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Article

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The use of computer-based learning tools for teaching and clinical purposes: Interactive computing strategy for Iraq

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Abstract— Medical universities and teaching hospitals in Iraq are facing a lack of professional staff due to the ongoing violence that forces them to flee the country. The professionals are now distributed outside the country which reduces the chances for the staff and students to be physically in one place to continue the teaching and limits the efficiency of the consultations in hospitals.

A survey was done among students and professional staff in Iraq to find the problems in the learning and clinical systems and how Information and Communication Technology could improve it. The survey has shown that 86% of the participants use the Internet as a learning resource and 25% for clinical purposes while less than 11% of them uses it for collaboration between different institutions.

A web-based collaborative tool is proposed to improve the teaching and clinical system. The tool helps the users to collaborate remotely to increase the quality of the learning system as well as it can be used for remote medical consultation in hospitals.

Index Terms— teleconsultation, learning and teaching, web-based collaboration

I. BACKGROUND

Information Communication Technology (ICT) tools facilitate electronic communication. ICT tools have major impacts in improving the teaching and health systems as it facilitates the collaboration between remote peers, enables remote consultations, sharing information for distance learning and improves public healthcare [1].

The persistent violence, threats and other exceptional circumstances in Iraq force professionals such as doctors, academic staff and specialists to flee the country. Statistics from September 2007 show that 40% of professionals have left Iraq since 2003 [2]. This lack of professionals and teaching staff has had a negative effect on the current teaching and clinical systems.

This research paper will consider the general problem that faces the teaching and clinical system in Iraq while focussing specifically on the Radiology department. The students of radiology are required to observe different cases during their studies to improve and practice their professional skills, but with the current unstable situation most students are limited in their movement between cities and provinces to examine different cases from various places to meet the requirements of their studies.

For the learning system in Iraq, some of the postgraduate study programmes have been limited in their scope or terminated altogether due to the unstable circumstances relating to security and shortage of resources. An example is the insufficient number of professional staff in universities leading to students not being able to gain valuable tuition and guidance from experienced doctors.

In addition to the learning factor, this problem affects the quality of general healthcare too. The Iraqi Medical Association reported that 90% of nearly 180 hospitals had a lack of resources because the majority of professional staff had moved to more secure cities or countries and thus some cities faced a lack of experienced or specialist doctors [3].

Hence, medical consultations for example involve inexperienced doctors. As patients do not receive their efficient treatment and medication, they are forced to travel to another city or even abroad to receive their full treatment.

The above problems show that the distribution of professionals and specialists around and outside the country limit the daily functioning of learning, teaching and clinical systems in Iraq.

II. PROBLEMS AND PROPOSED SOLUTIONS

Today, there are various collaborative applications being used for learning, teaching or clinical purposes. Most of these collaborative tools have been implemented in the developed countries which have the basic infrastructure such as high speed internet connection [4]. However, each of the implemented tools has different requirements, specifications and target different types of users.

A distance learning medical education system "RAFT" was implemented in some developing countries such as the ones in French-speaking Africa to improve the efficiency and quality of the health system. The system allowed the students to be in touch with the expert virtually to exchange material and knowledge over the Internet. This project had considered low-bandwidth technologies during the implementation, in addition to targeting rural areas that did not have any existing communication infrastructure. The main challenge that faced the system is the digital divide and the gap between the professionals and patients [5].

Another approach for using collaborative technology for medical distance learning uses digital video. The French Virtual Medical University project (UMVF) was implemented to share medical resources using digital

video over IP (Internet Protocol) as synchronous and asynchronous distance learning. This project was designed to exchange experience and knowledge between participants in different countries, but the drawback of this system was the lack of interactivity between the teachers and students [6].

Telederm.org is one of the current online teleconsultation systems in dermatology. The aim of this system is to provide a pool of expert consultants who can give diagnostic advice to physicians online. The system is designed for medical and clinical purposes although the availability of a discussion view the gives the users the ability to give their opinions. The system lacks formal quality assurance and the distribution of the experts is uneven which makes the administrators of the system monitor these functions informally [7].

The Department of Oncology at the University Hospital of North Norway had implemented a system that links the Oncology department with the remote palliative care unit. The system used video-conferencing and email.

The current learning and clinical systems that are available for medical students in Iraq have various problems such as the lack of resources and infrastructure problems. Therefore, the learning system is still face-to-face and the students need to be physically in one place to participate in any course or exchange knowledge and information. Similarly, in the clinical system, all the consultations require the specialist to be available physically in the hospital. These problems like electricity, internet availability can be classified as part of the digital divide in the current system which occurs in the developing countries like India for example [8].

