Gradual integration of information and communication technology in a medical curriculum may create a technology divide between 'have and have-nots'.

Bengt Kayser, Daniel Scherly, Jean-Dominique Vassalli and Nu V. Vu.

Unité de Développement et de Recherche en Education médicale

Faculté de Médecine

Centre Médical Universitaire

1211 Genève 4

Switzerland

Correspondence:

Bengt Kayser, MD, PhD

UDREM, CMU

CH-1211 Genève 4

Switzerland

Tél. +4122 702 59 48

Fax +4122 702 51 22

E-mail: bengt.kayser@medecine.unige.ch

Abstract

Objective: To assess the impact of a gradual integration of information and communication technology (ICT) in a problem-based-teaching medical curriculum.

Setting: A European medical school: the University of Geneva Faculty of Medicine.

Participants: Second and third year medical students.

Methods: Analysis of questionnaire responses and server statistics.

Results: One year after the introduction of a progressive integration of ICT in to the curriculum more than half of the students had happily adopted the technology and used it, convinced of its usefulness. However, about 20% still rarely or never used e-mail and 40% did not use the Internet as an information resource.

Conclusions: By choosing a gradual approach for the integration of ICT we created a technology divide between early adopters and those that find ways to escape from the use of the technology. It thus seems important to develop strategies to help students to more easily adopt ICT since these students, once graduated, will be practicing medicine for the next 5 decades, in a medical professional world that increasingly relies and depends on ICT.

Introduction

Students that enrol in medical studies today will be practising medicine up to the middle of the century. In view of the pace of change in the development and advent of Information and Communication Technology (ICT) it is absolutely mandatory that a modern medical curriculum yields a graduate that has appropriated ICT as one of his/her professional tools. Medical practice of tomorrow's doctors will rely heavily on informatics[1]. It will be the key for easy and fast access to up to date information. It will play an increasingly important role in the life-long learning of health professionals. It also will increasingly be used for communication between these professionals and the exchange of patient information contained in electronic patient records. Computers in general, and information and communication technology (ICT) in specific will be everywhere, and our future graduates should be at ease with these. It is therefore mandatory that we provide students with an environment in which they can adequately prepare themselves.

However, the transition we presently traverse, going from a paper-based paradigm to a different one based on an electronic ubiquitous access to information and communication is happening at a very high pace, and numerous are those that fail to follow its pace. In fact, in October 1998 about 50% of the second year students at the Geneva school of medicine were still unfamiliar with computers (unpublished observation). In order to improve computer literacy and ICT use by its students the Geneva medical school has imposed itself two main objectives in the ICT domain: 1) helping future physicians appropriate ICT as tools for their daily (professional) life; 2) exploiting the pedagogical potential of ICT and computer technology in general.

These are important objectives that should be addressed by all medical schools and as such are not unique. In fact, several international and national bodies advocate the importance of the use of technology and the teaching of medical informatics in the curriculum and give directives[⊗]. However, the way that these directives are implemented varies widely. The important question is how to optimally integrate ICT

[⊗] American Association of Medical Colleges: Medical School Objectives Project:
http://www.aamc.org/meded/msop/informat.htm
Schweizerische Gesellschaft für Medizinische Informatik: Arbeitsgruppe "Curriculum Medizinische und Gesundheitsinformatik":
http://www.sgmi-ssim.ch/activities/CMI/CMI_Leitbild.htm
International Medical Informatics Association: Health and Medical Informatics Education:
http://www.rzuser.uni-heidelberg.de/~d16/

in to the curriculum to reach the above mentioned objectives. Several important factors should be taken in to account. Faculty and students have different agendas and learning curves. Technology by itself is not the objective. It is the result that can be obtained after appropriate implementation of the technology. New possibilities arise at the horizon continuously and necessitate ongoing adaptation by faculty and students.

