ORIGINAL ARTICLE

Perceived Skill and Utilisation of Information Technology in Medical Education Among Final Year Medical Students, Universiti Putra Malaysia

T A Lim, FRCA, W H Wong, MMed (Anaes), K Y Lim, MMed (Anaes)

Anaesthesiology Unit, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Hospital Kuala Lumpur, Jalan Masjid, 50586 Kuala Lumpur

Summary

The objective of this survey was to obtain a self-reported assessment of the use of information technology (IT) by final year medical students. Two hundred and sixty five students responded to a questionnaire survey. 81.5% of students considered their computer skills adequate, while 87.9% had access to computers outside the campus. Most students reported adequate skills at word processing, e-mailing and surfing the Internet. Fifty three percent of students spent three hours or more each week on the computer. While students indicated a general willingness to access Internet-based materials, further steps need to be taken to increase the use of this method of instruction.

Key Words: Computer literacy, Education, Medical, Undergraduate, Information Technology

Introduction

Information Technology (IT) is fast becoming a part of our everyday life. The Internet has given us easy access to information at the click of a few buttons. This has lead educational institutions to develop Computer Assisted Instruction, and to use the Internet to deliver this method of instruction [1,2]. However, for this to be successful, students must be adequately skilled at using a computer, and must be willing to use Internet-based materials for learning.

Nurjahan and colleagues conducted an earlier study on utilisation of IT among pre-clinical students in a Malaysian private medical school [3]. About half of the students in that survey considered their computer skills as adequate. It was also noted that the skills acquired were those that were necessary for the students' daily activities such as word processing, e-mailing and surfing the Internet.

Bulgiba and Noran subsequently reported on the IT usage in a cross section of pre-clinical and clinical students in a local public university [4]. In that study, junior (pre-clinical) students had higher self-reported IT literacy scores. Word processing and using the Internet were again found to be among the main reasons for using the computer.

This study proceeded to survey undergraduate students who are undergoing their clinical training in University Putra Malaysia (UPM). The medical programme in UPM requires a student to conduct a formal research project in partial fulfillment for the degree. As such, all students receive formal training in scientific research during their pre-clinical years. This includes training in the necessary computer skills that would enable them to carry out a literature search on-line, and to present their project findings using electronic media.

The aim of this survey was to obtain a self-reported assessment of the use of IT by final year medical

This article was accepted: 9 March 2005

Corresponding Author: T A Lim, Anaesthesiology Unit, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Hospital Kuala Lumpur, Jalan Masjid, 50586 Kuala Lumpur

students who have had to use computers in their training. The data gathered may facilitate further planning of the medical curriculum as IT is becoming an essential component of effective medical practice.

Materials and Methods

Subjects

A questionnaire survey was carried out on four batches of final year medical students from 2001 to 2004. The first, third and fourth batches of students surveyed were given the questionnaire immediately after a lecture. The second batch of students was given the questionnaire at the end of their Anaesthesiology attachment. This second batch of students were required to print a case report form from the e-learning website of the University (http://spc.upm.edu.my/webkursus). In addition, the website contained information relevant to their posting.

Questionnaire

The questionnaire contained three sections (Appendix A). Section I consisted of five yes / no responses. Two questions enquired about access to computers, two questions about the students' computer skills and one question about usage of IT outside the academic setting. Section II consisted of five questions where students were requested to rate their skills in performing computer related tasks on a four-point scale. Section III consisted of two questions, which enquired about frequency of use of IT for study. In addition, the second batch of students were asked four questions related to their use of the University e-learning website.

Anonymous self-administered questionnaires were used. Students were asked to mark their responses in the questionnaire form. The data was then entered into an IBM compatible computer and processed using the Excel spreadsheet package (version 5.0, Microsoft Corporation, 1985) and SPSS for Windows (release 10.0.1, SPSS Inc, 1999).

Statistical analysis

One- and two- way tabulations were obtained. Effect of seniority on any variable was tested by comparing the students grouped according to their batch. In the second batch of students, the effect of perceived IT skills on the use of e-learning was also tested.

