

Proficiency in Information Communication Technology and its Use: A Survey among Clinical Students in a Ghanaian Medical School

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ABSTRACT

Insufficient prior knowledge about the array of skills possessed by medical students in information communication technology account for failed efforts at incorporating ICT into their academic work. The aim of this study is to assess information communication and technology skills and its use among clinical students undergoing medical training in northern Ghana. A longitudinal questionnaire was administered to 175 clinical year (1st, 2nd, and 3rd year) medical students aged between 22 and 29 years (mean \pm standard deviation; 25.0 \pm 1.26 years). Out of the total 175 questionnaires administered 140 (82.0%) students returned their questionnaires. Questionnaires from 5 students were incomplete leaving 135 complete and analyzable questionnaires, resulting in a 77.0% responses rate. Of the remaining 135 students, 55.6% of the respondents were proficient in the use of ICT related tools, 37.8% were using ICT resources for their academic work, and 85.2% were using such resources for social purposes, while use of ICT for academic work by gender was: 88.2% for males, and 11.8% for females. By gender 49.0% males and 52.2% females were using ICT for social purposes. The study revealed high and low levels of proficiency in ICT depending upon the ICT task to be performed, and concluded that a good curriculum designed to encourage ICT use by students as well as develop in them a multiplicity of skills, coupled with a teaching methodology that is student centred and encourages student engagement in active cognitive activities involving the use of ICTs may help stem this skewedness in proficiency.

General Terms

Computer Assisted Instruction, Medical Education

Keywords

Information Communication Technology Proficiency, Medical Students, Education, Northern Ghana

1. INTRODUCTION

The recent incursion of information and communication technologies into healthcare in the last 25 years has changed the ways in which medicine is practiced and taught [1]. One reason for this phenomenon is the increasing processing power and storage capacity of computers, together with falling world prices of computers that has made them widely

2. METHODS AND MATERIALS

This is a longitudinal questionnaire study involving clinical year (1st, 2nd, and 3rd year) medical students, designed to investigate their ICT skill levels, and use of ICT in their

available among large and growing segments of populations worldwide [2]. Added to this is the ease of accessing information through the interconnected platform provided by the internet that is empowering patients, and changing the dynamics of the patient – doctor relationship, these changes have heralded entirely new and unprecedented changes in the quality of healthcare, indeed for some of the changes we are only beginning to fathom their impact [2]. One other reason is the doubling in the size of the worldwide web (WWW) that occurred during the first six months of 2000, which led experts to project that by 2005 the number of internet users would have passed the one billion mark [3]. Use of information communication technology (ICT) has gained prominence in education, particularly for medical education in the developed world [4]. At a conceptual level ICT, enables the design, development, transfer, delivery and storage of information, and facilitates communication in the context of the instructional process [5]. Strong evidence exists to suggest that the presentation of graphical information (static graphics or animation) is superior to textual information; studies by [6] and [7] suggest that graphical representation (Such as the heart pump) result in better retention and transfer of the processed information. A study on the use of simulation software [8] with a computerized life-sized manikin- for surgery lessons with students during their clerkships concluded that the simulation software significantly improved skills. Another study on the delivery of a postgraduate course through the internet in a distance education program reported mixed findings, results from the study indicated high satisfaction levels on one hand and also revealed critical issues such as dropout and low participation levels on the other [9]. The study further revealed that the computer skill of the potential student was critical to the success or otherwise of the program. It is worthy of note that all the studies reviewed above were carried out in the developed world. In Ghana, like most developing countries ICT is not well integrated into medical education. Research shows that medical students in Ghana have high interest in the use of ICT for their studies and research [10]. However it is not clear if they have the proficiency needed to use these ICT resources. The purpose of this study was to assess ICT proficiency and the nature of its usage among clinical students in the School of Medicine and Health Sciences of the University for Development Studies, Tamale.

academic and social life. Completion of the questionnaire was taken as consent to participate in the study.