This papers' aim is to report our efforts at the Geneva school of medicine to integrate ICT into the curriculum so that it can be of use for other medical schools in their endeavour of ICT integration in their curriculum. The Geneva school of medicine recently introduced a major reform of the curriculum that is now Problem Based Learning (PBL) oriented [2]. When the curriculum committee of the 2[d] and 3[d] years decided to stimulate the use of ICT in all teaching units of the pre-clinical curriculum we stimulated a bottom-up approach and started out with eager faculty members. After one year the curriculum was supplemented with significant ICT that was widely appreciated by those students using the technology, however, despite a progressive presence of ICT based learning content, a significant contingent of students escaped from its use and did not adopt the technology. We thus unwillingly created a technology divide of 'have and have nots' of ICT knowledge and practice.

Strategy, subjects and methods

Strategy

Even though medical student access to the Geneva university network was introduced on a voluntary and piecemeal basis several years earlier, only at the beginning of the 1998-1999 academic year all students (> 10,000, including a total of ~1000 medical students) at the university of Geneva automatically received access to the campus network when enrolling. They also received an e-mail address, a personal home page and access to software that included Internet tools and an office suite. At the same time several hundred connected PCs were deployed at several places at the university, of which 45 at the library of the School of medicine. This access to computer technology allowed a progressive introduction of ICT in the medical curriculum.

After experimenting with a pilot web site in 1997 by an early technology adopting faculty member, the curriculum committee for the 2nd and 3[d] years decided in the

summer of 1998 to introduce ICT throughout these years of the pre-clinical curriculum. During the academic year 1998-1999 every PBL unit was supposed to have at a minimum its web site and an electronic discussion forum. The design of the web sites had to be similar. Every site would present an easy access to tutors and experts (e-mail addresses, telephone numbers), an electronic discussion forum, an index of learning material, an index of self assessment tools, and commented pre-selected hyperlinks to others sites of interest[⊗].

To allow the responsible persons of the various PBL units to comply with these requirements, a dedicated web server was installed and competent personnel was made available to assist in the design of the web sites. A workshop was organized for those faculty members that were interested in learning about html editing.

Subjects

In order to quantify the effects of the introduction of ICT, at the end of the academic year all second and third year students (n=186) of 1998-1999 of the medical school of Geneva received a questionnaire.

Questionnaire

We used an *ad hoc* questionnaire. It contained general items concerning ICT and its use by the students and items specific for the use of ICT in the various PBL units.

The general questions were: I use e-mail; I consult the Internet for medical or non-medical information; I read the electronic discussion forums of the teaching units; I consult the web sites of the teaching units (rated on a Likert scale from 1 to 5: 5 = several times a day, 1 = never); I have asked questions on the electronic discussion forums (Likert scale 1to 5: 5 = more then 50 times, 1= never); Access to ICT is useful for my medical studies; The web support of the teaching units is useful for my learning; The electronic discussion forums are useful for my learning; There are enough connected student PCs available; The quality of the computer infrastructure is sufficient; The coaching of ICT use (computer student assistants, courses) is sufficient (Likert scale 1to 5: 5 = I fully agree, 1 = I don't agree). The specific part contained two questions for each teaching unit: The web site of the teaching unit was well done and useful for my learning; The electronic discussion forum was well animated by the

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[⊗] See http://edumed.unige.ch/apprentissage/sitewebunite.html

faculty and useful for my learning (Likert scale 1 to5: 5 = I fully agree, 1 = I don't agree).

Use of infrastructure

We analysed our server logs to determine the number of requests for the units' web sites' home pages and that of the discussion forums. In addition we counted the discussion threads on the forums and calculated the mean latency between the post of a question and its associated response.

Results

Introduction of ICT in the curriculum

At the end of the year, twelve of the eighteen PBL units had their web site, of which 3 minimalist and 5 more elaborate ones including interactive on-line content. Interactive on-line content included interactive histology images with associated questions, a virtual molecular biology laboratory for virology experiments, on-line quizzes, and other interactive content.

Questionnaire

Response rate was 115 out of 186 (62%). About 69% of the students used e-mail at least once a week, of which more than 50% daily. By contrast, one year after the introduction of the automatic attribution of e-mail addresses to all students 22% did still never or rarely use e-mail. About 50% of the students consulted at least once a week the Internet for medical or other information of which 11% did so several times a day. By contrast, almost 40 % rarely or never consulted the Internet for any purpose. About 60% of the students consulted the teaching unit web sites at least once a week, and almost 20% more then once a day. By contrast, about 40% did not or very rarely consult these sites. About 50% of the students had never asked any questions on one of the PBL related discussion forums and only 6% had asked more then 10 questions in the past year. By contrast, almost 60% of the students found that the discussion threads on the forums were very useful for their learning. Even though more then 60% indicated that ICT is important for their learning, 18% was moderately convinced, and 8% did not agree.