Chi-square analysis was performed to ascertain the association between two variables. Further statistical testing using Chi-square test for trend, Kruskal-Wallis or Mann-Whitney U-test was done when one of the variables was ordered. Spearman rank correlation was used when both variables were ordered. A value of $p < 0.05$ was considered significant.

The response to the question on frequency of using computer aided learning (CAL) materials was dichotomised to frequent / infrequent by including all students who perceived use of CAL for at least 1 hour a week in the frequent user group. Chi-square analysis was used to determine which variables were associated with frequent use of CAL. Logistic regression was then performed to obtain a prediction model using the variables identified by Chi-square analysis. Variables were entered in a forward stepwise fashion. Those variables that lead to a significant improvement in the regression model were accepted as variables that were associated with an increased use of CAL.

Results

Two hundred and sixty five students out of a total of 289 responded to the survey (91.7%). All returned data sheets were analysed.

Access and use of computers outside the University

Two hundred and forty four students (92.1%) had used a computer before entering University. Most students (87.9%) had access to a computer outside the campus. There was no relationship between the batch of the students and use of computers before entering the University ($\chi^2 = 5.83$, df = 3, $p = 0.12$), or access to computers outside the campus ($\chi^2 = 2.69$, df = 3, $p = 0.44$). Only 69 students (26.0%) reported that they shop on the Internet.

Self-assessed computer skills

Two hundred and sixteen of the students surveyed (81.5%) considered their computer skills as adequate. The proportions were significantly different between students in the four batches ($\chi^2 = 10.1$, df = 3, $p = 0.02$). Multiple comparisons between groups revealed that a higher proportion of students in the second batch perceived they had adequate computer skills.

A corresponding proportion of students (72.8%) stated they usually do not need technical help when using the computer. A significantly greater proportion of students who perceived their computer skills as inadequate stated they needed technical help when using a computer ($\chi^2 = 22.0$, df = 1, $p < 0.01$).

Table I shows the reported computer skills of the students. 95.8% of students reported that they usually do not need help at word processing while 96.6%, 97.0% and 60.2% reported that same level of skill at e-mailing, surfing the Internet and computer graphics respectively. However, 87.2% cannot create a home page without help.

The seniority of the students did not affect their perceived skill at word processing, e-mailing, surfing the Internet or creating a home page. Skill at computer graphics was significantly different between batches of students (Kruskal Wallis test, $p < 0.01$). The first batch of students had a higher proportion of students who require help frequently, while the third batch had the highest proportion of students who do not frequently require help. However, Spearman correlation did not reveal a significant correlation between seniority and skill ($r_s = -0.02$, $p = 0.71$).

Frequency of use

All students reported that, on average, they used the computer at least once a week. About 53% of students reported spending three hours or more each week on the computer. The number of hours per week the students spend on the computer is shown in Table II. Frequency in use of computers was significantly different between batches of students (Kruskal Wallis test, $p < 0.01$). Multiple comparisons using the Mann-Whitney test revealed that the first batch of students surveyed reported a lower amount of time spent using the computer ($p = 0.027$ vs. 2nd batch; $p < 0.01$ vs. 3rd batch; $p < 0.01$ vs. 4th batch).

One hundred and eighty eight students (71.8%) used computer aided learning (CAL) programmes for study. Frequency in use of CAL programmes was not significantly different between students who perceived their computer skills as adequate and students who did not (χ^2 for trend = 1.94, $p = 0.16$). There was also no significant correlation between seniority and frequency in use of CAL ($r_s = -0.05$, $p = 0.47$).

Factors associated with the use of CAL for at least 1 hour per week were:

i. Access to a computer outside the university
ii. Skill at word processing
iii. Skill at computer graphics
iv. Skill at e-mailing
v. Skill at surfing the internet
vi. Skill at setting up a homepage

Table III shows the results from logistic regression. The proportion of students who spent at least 1 hour per week on CAL increased with greater skill in computer graphics. In addition, a higher proportion of students with access to a computer outside the campus spent more than 1 hour per week on CAL. The overall percentage of correct predictions using the model was 64.9%.