2.1 Setting and Participants

Participants in the study were full-time students of the School of Medicine and Health Sciences, University for Development

Studies, Tamale, Ghana. Questionnaires were administered to a total of 175 students. The students were informed of the Purpose of the study, the requirement to complete a questionnaire, and the general content of the questionnaire. They were also told that their participation in the study was voluntary and that no personal identifiable information was going to be taken. The University for Development studies, Tamale is located in the north of Ghana and is one of the third generations of tertiary Universities to be established in the country. At the moment, the medical school has no public access to computers for medical students, it however provides broadband internet access for staff and students, and computers are not available in the library for students to use. All students at the medical school take a mandatory course in basic ICT skills (introduction to computers, and the internet, windows, Microsoft application programs) at the beginning of their University studies.

2.1 Survey Instrument

The students were asked the following questions: frequency of computer use, ability to perform certain task with computers, training in computers and how sophisticated they taught they were in the use of computers. A drafted version of the questionnaire was administered to students (n=50) in April, 2011. Internal reliability (Cronbach's alpha) obtained from combining items with ordinal responses was 0.80 (95% CI) for intra class correlation coefficient; 0.79 to 0.88. The questionnaires were administered to the students who consented to participate in the study.

2.2 Data Analysis

Statistical analysis was performed using STATA (version 11.0, StataCorp. 2009). In order to identify medical students' utilization of ICT and their ICT skills, an analysis of frequencies of items derived from responses to questions related to 'Internet utilization', 'commonly performed ICT led tasks' and ICT skills was undertaken. Categorical variables were analyzed using chi-square.

3. RESULTS

Out of the total of 175 questionnaires administered, 140 (80.0%) students returned their questionnaires. The questionnaires from 5 students were incomplete, leaving 135 complete questionnaires indicating a (77%) response rate. The age range for the responding students was 22 to 29 with a distribution of 25.0 ± 1.26 years. (Mean \pm standard deviation). Majority of the students who responded were male (53.3%), and used a computer daily (90.0%). About half of them were in their first year of clinical training. Respondents received the

following training in computers: formal course in computer science (23.7%), training as part of the curriculum at the Medical School (21.5%), Medical School sponsored training (3.7%), attended a workshop on computers (11.1%), while 81.5% were self-taught computer users. The self-rated ICT

Table 1 - Participant Characteristics (n=135) and Demographics

Variables	n (%)
Age	25.0 \pm 1.3
Gender	
Male	72(53.33)
Female	63(46.67)
Year of Clinical Training	
First year	55(40.7%)
Second year	53(39.3%)
Third year	27(20.0%)
Frequency of computer usage	
Never	3(2.2%)
Rarely	2(2.2%)
Weekly	8(5.9%)
Daily	122(90.4%)
Ever attend computer training	
Having formal com. Sci. training	33(24.4%)
Comp. training as part of curriculum	29(21.5%)
Med. Sch. Sponsored training in comp.	5(3.7%)
Workshop on comp. training	15(11.1%)
Self-guided learner	110(81.5%)
None	5(3.7%)
How Sophisticated a Computer user are you	
Very Sophisticated	8(5.9%)
Sophisticated	33(24.4%)
Neither Sophisticated nor unsophisticated	53(39.3%)
Unsophisticated	30(22.2%)
Very unsophisticated	11(8.1%)

Competency of respondents was as follows: Very sophisticated (5.9%), sophisticated (24.4%), neither sophisticated nor unsophisticated (39.3%), unsophisticated (22.2%), and, very unsophisticated (8.1%), (as shown in Table 1)

ICT proficiency among respondents was 55.6% with almost two thirds of respondents (93.3 %) knowing how to: log into a mail system application program, send messages, read messages, delete messages, print messages, save messages into appropriate folders, create folders or mailboxes, change passwords, attach files for shipment, and read or save attachments more than they wanted to already. A substantial number of respondents (58.5%) said they would like to learn how to: use online help, create personal mail groups, create or use a signature, customize button bars, and create user rules. Respondents were less proficient in the use of search engine application programs. More than half of respondents (66.7%) would like to learn how to; log into the Medline computer; select a bibliographic database, select a search type; review

search results on the screen; print search results on a disk and disconnect from the system (Table 2). a great number of respondents (96.3%) knew how to create a new document, open and existing document, save a document, and print a document using a word processing application program like Microsoft Word, 26.0% were also proficient in other word processing application skills such as: creating headers or footers, using the thesaurus, creating a table, using hanging indent, creating user-defined tabs, and save files in different formats. The operating system skills of respondents were also assessed, 43.0% knew how to, create directories/folders, access files on a shared network, while 57.0% wanted to learn more about this skill As shown in table 2

