



USE OF VIRTUAL MICROSCOPY IN HISTOLOGY LABORATORY AS AN INNOVATIVE TEACHING LEARNING METHOD FOR UNDER GRADUATE MEDICAL STUDENTS

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ABSTRACT

The COVID-19 has resulted in colleges shut all across the world. With this sudden shift away from the classroom in many parts of the globe, many institutions shifted to online learning. In undergraduate medical curriculum, histology is taught by visualising and studying the structure and function of cells. It is evident that different research areas rely on microscopic findings for diagnostic purposes. Here, we analysed the effectiveness of virtual microscopy among first professional medical students in post pandemic era by online teaching. Virtual microscopy proved that ability to learn and to understand histology component of anatomy gets increased. It also helps in enhanced student learning and save time for both students and instructors. The collection of data described here shows a vast difference in the use of virtual microscopy is better than optical microscopy among different fields of biomedical sciences.

INTRODUCTION

Histology is the study of cells at microscopic level. Histology is also important in first MBBS curriculum. Since decades, medical students are taught histology in first professional course by light microscopy using conventional light microscopes which is also called as optical microscopy. In conventional observation of slides under microscope, students look through an optical microscope at a tissue mounted on a glass microscope slide. In this fashion, the practice of optical microscopy continues a pattern of research and learning that was begun several hundred years ago.

It is evident that the whole educational system has been collapsed during the lockdown period of the novel coronavirus disease 2019 (COVID-19) not only in India but across the globe. Accordingly, need to teach through online classes became essential through modified and advanced learning system such as virtual microscopy. This study is a portrayal of online teaching-learning methods adopted to teach histology for undergraduate medical students. Virtual microscopy is slowly replacing this conventional method. In Virtual Microscopy, high-resolution digital files are created by digitally scanning high quality tissue specimens mounted on glass microscope slides. The digitized information is stored on a server in a manner that allows users to access the digital image, and to search and magnify the image. Focusing in multiple image layers and across different focal planes can also be carried out using appropriate technology. Multiple

users can access images simultaneously via the Internet if image data is set up on a web-based platform like cloud storage.

Virtual microscopy has been widely available since approximately 2005 (Ogilvie 2005, Scoville and Buskirk 2007), especially in clinical settings and in medical schools, where funds for the needed technological changes are more readily available than in two-year and four-year undergraduate colleges (Wilson *et al.* 2016, Vainer *et al.* 2017).

It has been observed that first year MBBS students face some difficulties in conventional light microscopy learning due to gap in teaching and observations under microscope simultaneously. So, it is necessary that, the pattern of histology teaching should be updated.

Present study aims to assess the usefulness of virtual static images over conventional teaching method using light microscopy (optical microscope) and to know the perception of students towards these methods.

METHODS

All students (number of students in one academic year is 150) of first year MBBS were taught histology by virtual microscopy through google meet online teaching platform. Total of 20 lectures were taken on general histology and systemic histology. After completion of classes, assessment was done by practical examination. Students were asked to