Use of web-based learning

Fifty seven students in the second batch responded to the questionnaire. Seven of these students did not log in to the e-learning website at all. Out of the 50 students who did log in, two did not make use of any of the study materials. Most students (73.7%) who logged in found the website easy to use.

Students who use the computer more frequently reported less difficulty using the website ($r_s = 0.29$, $p = 0.04$). However, the frequency of computer use was not significantly different between students who logged in to the website and those who did not (χ^2 for trend = 3.34, $p = 0.068$).

Students who spent more time on CAL reported using more of the information from the website ($r_s = 0.36$, $p = 0.01$), and are more likely to print the case report form (χ^2 for trend = 4.23, $p = 0.04$).

Table I: Frequency distribution of students according to their ability to perform computer related tasks.

Skill	Cannot perform	Can perform but need help frequently	Need help infrequently	Can provide to others	Total
	(1)	(2)	(3)	(4)	
Word Processing	3	8	94	160	265
	(1.1%)	(3.0%)	(35.5%)	(60.4%)	(100.0%)
Computer Graphics	24	81	114	45	264*
	(9.1 %)	(30.7%)	(43.2%)	(17.0%)	(100.0%)
E-mailing	1	8	76	180	265
	(0.4%)	(3.0%)	(28.7%)	(67.9%)	(100.0%)
Surfing the Web	1	7	85	171	264*
	(0.4%)	(2.6%)	(32.2%)	(64.8%)	(100.0%)
Creating a Home page	170	61	26	8	265
	(64.2%)	(23.0%)	(9.8%)	(3.0%)	(100.0%)

Total number of respondents: 265

* One student did not rate his skill at computer graphics and another student did not rate skill at surfing the web.

Table II: Frequency table showing number of students based on time spent using the computer and time spent using computer aided learning (CAL).

	0 h / wk	<1 h / wk	1-2 h / wk	3-6 h / wk	>6 h / wk	Total
Time spent using computer	0	29	96	71	69	265
	(0.0%)	(11.0%)	(36.2%)	(26.8%)	(26.0%)	(100.0%)
Time spent using CAL	74	87	75	17	9	262*
	(28.3%)	(33.2%)	(28.6%)	(6.5%)	(3.4%)	(100.0%)

*One student did not rate his skill at graphics and another student did not rate surfing the web.

Table III: Independent factors which influenced the use of CAL for at least 1 hour per week

Independent variable	β (SE)	Wald statistic	Significance
Constant	0.50 (0.31)	2.63	0.11
Access to a computer outside campus	-1.08 (0.48)	4.96	0.03
Skill at computer graphics			
Can provide help to others (ref)			
Cannot perform	-1.95 (0.63)	9.49	< 0.01
Can perform but need help frequently	-1.11 (0.39)	8.12	< 0.01
Need help infrequently	-0.78 (0.36)	4.62	0.03

Discussion

The level of computer literacy and access to computers reported in this study appears to be higher than that reported in some of the previous studies [5,6,7,8]. This is not surprising given that those studies were reported more than 5 years ago. Over the past decade, there has been a marked increase in the availability of IT resources, thus providing greater opportunity for today's medical students to acquire computer related skills. This is reflected in a recent study by Dorup, who reported that the use of Internet and e-mail among first year medical students in Denmark increased dramatically during a five-year study period [9].

It was particularly encouraging to find that a high proportion of students in this survey reported the use of CAL materials for study, with 38.5% using CAL for more than an hour a week. Students who were more likely to use CAL were those who had greater access to a computer and those who were more skilled at computer related tasks.