Table 2 - Participants (n =135) ICT skills

	I know more than, I want	I'd like to learn more
Basic Email skills	126(93.3%)	9(6.7%)
Advanced Email skills (use online help; create personal mail groups, create or use a signature; customize button bars, and create user rules.)	56(41.5%)	79(58.5%)
Search Engine skills (log into the Medline computer; select a bibliographic database, select a search type etc.)	45(33.3%)	90(66.7%)
Basic word processing skills (create a new document, open and existing document, save a document, print a document)	130(96.3%)	5(3.7%)
Advanced word processing skills (use headers or footers, using the thesaurus etc.)	35(26.0%)	100(74.0%)
Operating system skills (create directories/folders, access files on a shared network etc.)	58(43.0%)	77(57.0%)

3.1 Use of ICT for Academic Work

Further categorization of respondents into two distinct yet homogeneous groups based on use of ICT for academic purposes (Table 3) revealed that the first category of students (37.8%) who used ICT for academic work comprised of: males (88.2%), 39.2% first and 33.3% third year students, weekly computer users (11.8%), students who have had the following training in computers: formal course in computer science (41.2%), course unit in computers from the Medical

School (37.3%), workshop on computer training (19.6%), and those who rated their ICT competence as either sophisticated (33.3%), or very sophisticated (15.7%). While those who made little or no use of ICT for academic activities consisted of: second year clinical students (46.4%), daily computer users (95.2%), students who rated their ICT competence as either unsophisticated (28.6%), or much unsophisticated (15.5%) as shown in table 3.

Table 3 - stratification of participants characteristics by incorporation of ICT into academic work

Variables	ICT incorporation into academic activities			P value
	Total(n=135)	Yes(n=51)	No(n=84)	
Age	25.0 ± 1.3	25.1 ± 1.3	24.9 ± 1.3	0.2874
Gender				
Male	72(53.3%)	45(88.2%)	27(32.1%)	0.0001
Female	63(46.7%)	6(11.8%)	57(68.0%)	0.0001
Year of Clinical Training				
First year	55(40.7%)	20(39.2%)	35(41.7%)	0.0466
Second year	53(39.3%)	14(27.5%)	39(46.4%)	0.0032
Third year	27(20.0%)	17(33.3%)	10(12.0%)	0.0025
Frequency of computer usage				
Never	2(1.5%)	2(3.9%)	0(0.0%)	0.0675
Rarely	3(2.2%)	1(2.0%)	2(2.4%)	0.2966
Weekly	8(5.9%)	6(11.8%)	2(2.4%)	0.0252
Daily	122(90.4%)	42(82.4%)	80(95.2%)	0.0139
Ever attend computer training				
Having formal com. Sci. training	33(24.4%)	21(41.2%)	12(14.3%)	0.0004
Comp. training as part of curriculum	30(22.2%)	19(37.3%)	11(13.1%)	0.0011
Med. Sch. Sponsored training in comp.	5(3.7%)	1(2.0%)	4(4.8%)	0.4034
Workshop on comp. training	15(11.1%)	10(19.6%)	5(6.0%)	0.0144
Self-guided learner	110(81.5%)	46(80.4%)	63(82.1%)	0.0299
None	5(3.7%)	3(5.9%)	2(2.4%)	0.2963

How Sophisticated a Computer user are you				
Very Sophisticated	8(5.9%)	8(15.7%)	0(0.0%)	0.0002
Sophisticated	31(23.0%)	17(33.3%)	14(16.7%)	0.0404
Neither Sophisticated nor unsophisticated	53(39.3%)	20(39.2%)	33(39.3%)	0.9936
Unsophisticated	30(22.2%)	6(11.8%)	24(28.6%)	0.0228
Very unsophisticated	13(9.6%)	0(0.0%)	13(15.5%)	0.0031

From table 4, stratification of respondents by gender revealed the following: Females used a computer daily (98.4%), reported taking a Medical School course on computers (31.7%), and rated their ICT competence as very sophisticated (11.1%) than did males and the differences were significant.

