Virtual microscopy in medical education

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Virtual microscopy is one of the effective ways to implement e-learning in the curriculum delivery methods and digitalization of the sections is very effective in teaching via virtual microscopy. This would make it possible to put innumerable new learning scenarios into practice. Virtual microscopy may be fully integrated into the teaching of anatomy, histopathology, haematology and microbiology. Virtual microscopy can be employed in various teaching learning modes like problem based learning (PBL), practical sessions, quiz, tutorials/revisions. Virtual microscopy helps a large number of users to examine/access specimens at the same time. It broadens the avenue for directed self-learning (DSL). It can also be used as online learning modules, and for e-PBL's. The virtual microscope can be used to conduct/evaluate objective structured practical examination (OSPE) examination. It is also a useful educational tool for discussions in small group teaching and interactive review sessions (IRS). This application has a major advantage and scope for continuous improvement with options for newer additions of slides from time to time. It is a definite enhancement in teaching learning sessions. High resolution images, interactivity and ease of use are the advantages of virtual microscopy in medical education.

Keywords: Virtual microscopy, e-learning, medical education

Introduction

'If we teach today's students the same way we taught yesterday's, we rob them of tomorrow' said John Dewey. In medical education today, the emphasis is on producing a holistic 21st century leader with the appropriate knowledge, skills and attitude to be a safe and effective medical practioner with a penchant for continuing medical education. (Cynthia Luna Scott, 2015) It is imperative the learners should find the learning process as close as possible to real life situations for the impact to be lasting. The learning process should be enjoyable too. (Hugh, G., & Aravinthan, V.2010).

In this chapter we shall discuss the utility of the virtual microscope to integrate across subject modules as well as the cognitive, psychomotor and effector domains. Virtual microscopy involves using real slides, that is scanned to prepare virtual slides that can be annotated with labels, graphics, images and videos. This archive can then be applied on a web based platform. (Xavier Albe, Walter Friez 2006). The images are clear and also maintain the cellular details. Virtual microscopy today is not only an educational tool but has found utility in the diagnostic and research laboratories. (Henrik Helin *et al* 2005).

E-Learning in Medical Education

We shall now discuss the 12 tips that would align the utilities of virtual microscopy with the desired qualities of a 21st century learner.

1. Focus on the content

a) Always focus on the content and not just on the technology. (Kalyani Premkumar, Cyril Coupal, 2008). The core content should be chosen by the subject experts as per the requirements of the curriculum.
b) The content for each of the teaching learning sessions have to be identified and be moved to a separate folder for easy access. For example, when the normal histology has to be recalled when teaching pathology, it is best that content that needs to be used is identified early. The phase of the education of the learner should be accounted to match the right proficiency to explore the topic/subject.

2. Train the trainers

a) The faculty has to be trained to adapt to the new technology. If the faculty is not trained the students will never get attracted to the process. Medical students will do what we do, not what we say (Kassebaum & Cutler 1998). Hidden curriculum can come into effect here and affect the learner's attitude negatively.
b) The faculty should be trained to add on the digital library, use the virtual microscope to set pre and posttests, quizzes, run OSPE's and evaluate the effectiveness of the teaching methodology. The facilitators should encourage the students to participate in the process ethically and also set an example.

3. Interactive learning

a) The new generation interact best on a web 2 platform (Sandars, J., & Schroter, S. 2007). The virtual microscope can tap into this student interest and ensure interactive learning with a round the clock accessibility advantage. Questions can be posed and answers evaluated.
b) Unlike conventional microscopy, in virtual the facilitator can see what his/her pupil is visualizing and can monitor large numbers of students at the same time. (Andre Schutte & Mark Braun, 2009).
c) The students can work in groups and share the material to peers near or far. Team work, Communication, Critical thinking can be honed by this process apart from the sharing of knowledge and gaining new insights. In the real world, virtual microscope allows for obtaining external expert opinion quickly and also for documenting external quality assurance. (Xavier Albe, Walter Friez 2006). For a student thus this serves as an experiential learning process.

4. Package the lesson plan

a) The content must be presented in a manner to spark interest like clinical case scenarios or ethically challenging situations concerning financial and sociocultural issues;
b) The content has to be linked to current contemporary issues to relate to the participants;
c) Areas of interest by participants can be weaved into the lesson plan, like movies, sports, or novels. Alternate ways of teaching have been proved to be effective for long-lasting global knowledge (Patricia et al., 2009).
d) a,b,c above is applicable for all the teaching delivery tools that we can make use of ranging from seminars, Retrieval of information, Journal club, Research field work/Hospital posting, Self-study Assignments, Laboratory practical, concept lectures up to Thesis submission.