Similar to the earlier studies conducted in local medical schools, over 90% of the students had used a computer before entering medical school [3,4]. Nurjahan went on to suggest that formal inclusion of IT in the curriculum would help increase the level of computer literacy among medical students [3]. Our study supports this assumption. A higher proportion of students in this study reported adequate computer related skills, especially at word processing, e-mailing, surfing the Internet and computer graphics. These are the skills most useful to the students for learning purposes. It has been previously noted that the demands of the overall curriculum has an influence over the IT skills of the students [10].

Increasing usage of Computer aided learning

Previous studies have also reported that a small proportion of students (less than 7%) prefer not to use computers in their studies [3,9]. With rapid development towards universal IT usage by medical practitioners, students may have no choice but to participate in CAL. Our study suggests that increasing access to computers will increase their use of CAL materials. One approach to facilitate this would be to make available more computer terminals in the medical school, as well as arranging for more classes to be held in computer laboratories.

Our study also suggests that increased use of CAL is associated with increased computer related skills. A course in IT may be necessary to better equip medical students for their studies [10]. Such courses have been successfully implemented and have been reported to cause students to develop a more favourably attitude towards IT [11].

All the respondents in this survey were in their final clinical year, and had earlier received compulsory training in computer skills as part of the requirement for a medical science degree. It would therefore be reasonable to expect students in the earlier batches to be as skilled as students in the later batches. This could be the reason why we did not detect any significant association between seniority and computer related skills.

In contrast, Bulgiba and Noran reported that junior students had significantly higher self-reported IT literacy scores [4]. Possible reasons for the contrasting results include differences in methodology and the medical curriculum. We sampled the four batches of students over four years while Bulgiba and Noran sampled their five batches of students at one point in time (i.e. December 2000 to January 2001). In addition, the students in our survey had already completed a science degree within their medical training, unlike in most other medical schools where a medical science degree requires an additional year.

Usage of web-based learning

Given the degree of computer literacy reported in this study, the high percentage of students logging in to the e-learning website is not surprising. However, despite being told the study materials required for the attachment was on the website, eight students did not use any of it. This failure to achieve 100% usage suggests that further steps need to be taken to improve the use of Web-based materials for learning.

Previous studies reported variable success using Web-based instruction. Hallgren and colleagues reported Web-based learning was effective in improving students' scores on anatomic landmark exams [12]. However, Chew and Relyea-Chew reported that for radiology, Web-based educational materials are more valuable to faculty than to students [13]. Baumlin and colleagues concluded that it remains unclear whether Web-based instruction is a useful adjunct for teaching emergency medicine to medical students [14].

Simply having a website containing the relevant information does not ensure students will use it, as

shown in this study and as reported in previous studies [13,14]. Crowe and colleagues suggest that the availability of an electronic classroom that provided on-line resources is not enough, and appropriate computer training may be necessary [5]. Koschmann suggested that one method to make students use information technology is to require them to use computers on a day-to-day basis to support their curricular activities [15]. The results of this survey support this, as there appears to be a positive relationship between time spent on computing and the use of Web-based study materials.

Study methodology and limitations

In this study, a different method of collecting data was used with the second batch of students as there was a need to evaluate their use of the e-learning website. As these students were surveyed in small groups, the issue of non-anonymity influencing the students' responses might be questioned. In fact, this group of students reported a higher degree of adequacy in computer skills. However, there was no trend seen in the other variables surveyed. Therefore, it was decided that the information obtained from the second batch would be included in the pooled analysis.

This study was conducted in one institution, and cannot claim to be representative of medical students in Malaysia as a whole. Nevertheless, with the easy availability of computer resources nationwide, one would expect the general level of computer literacy among medical students in the country to be similar to that reported in this study.

In conclusion, the results suggest that a high level of computer literacy among medical students can be achieved by adapting the curriculum to require students to use computer related skills. This study also revealed that students are willing to access study materials through the Internet. However, willingness alone is not enough to make learning using Web-based materials a success. The materials must be suitable for learning through the Internet. More important perhaps, is to develop a culture of using computers for day-to-day activities.