On the contrary a significant number of males reported attending a workshop on computer training (16.7%), used computers weekly (9.7%), received formal computer science training (34.7%), rated their ICT competence as sophisticated (32.0%), than did females.

Table 4 – Participant (n=135) characteristics stratified by gender

Variables	Total(n=135)	Female (n=63)	Male (n=72)	P value
Age	25.0 ± 1.3	25.1 ± 1.3	24.9 ± 1.3	0.2874
Year of Clinical Training				
First year	55(40.7%)	26(41.3%)	29(40.3%)	0.9068
Second year	53(39.3%)	24(38.1%)	29(40.3%)	0.7956
Third year	27(20.0%)	13(20.6%)	14(19.4%)	0.863
Frequency of computer usage				
Never	2(1.5%)	0(0.0%)	2(1.4%)	0.1826
Rarely	3(2.2%)	0(0.0%)	3(2.8%)	0.1013
Weekly	8(5.9%)	1(1.6%)	7(9.7%)	0.0458
Daily	122(90.4%)	62(98.4%)	60(83.3%)	0.0030
Ever attend computer training				
Having formal com. Sci. training	33(24.4%)	8(12.7%)	25(34.7%)	0.0030
Comp. training as part of curriculum	30(22.2%)	20(31.7%)	10(14.0%)	0.0128
Med. Sch. Sponsored training in comp.	5(3.7%)	4(6.3%)	1(1.4%)	0.1279
Workshop on comp. training	15(11.1%)	3(4.8%)	12(16.7%)	0.0281
Self-guided learner	110(81.5%)	45(71.4%)	65(90.3%)	0.0049
None	5(3.7%)	3(4.8%)	2(2.8%)	0.5425
How Sophisticated a Computer user are you				
Very Sophisticated	8(5.9%)	7(11.1%)	1(1.3%)	0.0170
Sophisticated	33(24.4%)	10(16.0%)	23(32.0%)	0.0302
Neither Sophisticated nor unsophisticated	53(39.3%)	27(43.0%)	26(36.1%)	0.6545
Unsophisticated	30(22.2%)	15(23.8%)	15(20.8%)	0.6782
Very unsophisticated	11(8.1%)	4(6.3%)	7(9.7%)	0.4748

3.2 Use of ICT for Social Purposes (communicating with colleagues)

Respondents (85.2 %) using ICT to communicate with colleagues (Table 5) were more likely to be: females (52.2%), first (46.1%) and second (43.5%) year students, doing this on a daily basis (95.7%), students who have taken a Medical School course unit in computers (26.1%), unsophisticated computer users (26.1%). While those who made less or no use of ICT for communicating with colleagues included the

following: males (85.0%), third year students (75.0%), students who used computers either rarely (15.0%) or weekly (20.0%), self-taught (95.0%), and very sophisticated (35.0%) computer users.

Table 5 - Use ICT to communicate with colleagues (n=135)

