On the other hand, professors and medical residents are more competent in bibliographic referencing since they do more scientific research.

About one-quarter of our medical staff and about one-third of Arabic students in many studies [11] [20] had prior training in ICT skills. These courses were organized by their university or elsewhere. The major subject of these courses was the use of the Internet to search medical literature as an additional source for education and the evaluation of medical information [4]. However, in other experiences, [2] almost all students have not had any training in ICT.

Despite the multiplicity of ICT tools, and in agreement with the results of our study as well as other studies [2] [4] [8] [14] [26] [27] [29] [34] [36], participants indicated that ICT was a potentially important tool for their education and research, as it helps working faster and make learning creative [3] [29]. They also state that ICT skills training should be a part of the medical curriculum and that it should be integrated into medical studies [2].

When participants in our study and in other studies were asked about the most important ICT topics to be included in the curriculum, they raised that the most useful ICT tools are how to search resources [2] [26], word processing [26], presentation software [26], email management [26], the knowledge of databases [2], the data management, [2] [6], and performing personal computer hygiene [2]. Some of them were also interested in spreadsheet software, statistical analysis software, and online interaction tools [26]. However, some students [16] [29], stated that they did not need ICT programs during medical training. This could

indicate that some students were not knowledgeable about the potential of computer- and Web-based programs.

On the other hand, existing research has proven a positive relationship between the active and positive role of teachers and the successful implementation of ICT in the classrooms [10]. However, the lack of continuous training is cited by many studies as one of the major barriers to integrating ICT in the classroom [7] [8] [10] [12].

Our study has some limitations. First, we tried to explore many faces of ICT tool utilization, so every tool was explored just superficially. Then other studies must be conducted in the future to study each subject in detail. On the other hand, this work did not include the clinical use of ICT so as not to burden the questionnaire. This side of the question must be the subject of another study. Nevertheless, the findings of the current study should provide researchers with some initial insights that could be incorporated within the framework of any future ICT training programs.

5. Recommendations & Conclusion

According to our results and to the literature, the improvement of ICT use in education must first be a decision of the relevant authorities to set up ICT training programs for the medical profession. It is probably important to deeply review curricula so that it is not simply an optional additional resource added to conventional transmissive teaching devices but rather tools used throughout medical teaching and practice in an integrated and continuous character of medical education. Nevertheless, the benefits of Information Technology depend on the way they are being used. Then, all teachers and students need both to be integrated into such a training program and to develop sufficient flexibility to acquire ICT skills, which can assure the long-term success of the improvement strategy.

Also, as the term ICT is vaguely used across studies, future studies should clearly define the scopes of activities that are covered to describe ICT, and to identify the specific ICT tools that have more effectiveness over others.

Acknowledgements

The authors thank all the participants, students, medical internet, medical residents, and professors in the faculty of Medicine and Pharmacy and Dental medicine in Fez Morocco for their participation in the study.

Conflicts of Interest

The authors declare no conflicts of interest.

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