Framework for online classroom tool for collaborative learning in undergraduate Pathology teaching

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Abstract

Pathology is one of the key focuses in any medical curriculum, which helps students to understand the causes and nature and effects of diseases[(1)]. Conventionally, pathology is being taught using macroscopic and microscopic specimens combined with didactic teaching methodologies. Peer assisted learning is a commonly observable teaching learning method in studying macroscopic specimen especially among Sri Lankan medical undergraduates. However, the main drawback of the conventional laboratory based peer assisted learning is that the group of students have to be in the pathology museum physically to successfully engaged in the learning process and the teacher has to be available to clarify matters arising from the student centered learning exercise.

On the contrary, online learning frees students and teacher from the need to be in a single physical location and online content delivery is gaining increasing popularity in medical curriculum. The proposed tool is the result of exploring the possibility of applying instructional designing and content delivery principals for pathology to facilitate peer assisted learning. This tool will assist integrating pathology with clinical presentation of diseases in developing a supplementary content management system for the pathology macroscopic and microscopic specimen studying process in medical undergraduate curricula.

Keywords: Pathology, Learning Management System, peer assisted learning, instructional designing, student centred teaching, on line assessment, large group teaching

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Introduction

Pathology is the study of abnormal structures of the human body to understand the basis of the clinical presentations, in other words, it is the medical specialty concerned with the study

of the nature and causes of diseases[2]. Pathology consists of diagnosis of disease based on the gross, microscopic, immunologic and molecular examination of organs and tissues. It is taught in varying degree in multi disciplinary approach and contributes significantly to any medical curriculum [3]. Teacher centered lectures and laboratory sessions are the commonest means of teaching even in modern pathology courses[4]. These laboratory sessions mainly consist of the study of macroscopic specimen and microscopic slides. Peer assisted learning is also a commonly observable teaching-learning component in lab based study of macroscopic and microscopic specimens among undergraduate medical students.

However there are several problems inherent to pathology museum or laboratory based teaching with conventional peer assisted learning in large group teaching. The group of students physically have to be in the pathology museum to successfully engage in the learning process and the teacher has to be available to clarify matters arising from the student centred learning exercise. Furthermore, in integrating the learning content, it is difficult to expect getting clinical teachers to serve as content designers for pathology laboratories and pathology museums.

Can Pathology be taught online?

In the past few years online or computer assisted teaching and learning has gained popularity in all the disciplines[5] including medicine and the results of introducing these have been quite encouraging[6]. It has been shown that on-line teaching can be successfully employed in medical teaching as well[7,8]. Several researchers have reported that on-line education can encourage students to engage in deep learning and develop critical thinking skills when learned collaboratively or under problem-based scenarios[9,10].

In introducing online teaching/learning, there are some identified barrier to the process like the new role of teachers and students and the new learning environment. Since the on-line environment is different from the traditional classroom, it is important for the instructor to motivate students to adjust their role to become an on-line learner[11]. The interaction between students and their instructors changes from a synchronous mode in face to face instruction to an asynchronous virtual community when it comes to on-line education. Thus, a significant role adjustment for students may be required if they are to experience success. Students must move from being more traditional passive classroom learners into more active on-line inquirers. According to the social constructivist theory learning should involve interaction with other people or environment, which foster potential development through instructors' guidance or in collaboration with more capable peers[12]. Creating a social negotiation environment can foster reflective response and support collaborative construction. Furthermore, online teaching learning technologies might overcome some of the barriers to learners' interaction and support collaborative work to synthesize shared knowledge. In other words, based on the principles of constructivism, online educators need to find ways to promote collaborative learning through reflection and social negotiation.

There have been some efforts aimed at introducing computer aided learning and online teaching to Pathology teaching as well. One such system is The Group for Research in Pathology Education (GRIPE) Image Bank[13], which includes, The GRIPE image bank--containing approximately 3000 peer-reviewed gross and microscopic pathologic images along with textual descriptions and GRIPE test question bank using Gossamer Thread's DBMan Web database management program[14]. There are several other web and CD ROM

based pathology learning aids and teaching learning environments or content management systems[15,16].

Materials and method

The following model of possible online interactions was considered in designing the system[17]. It emphasizes the interaction between teachers, students and contents. Furthermore, it highlights the interaction among students themselves; encouraging peer assisted learning, and interaction among teacher and interactions among the contents itself, facilitating integration of pathology with clinical application.