Variable	Total (n=135)	No (n=20)	Yes (n=115)	P value
Age	24.9 ± 1.3	24.9 ± 1.3	24.9 ± 1.3	0.2874
Gender				
Male	72(53.3%)	17(85.0%)	55(49.0%)	0.0021
Female	63(46.7%)	3(15.0%)	60(52.2%)	0.0021
Year of Clinical Training				
First year	55(40.7%)	2(10.0%)	53(46.1%)	0.0024
Second year	53(39.3%)	3(15.0%)	50(43.5%)	0.0161
Third year	27(20.0%)	15(75.0%)	12(10.4%)	0.0001
Frequency of computer usage				
Never	2(1.5%)	1(5.0%)	1(1.0%)	0.1582
Rarely	3(2.2%)	3(15.0%)	0(0.0%)	0.0001
Weekly	8(5.9%)	4(20.0%)	4(3.5%)	0.0039
Daily	122(90.4%)	12(60.0%)	110(95.7%)	0.0001
Ever attend computer training				
Having formal com. Sci. training	33(24.4%)	4(20.0%)	29(25.2%)	0.7513
Comp. training as part of curriculum	30(22.2%)	0(0.0%)	30(26.1%)	0.0096
Med. Sch. Sponsored training in comp.	5(3.7%)	0(0.0%)	5(4.3%)	0.342
Workshop on comp. training	15(11.1%)	1(5.0%)	14(12.2%)	0.3461
Self-guided learner	110(81.5%)	19(95.0%)	91(79.1%)	0.0205
None	5(3.7%)	0(0.0%)	5(4.3%)	0.342
How Sophisticated a Computer user are you				
Very Sophisticated	10(7.4%)	7(35.0%)	3(2.6%)	0.0001
Sophisticated	31(23.0%)	2(10.0%)	29(25.2%)	0.1353
Neither Sophisticated nor unsophisticated	53(39.3%)	9(45.0%)	44(38.3%)	0.5689
Unsophisticated	30(22.2%)	0(0.0%)	30(26.1%)	0.0096
Very unsophisticated	11(8.1%)	2(10.0%)	9(7.8%)	0.7429

4. DISCUSSION

Increasing access to and availability of information and communication technology tools have encouraged their use for teaching and learning at many universities around the world, especially in developed countries. The availability of technology is however only a necessary condition for its meaningful use and not a sufficient one. It is important that medical students not only have access to ICT resources on their campuses, but also have the skill to use them in various aspects of their training. The inability to use readily available ICT resources due to deficiencies in skills has been cited as one of the reasons for the digital divide (Fink C, unpublished paper)

Several studies have reported varying degrees of proficiency in the use of ICT's by medical students, depending upon methodology, target group, sample size, access to ICT resources and the type of ICT- related task to be performed. The observed proportion of 55.6% proficiency in the use of ICT from this study mirrors other findings in other African countries with similar sociocultural characteristics and levels of development. It is in agreement with 55.7% reported among clinical students in Nigeria [11], higher than two other studies [12] and [13] also from Nigeria and one other study

[14] from Tanzania, but however lower than the 72.0% obtained among osteopathic medical students in the USA (Forman et al., 2004) and 89.9% obtained among undergraduate medical students in another Ghanaian Medical School [10].

These variations may be due to differences in methodology, sample size, access to ICT resources, and the target group of medical students studied. Recent advancements in computer technology may also account for the observed variations; as a consequence of which, trivial computer task that hitherto did not require dexterity in skill, may now require advanced knowledge and skill to perform [15]. Thus analysing ICT skills by comparing results over a span of years may lead to conclusions that are misleading. It also implies that the skills of a virtuoso computer user yesterday may become absolute today without opportunities for continuous training. For most of the respondents in this study, the only formal University training in computers they had, occurred more than four years ago at the beginning of their University studies, when they took the mandatory course in basic ICT skills.

The findings of our study also agree with the findings of previous studies [16], [17], [15] where students self-assessment of their ICT skills appeared to be lower than their self-assessed word processing skills. While 30.3% felt competent (Very sophisticated and sophisticated) in using ICT, the proportion of students who rated themselves as proficient in word processing increased to 96.3%. Lamis and colleagues [15] explained this trend by noting that the increasing workload during clinical training requiring word processing and literature search for writing reports, clinical seminars, and presentations may have contributed to this heighten confidence in word processing.