5. Plan the Virtual microscopy delivery

a) Issues like timing and duration of discussion must be agreed upon and fixed early. It should be documented in the students teaching learning schedule. Time management, responsibility and ethics can be measured here.
b) Logistics, audiovisual support, and reference materials, like books or Wi-Fi, have to be decided and booked early;
c) The virtual microscopy can be embedded in to PBL. Instead of a paper base d PBL trigger where the histology or the pathology is described, it can be shown as a slide for the students to interpret. This fosters inquiry, critical thinking and the ability to make conclusions.

6. Group oriented exploration of real life scenarios

a) The students can be divided into groups and given a scenario. They would be required to order laboratory tests to make a diagnosis. The cost of each investigation would be subtracted from a fixed sum each group is allotted to. The lab test the group clicks on is immediately available for them to visualize. This comes with information of the turnaround time for the test. The groups should be able to follow the algorithm, interpret the tests and present the differential diagnosis.
b) The learning process can be made fool proof by allowing only the right algorithm to be chosen. The process can be further escalated by making the students break the news of the results to a simulated patient or relative. This exercise will align with the drawing conclusions, making informed decisions and applying knowledge to new situations.

7. Communicate

a) All stakeholders of the learning exercise have to be well-informed about the date, time, and main subject matter;
b) Effective and efficient communication through e-mail and social media, like Facebook, correlates with the continuity of the lifelong education. Kathleen, Lucas, and Gregor (2010) have referred to Facebook as an important tool preferred by medical students;
c) Types of communication that need to be addressed:
    (1) Faculty expert-facilitators: planning and execution;
    (2) Facilitator-student: execution;
    (3) Student-Peer-Group: discussion within groups;
d) Facilitators can offer off-the-road stems in mid-discussion to spur and bring back the participants' attention; Facilitators can also put forth ethical issues challenging the norm to incite interest and to bring out analytical and creative skills of the participants;

8. Tele pathology/Conference

a) Virtual microscope can open the learning to a new dimension by networking with other medical universities locally or abroad.
b) Conferences can be organized and lots of teaching material shared or sourced.
c) This can be a platform to obtain stakeholder feedback to improvise the standards of the teaching exercise.

9. Cost reduction/Entrepreneurship

a) The large bank of virtual slides, the accessibility of it, the non-requirement of preparing new material for every lesson, the advantage of reaching out to a large number of students at the same time, the availability of the service around the clock, the need for lesser number of facilitators definitely reduces running costs over time.
b) Use of this tool to encourage students to virtually have electives at exotic or special venues across the world will be a challenge to their communication skills, networking, exploration of resources and entrepreneurship skills.

10. Flip-Student self-assessment and self-accountability

The students can use the tool to self-assess. This formative assessment and the student's academic progress can be tracked. The student thus can realize his/her mistakes and take corrective action. This tool can be linked to the learning management system for compilation of the students final scores. Self-accountability and recognition of personal strengths and weaknesses is possible with this tool.

11. Feedback and rating

a) Each teaching learning activity can be rated by a standardized feedback form in terms of content, delivery, facilitator, general set-up, etc.;
b) Both positive feedback and negative feedback should be collected and analyzed.
c) Besides relying on feedback, the organisers also have to break their own records and keep benchmarking upwards to organize sessions of higher magnitudes. The virtual microscope serves as an excellent briefing and de-briefing for the practical session.

12. Closing the loop

A post activity formative assessment and comparison with the pre-activity scores could be used to evaluate the effectiveness of the session.

Conclusions

We believe these strategies will be useful and envisage that the application of these tips can help maximize learner engagement and learning. Virtual microscopy can be associated with cognitive, pedagogical, attitudinal, social, and economic benefits and linked to hone the higher order thinking skills of the students. Students take onus of their learning actively and even start to enjoy the process (Hugh & Aravinthan, 2010).

We are certain that AIMST Virtual microscopy sessions will (AIMST):

- Activate prior knowledge;
- Integrate basic and clinical sciences;
- Motivate interactive learning;
- Stimulate self-directed learning; and
- Trigger curiosity and thus encourage further reading.

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