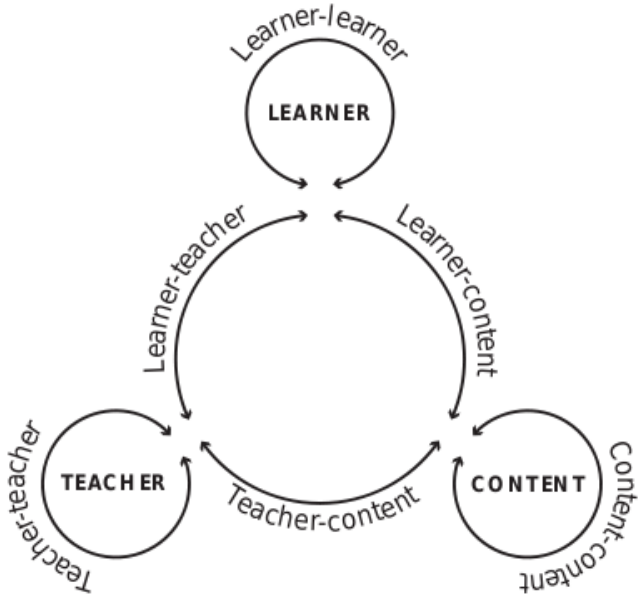

Figure 1. Educational interactions in the proposed teaching-learning tool.

As discussed above in an on line learning environment, there are many roles for students and teachers. The designed framework enables teachers to function as an information provider as well as an assessor, course planners and material developer[18]. It helps teachers to continuously evaluate the course and appropriately update the flow, phase and content of the course based on performance of the students. This eventually leads to better retention of the subject and improved outcome in a long term manner.

Strategies and technology

Several strategies were followed by the authors in designing the content layout of the system building an effective learning environment[19]. These strategies were:

- Providing background information on the course outline
- Incorporating text and images in the content sections with integration of macroscopic and microscopic anatomy with clinical presentation
- Designing activities and discussion questions (forum) which can trigger students' interest to explore the answer, which will ultimately foster students' critical thinking and deep learning
- Requiring students to play roles in certain scenarios in online discussion and encouraging students to contribute to the Pathology image database with appropriate macroscopic and microscopic images with appropriate textual descriptions

Successful implementation of those strategies will improve the quality of online instructional delivery and in the proposed collaborative teaching-learning platform. In order to achieve the goals, content management system and online interaction platform was developed in a web enabled manner. The system can be deployed on an Intranet as well as on the Internet, depending on the required level of access and target user community. In order to promote the free use of the system, open source technology was used on a Linux-Apache-MySQL-PHP(LAMP) stack[20] under GNU General Public Licence[21]. Client end of the system was browser based and capable of supporting all major web browsers and all popular operating systems. Following is the architecture of the system with its main components.

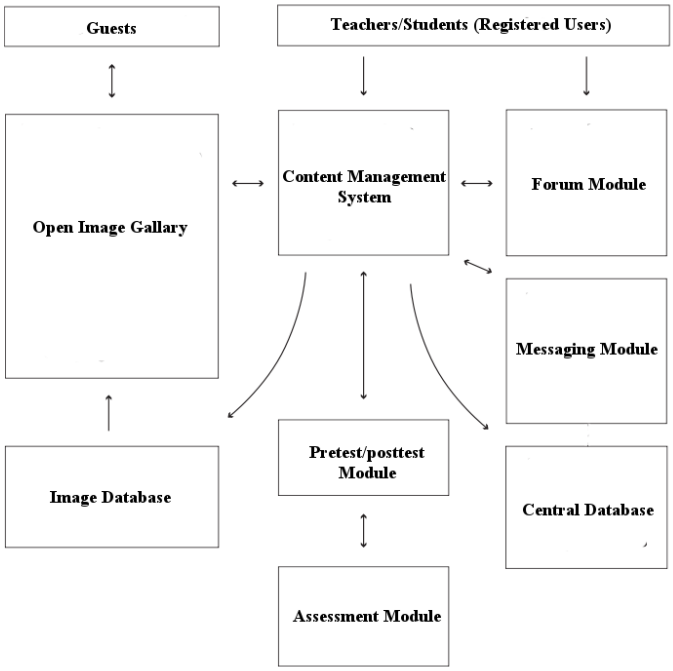

Figure 2. The framework in building the tool

The key components of the system are the content management system (Museum), open image gallery (Gallery), forum module (Forum), assessment module and messaging module. The Museum, the Gallery and the assessment module form the major part of the content where as the Forum and the messaging module is the student and teacher interaction media embedded to the system.

Figure 3. Main menu and the content selection option

Content section

Contents are organized in three major subsections; macroscopic, microscopic and clinical pathology. Macroscopic section can hold few macroscopic images of pathological macro-specimens with relevant textual descriptions. It is followed by the microscopy section, which describes the microscopic anatomy of the specimen shown in the macroscopic section with suitable light microscopic images of pathology slides complemented with textual descriptions. Finally clinico-pathology section will conclude each section with appropriate clinical description of the condition with images and text. This arrangement will help students to correlate the pathological findings with the clinical presentation of the condition.