III. PROPOSED SYSTEM

The proposed system has been based on the results of a survey involving postgraduate medical students, lecturers and professional staff such as doctors and specialists in different universities, teaching hospitals and hospitals in Iraq.

The results were collected using an online surveying tool, but these online results were not enough to base our proposed system on, as it only targeted the students and professional staff who are using the Internet. Hence, an offline survey was performed as well.

The survey illustrates how the teaching and clinical systems are isolated from any collaboration between various institutions. Currently, the collaboration between institutions needs to be done physically in the same place which is not always possible or practical. The result of the survey is shown in Table 1.

It illustrates that there is not any electronic collaboration between universities, teaching hospitals and any other institutions for learning or clinical purposes while this is crucial. The only collaboration that happens between institutions is done face to face or, in some cases, over the telephone.

In the survey, most of the participants criticize the quality of the Internet connection that is available. It is not widely distributed and the connection speed is slow which limited the users from retrieving large datasets and documents. Therefore, they use the Internet mostly for browsing. An additional issue is electricity, as it is not always available and a power outage could happen any time.

TABLE 1 THE USE OF ICT FOR LEARNING AND CLINICAL PURPOSES BY STUDENTS AND PROFESSIONALS (N=30)

Using Internet for EDUCATIONAL purposes	86%
Using Internet for CLINICAL purposes	25%
Using collaborative tools between universities or institutions	11%
Using collaborative tools between hospitals or clinics	7%

All these and other factors need to be considered while proposing the new system.

Using ICT tools such as web-based applications for teaching and clinical purposes is the practical solution for the issues faced by the current system, but due to the limitation imposed by available resources, we are limited in our implementation and which tools we can use.

There are different web-based collaborative tools that have been implemented and used for learning or other purposes. However, most of them were designed for a specific purpose such as learning only or clinical purposes only while there is a lack of a general tool that can be used for both purposes.

As academic staff and students are distributed geographically, it is proposed to develop a web-based collaborative application which links the professional staff such as doctors and specialists with the students remotely. In the case of Radiology studies for example, they need this collaboration to facilitate the exchange of files, images, course material, patients' notes and remote discussion between peers with the aid of digital images such as X-ray, MRI and CT scans.

For the clinical aspect, the professional and specialist doctors are distributed, and, in cases where external or specialist opinion is needed while they are not available, exchanging cases that need consultation or external opinion through a web-based application will facilitate the clinical and consultation system for the patient and the staff in the hospital.

IV. DESIGN/ SPECIFICATION

The limitation of resources in the current system limits the designing and specification of the web-based collaborative application's features. The case study under consideration is for a Radiology department.

An example workflow of a scenario when there is a case that needs consulting:

The specialist (a radiologist in this example) has two different associated roles in this Teaching & Clinical web-based collaborative system – a teaching / educational role and a clinical consultation role.

Firstly, when the patient needs a consultation from a radiologist in the hospital, the referring physician will digitize any medical images (if the medical images are X-ray scans) then upload them to the web-based collaboration application database with any other related reports and lab results of the patient.

The specialist or radiologist at the other end, such as in an academic hospital, will receive a notification email that there is a case that needs a consultation.

The radiologist accesses the web-based collaboration application to retrieve the case and review the reports and images, and then uploads the consultation.

A notification email will be sent to the referring physician and other staff that requested the consultation to inform them that it is ready.

The other role for the specialist requires her / him to prepare teaching material for the students to be available online so they can get the material remotely and collaborate with other users and with different resources.

The web-based collaborative application helps the students to review different cases from different places without the need for travelling.

For each of the cases that needed clinical consultation, the students can practice their own knowledge by reporting their consultation and upload it, which can be accessed by the radiologist. The radiologist will assess the student performance and provide feedback as each case has a discussion form between the students and specialists.

So generally, the web-based collaborative application for learning and clinical purposes will include the teaching and clinical material such as handouts, articles and notes, a discussion board, assessments for the cases that had been discussed, some links to useful websites and journals and remote medical consultations on different cases as depicted in Figure 1.

There are some fundamental requirements while designing the system. Some of the issues and barriers that affect the use of technologies in learning and teaching systems generally are the slow speed of connections and poor access to the Internet rather than the design and delivery of the learning system [9].

Due to the basic nature of the communication infrastructure now available in Iraq, the project has been based on low bandwidth technology for the time being to fit the available Internet connection.

The Teaching & Clinical web-based collaborative system proposes to work using a store-and-forward telecommunication technique rather than a real time technique. The Internet connection is not always available and there is a long delay in transmission data. Therefore, using a store and forward technique will be more reliable for the system as the specialist and students could interact with the system when their Internet connection is available and not be restricted at times when the connection is not accessible.