Web site access

Cumulative specific teaching web site home page access for the academic year studied varied between 1699 and 544 requests between teaching units. In the months corresponding with the teaching units' place in the curriculum the units' home page access varied between 577 and 271 requests. Based on the findings of web site use by the students this implies an average number of student access of a specific teaching units' web site between 10 and 5 times per teaching unit and a total of 28 and 9 times for all sites per year and per student.

Discussion forum access

The average number of questions asked on the various forums was 7 ± 4 per week (mean $\pm$ SD). The average number of requests for the specific discussion forums' home pages was 270 ± 123 times per week. These variables correlated ($R = 0.6$) in so far that those forums that received a lot of questions were accessed more often. Interestingly, the latency time (average 3 ± 2 days) between a question and its associated response did not relate to forum activity, either measured by forum access or number of questions asked. Although not formally assessed it appeared that those forums that were animated by enthusiastic faculty members did better than those animated by sceptic faculty members.

Discussion

One year after the introduction of a progressive integration of ICT in to the pre-clinical curriculum at the Geneva school of medicine there is clear evidence of successful appropriation of the technology both by the majority of students and faculty members. However, even though more than half of the students happily adopted the technology and used it, convinced of its usefulness, about 20% still rarely or never used e-mail and 40% did not use the Internet as an information resource. We thus created a technology divide between 'have and have-nots', between adopters and those that find ways to escape from the use of the technology.

We have no data but believe that this may be partly explained by the fact that our curriculum is full and that the extent of ICT integration is not yet such that a student cannot progress successfully without it. In addition, and related to the former, it may

be that there is technology anxiety that prevents some students in engaging into ICT use.

Although it certainly needs attention, we believe that this technology divide is of temporary nature. We expect that ICT use of the first year student will increase as computer literacy is achieved at pre med school and will become an entry condition for studying medicine[3]. But for the moment and for the next few years we will have to develop strategies to salvage those students that fail to easily adopt ICT and prevent them from developing strategies to escape from ICT use. This is mandatory since these students, once graduated, will be practicing for the next 5 decades, in a medical professional world that will increasingly rely and depend on ICT.

The rapid paradigm shift that society goes through with the introduction of ubiquitous electronic access to information and communication inevitably leaves several behind. As with any important cultural shift it is not necessarily good to force along those that are hesitant. We believe that a gradual approach with successful pilot projects involving those that are enthusiastic is best. The process of ICT integration at the Geneva faculty of medicine is therefore planned in a progressive way. Although the initial decision to start the process of integrating ICT into the curriculum was done 'top-down' by the schools' curriculum committee, we subsequently used a 'bottom-up' strategy to implement this integration. By starting out with those teaching faculty members that were interested in using technology we set an example both for the students and the other faculty members [4]. Students then asked for similar environments for the other PBL units and several other teaching unit leaders, having seen the work of others, followed suite. In this way faculty members gradually learn to use ICT in their teaching, students gradually learn using ICT for their learning, and in addition the curriculum contains an increasing amount of medical informatics. The whole process implies an important change in institutional culture where in the end ICT use should become as natural as any other means of information or communication [5].

A weakness of the present study is the response rate of 62%. The reason for this may be the great number of evaluation questionnaires that our students are asked to fill out all along their curriculum (~20 / year). The introduction of the new PBL based system necessitates continuous monitoring in order to adapt when necessary. The students show signs of saturation with regard to these evaluations. Nevertheless, we believe

that the questionnaires that were returned represent the student population as whole quite well.

Conclusions

Those students that use ICT appreciate the integration of ICT, but lack of full embrace by the faculty coupled to a lack of full integration created a technology divide between adopters and non-adopters. By building a solid base of ICT use by introducing successful pilot projects that change institutional culture we hope to increase the level of integration in such way that it ICT becomes inescapable for the student (and the faculty!), while guaranteeing that this integration continues to significantly add to the quality of the program.

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