Majority of medical students are willing to use ICT-resources for their academic work [18], use of ICT for academic work by this group of students is primarily for internet access and word processing [15]. A study conducted in Jordan among dental students [15] found that placing lecture notes on the schools website was favoured by 83.0% of the students, while only 11.2% of the students felt this would stop them from going to lectures. The same study also reported that males were using ICT for academic work than their female counterparts, while female students were more likely to use ICT resources such as the internet for pleasure than for academic work. A similar trend in ICT usage by gender was observed in this study as well as in another study [10]. As it was also reported in the Jordanian study, our study revealed that few students are using ICT for their academic work on a daily basis, whereas this study revealed that majority of the students using ICT for academic work are in their first year of clinical training, the Jordanian study reported that more senior year students were using ICT for their academic work than their juniors. This apparent contradiction may be explained by differences in curriculum and teaching methodology. The trend in usage reported by the Jordan study is substantiated by our findings regarding the third and second year classes, this two classes are the remaining batches of students to be trained using the traditional lecture centred curriculum of medical training, however students in the first year class are pioneers of a Problem Based Learning (PBL) curriculum that was introduced five years ago for medical training (for both basic science and clinical training). The PBL is student centred requiring personal study and research, to carry out this research, students have had to rely on the internet and other ICT resources, to conduct literature searches, write reports, and make presentations during tutorial sessions. This form of training may therefore be the reason for the high proportions of students in this year group reporting use of ICT for academic work.

Use of Email for communication was reported among 75.0% of medical students in Tanzania [14]. This is in agreement with reports from Nigeria were 76.4% of first year clinical and nursing students in Ibadan [12], and 56% of final year medical and dental students in Lagos [13] have used email, this rates of internet and email use amongst medical students is also similar to other countries such as Denmark [19], Finland [20], India [21], Malaysia [18], the United Kingdom [22]. Use of ICT for communication in the current study was 82.5%, which is quite high compared to the studies reviewed above; this may be due to the recent proliferation and accessibility of social media sites.

Notwithstanding the high proficiency in basic word processing as well as email use reported in this study, a caveat in our findings is the low proficiency in advanced word processing and search engine skills. Ameh and colleagues

[23], in a study of computer knowledge among clinical year students, report that students with low competence in the use of computers would have difficulty accessing and utilizing electronic information, they also posit that access to current books and journals may be difficult for such students, and their knowledge of up-to-date information may be limited. One study in Tanzania among medical students found that only 23.0% of the students had ever consulted an electronic journal, and nearly 70.0% did not use any electronic resource [14]. Though in our study we did not ask the students if they had used an electronic journal or some other electronic resource, given similarities in culture and socioeconomic characteristics we can infer similar findings among our students. Ameh [23] in their study note that dissertations from students with weak ICT skills may be poor in quality, since their inability to access current information and use relevant statistical software may adversely affect the collation and analysis of data.

Previous studies show that a medical student's decision to use ICT for academic work is influenced by their self-assessed competence in the use of ICT [24], [15], [11]. Fadeyi and colleagues [11], report that competent computer users preferred a web-based learning medium than non-competent users. Lloyd and colleagues [24] in their study found that students with advanced computer skills were less inclined to buy a textbook for a course unit, and rather indicated interest in having material covering the course placed on a website, compared with students with intermediate or basic computer skills. Given that use of ICT for academic work is associated with increased computer related skills [25], it's unfortunate that courses been taught at medical schools in ICT are not better equipping medical students to use ICT for their studies [26]. A study [15] among dental students found that 69.0% gained their ICT skills through personal study and experience, while 21.0% gained theirs through a university course unit, only 9.0% of the students who felt competent in using ICT reported receiving their training in ICT from the medical school. The findings reviewed above are suggestive of dissatisfaction with the ICT-training given to medical students, an observation that is inherent in our findings. To adequately prepare medical students to use ICT for their academic work, course units in ICT been taught at medical schools need to be designed to develop in students a continuum of skills [27], such courses have been reported to cause students to develop a more favourable attitude towards using information communication technology resources in their studies [28].

5. CONCLUSION

This study has established that ICT proficiency among this group of clinical medical students in Northern Ghana is skewed; while proficiency in word processing and email use is high, proficiencies in the use of other ICT tools such as operating systems, and search engines are low. This has been attributed to curriculum design and teaching methodology. The study also predicts that dissertations from these students may be poor due to the skewed proficiency in ICT; also without effective interventions aimed at rectifying this skewedness graduating students may not have adequate functional skills to work in the increasing sophisticated and ICT-dominated medical practice environment. Based on our findings in this study we may also postulate that a curriculum designed to develop in students a plethora of ICT skills while encouraging ICT use, together with changes in teaching methodology may help stem this skewedness.

6. ACKNOWLEDGMENTS

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