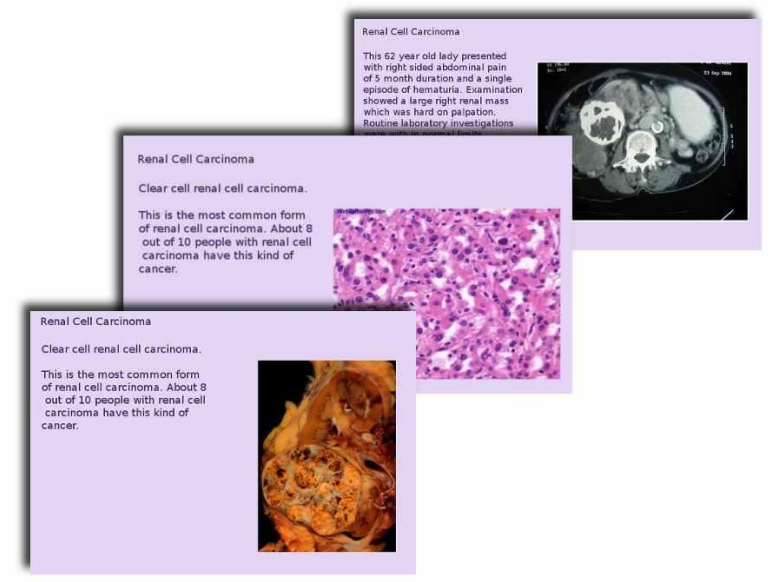

Figure 4. Content area representing macroscopic, microscopic and clinical sections

Assessment section

Formative as well as summative assessments are possible using the proposed system. Before the each pathological condition, there is a Pretest section to assist student on self assessment prior to study the content. Similarly each pathological condition is followed by a post test and after completing the post test, student can compare the results of pre and post tests to evaluate the progress made. After the post test, students are allowed to view the answers to the pre and post test.

Apart from the pre and post tests, the system facilitates assignments based on various question types, including multiple choice questions and short answers or essay type questions[22]. Teacher can assign each type of question, or set of questions to a single students or a group of students registered in the system. Teachers can specify a time period for a particular question and system can automatically submit the students' answers to the teacher, regardless of whether students have completed the relevant questions or not within the allocated time period. After the teacher evaluates the student's performance, the system will convey the result of the student in the assessment as a message from the teacher.

System will summarise the performance of a batch of students over a period of time or in a particular 'module' or a teaching session, with graphs and charts. The results of an assignment can be exported in the spreadsheet format as well.

Collection of supplementary materials

Teachers and even registered students can upload images of macroscopic and microscopic images to the Gallery section with suitable textual descriptions. This enables the system to function as an online repository of images. These images, while helping students to broaden their knowledge, can be used by teachers in preparing lecture materials or any other teaching aids. Unlike the formal teaching-learning section, the Gallery can be accessed even by guests whereas the content proper can only be accessed by the registered students and teachers.

Teacher and student interactions

As in many content management systems, the proposed system will assist students and teachers to interact with the contents. In addition to this the system will provide a Forum and an in built messaging module to facilitate interaction among users. Students and teachers as well as students themselves can interact in the Forum. Students can pose a question in the forum, which can be ideally answered by another student allowing peer-assisted learning. However if students fails to find an answer to a particular problem, a teacher can guide them towards the correct answer using on line discussions. These asynchronous discussions allow teachers and students to continue the discussion at a phase which is comfortable to both parties.

The proposed system also allows teacher – teacher interactions through forums and personal messages. Furthermore a section can be updated by more than one teacher. These features together facilitate pathology and clinical teachers to design and update a lesson in an integrated manner.

Discussion

The authors followed the best practices recommended in designing online teaching-learning environments[23]. Online courses are said to be of high quality when they are student-centred and when :-

- Knowledge is constructed
- Students can take responsibility for their own learning
- Students are motivated to want to learn
- Learning activities appropriately match student learning styles
- Experiential, active learning augments the Web site learning environment
- Solitary and interpersonal learning activities are interspersed
- Inaccurate prior learning is identified and corrected
- “Spiral learning” provides for revisiting and expanding prior lessons
- The master teacher is able to guide the overall learning process

The knowledge is constructed based on the lectures and text books and it will be gradually expanded through a series of pre-tests and pathology and clinical contents designed by a panel of teachers. Students are encouraged to manage the discussions and contributed to the pathology image database. Individual as well as peers assisted learning is facilitates by the system and students are guided with information about course outline and indexed specimen panel, categorized according to a recommended text book.

Clinical significance or the correlation of the Pathology to clinical presentation was emphasized at the end of each specimen to improve the integration of knowledge [24] combining that with background knowledge of each student.

Conclusion and anticipated further progress

This system follows the key features[24] of computer mediated communication promoting collaborative learning, viz. text based and computer mediated interaction, many to many communication, time and place independent content and interactions, long distance exchange and hypermedia links. In addition to these the authors are planning to add a concept map generation and automated multiple choice and short answer question marking systems to the learning tool.

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