In addition to this, the real-time telecommunication technique requires high bandwidth, especially for

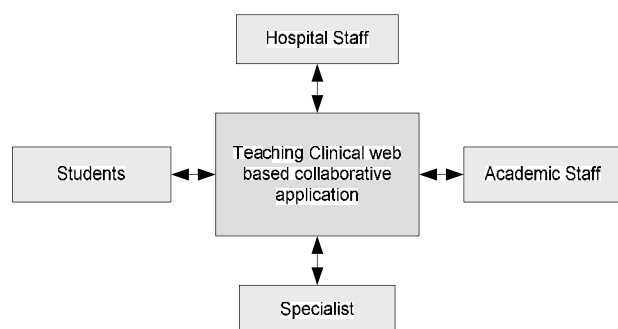


Figure1. Teaching & Clinical web-based collaborative application overview

streaming video conferences, while it is not available in the current system therefore store and forward system will be more appropriate for our system.

The Teaching & Clinical web server is one of the primary components of the Teaching & Clinical web-based collaborative system. It is a multi-threaded server that can be accessed by multiple clients. The server saves the entire patients' reports, images and consultations in a database from which the specialist can retrieve the cases for clinical and teaching purposes.

The database for the Teaching & Clinical web-based collaborative application stores all the cases that are useful for the students or need consultations by the specialists.

The radiologist and students are able to access it and retrieve different patients' cases from the web application.

The initial implementation will be using an open source medical web application solution to find out how the students and professionals will use the system effectively to improve the teaching and clinical consultations. There are various platforms have been implemented for teleconsultation, and each has their own specifications as shown in Figure 2.

Open source applications are suitable solutions for the system currently as it is a cost effective solution. iPath [10] is an open source consultation application that has been suggested. It covers the user's needs for the time being by allowing her / him (the referring side) to upload the case with the available medical images while the specialists access it to report the consultation.

V. POTENTIAL BENEFITS

The web-based collaborative application is designed to link universities, teaching hospitals and any other institutions that are distributed geographically.

There are various advantages to using the teaching & clinical web-based collaborative application, as, from the educational perspective:

- Students can continue their studies although they are geographically distributed and so there is no need for all to be available in one room.
- Students can study and examine various cases.
- External online resources will be available such as course material and e-books.
- It will provide the students with a remote collaboration facility with other peers such as specialist doctors for exchanging knowledge without any destination barriers.

In addition to this, the system could be used for clinical purposes as well. It could be used to cover some of the consultations that can be done remotely without the need for the specialist to be physically available in the hospital or where the patient is located.

And, in some other consultation cases, there may be a need for more than one specialist, hence, the teaching & clinical web-based collaborative application will be the best solution in such cases to have efficient results.

The specialist and professional staff can collaborate and discuss different cases remotely and this can assist in speeding up the patient's treatment with better results.

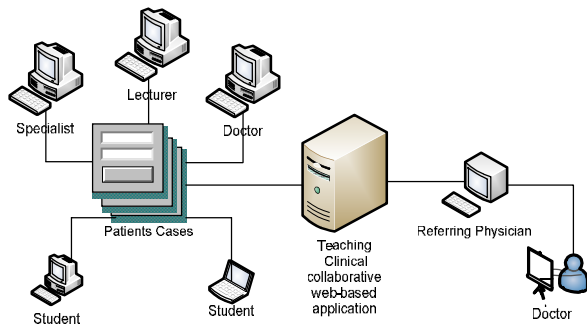


Fig.2 Teaching & Clinical web-based collaborative application architecture

The Teaching & Clinical web-based collaborative application will be beneficial for patients as well as students and doctors as the patients do not need to travel to different medical centres. In some cases, the consultation can be done remotely, and the patient can receive a consultation from different specialists and experts even though not all of them are based in the same location.

The discussion of different cases between professionals and students will be a significant way to improve the efficiency of the consultations.

Generally, the teaching & clinical web-based collaborative application will be less time consuming and more cost-effective for the teaching and clinical staff as well as the students and patients.

VI. CONCLUSION

The fleeing of medical professionals from Iraq have negative effects. In this paper, a survey has been done to find out what are the problems that limit the teaching and clinical system in Iraq during these circumstances.

A proposed solution is able to cover some of the educational problems as well as the clinical consultation issues in hospitals through the use of a collaborative web-based application.

The result of this proposed system can satisfy the needs of students, lecturers and doctors through extending their knowledge while having the ability to study, discuss, examine and collaborate on various cases remotely, as it can be a less time consuming and more cost effective solution for all users.

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