References

1. Leong SL, Baldwin CD, Adelman AM. Integrating Web-based computer cases into a required clerkship: development and evaluation. Acad Med 2003; 78: 295-301.
2. Matthew IR, Pollard DJ, Frame JW. Development and evaluation of a computer-aided learning package for minor oral surgery teaching. Med Educ 1998; 32: 89-94.
3. Nurjahan MI, Lim TA, Yeong SW, Foong A, Ware J. Utilization of information technology in medical education: a questionnaire survey of students in a Malaysian institution. Med J Mal 2002; 57 (Suppl E): 58-66.
4. Bulgiba AM, Noran MH. IT usage, perceptions and literacy of medical students. Asia Pac J Public Health 2003; 15: 127-34.
5. Crowe P, Howie C, Thorpe M. Self-reported computer literacy of medical students and staff: good facilities are not enough. Med Teacher 1998; 20: 264-65.
6. Asgari-Jirhandeh N, Haywood J. Computer awareness among medical students: a survey. Med Educ 1997; 31: 225-29.
7. Gouveia-Oliveira A, Rodrigues T, de Melo FG. Computer education: attitudes and opinions of first-year medical students. Med Educ 1994; 28: 501-507.
8. Osman LM, Muir AL. Computer skills and attitudes to computer-aided learning among medical students. Med Educ 1994; 28: 381-85.
9. Dorup J. Experience and attitudes towards information technology among first-year medical students in Denmark: longitudinal questionnaire survey. J Med Internet Res. 2004; 6: e10.
10. McGlade KJ, McKeveney CJ, Crawford VL, Brannigan P. Preparing tomorrow's doctors: the impact of a special study module in medical informatics. Med Educ 2001; 35: 62-67.
11. Chan M, Fox NJ, Clamp SE, de Dombal FT. An information technology course in the medical curriculum. Med Educ 1996; 30: 112-20.
12. Hallgren RC, Parkhurst PE, Monson CL, Crewe NM. An interactive, web-based tool for learning anatomic landmarks. Acad Med 2002; 77: 263-65.
13. Chew FS, Relyea-Chew A. Distributed Web-supported radiology clerkship for the required clinical clerkship year of medical school: development, implementation, and evaluation. Acad Radiol 2002; 9: 713-20.
14. Baumlin KM, Bessette MJ, Lewis C, Richardson LD. EMCyberSchool: an evaluation of computer-assisted instruction on the Internet. Acad Emerg Med 2000; 7: 959-62.
15. Koschmann T. Medical education and computer literacy: learning about, through and with computers. Acad Med 1995; 70: 818-21.

FACULTY OF MEDICINE & HEALTH SCIENCES
UNIVERSITI PUTRA MALAYSIA

	Yes	No
Do you have access to a computer outside UPM?.....	☐	☐
Have you used a computer prior to joining UPM?.....	☐	☐
Do you find that you usually need technical help when you use the computer?.....	☐	☐
Do you consider your computer skills adequate for your present needs?..	☐	☐
Do you shop or window shop on the Internet?.....	☐	☐

Please rate your skill at performing the following computer related activities:

	Cannot perform (1)	Can perform but need help frequently (2)	Need help infrequently (3)	Can provide help to others (4)
Word Processing				
Graphics				
E-mailing				
Surfing on the Internet				
Creating a Home page				

	Not at all	< 1 hour per week	1 – 2 hours per week	3 – 6 hours per week	> 6 hours per week
How much time do you spend using the computer?.....	☐	☐	☐	☐	☐
How much time do you spend using **Computer Assisted Learning** materials?.....	☐	☐	☐	☐	☐

	Yes	No
Did you log on to the e-learning web page of the University during the attachment?	☐	☐
Did you print the case report sheet from the site yourself?	☐	☐

	Did not use it at all	Needed help to use it	Able to use it on my own	Very easy to use
Was it easy to use the web page?	☐	☐	☐	☐

	None of it	Some of it	Most of it	All of it
Did you look up the information available on the web page?	☐	☐	☐	☐