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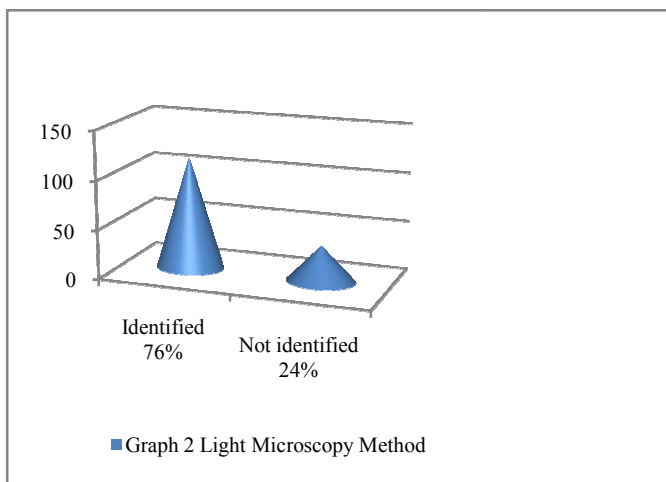
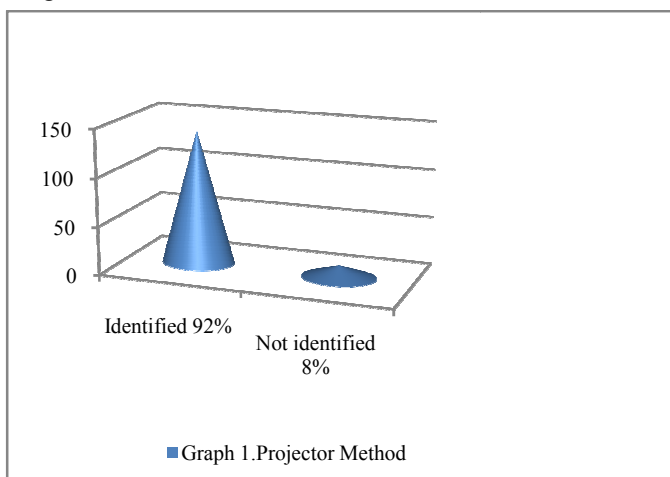
identify 15 slides (General as well as system wise) histology slides by two methods. We have used two methods for slide identification, one is conventional light microscopy followed by virtual microscopy in which we have projected same slide over projector as static image display. We have asked the students to identify the slides at first by light microscopy then same slide has to be identifying on projector. We have recorded the scores obtained by both methods then tabulated and analysed. Student's feedback on both methods were collected.

RESULTS

We found that Most of the students (92%) identified the slide very quickly on focused projector. While in conventional light microscopy 76 % students identified the slide correctly but they took extra time (around 2 minutes) for identification as compared to projector method.

All students opined that it is better to understand and identify slide at first on slide projector followed by light microscopy for more details.

It is also observed that, Students are comfortable with digital imagery, understand its provenance, and readily understand the relationship between glass microscope slides and digital images.



DISCUSSION

Microscopy typically occupies a significant amount of time in most histology laboratory periods. However, despite the many hours that students spend in the anatomy and physiology lab using optical microscopy method to learn histology, the general consensus in our department is that our students get

very little productive learning out of the time and effort that they devote to this endeavour. The reasons for this state of affairs are manifold. Large lab class sizes prevent personalized instruction, the many variations among the slides of a single tissue cause confusion, unfamiliarity with the microscope and the lack of access to microscopes and slides outside of scheduled lab class means that students cannot study the slides on their own. Student difficulties with optical microscopy are not limited to undergraduate students. The same problems appear among post graduate students.

Today's students can easily adapt to technologies like computers, software, and the Internet. In contrast, the optical microscope, with its glass and metal parts, and its manual adjustment knobs, is difficult and unfamiliar. Many students never fully master the complex skills involved in optical microscopy such as focusing on a single or multiple planes, adjusting the light, or panning over different areas of the slide. In the typical histology lab using optical microscopy, weaker students waste valuable lab time looking at unfocused images, the wrong area of the glass slide, or a slide in which the sectioning and staining are inadequate. It is impossible for instructors in large lab sections to help every student who has optical microscopy problems. Consequently, by the end of a typical optical microscopy histology lesson a large percentage of students have not mastered what they were supposed to see or learn during the lab period.

Due to COVID-19, education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. So use of virtual microscopy helped in enhancing the instructor's ability to present core principles, and can free up lab time for recitation and student-centered activities that enhance learning, such as self-study, groupwork, peer-teaching, collaborative education, and team based learning.

Virtual microscopy images can be presented in both labelled and unlabelled versions for student self-study online. The Virtual microscopy images can have explanatory text added, and can be further used in digitized in-class or on-line histology exams and for on-line learning. These options facilitate more uniform and comprehensive lab instructions. Newer instructors, who may be less familiar with the intricacies of histology or the manner in which it is taught in a specific program, will be able to prepare their lessons more effectively.

Virtual microscopy also permits students to learn histology at "any time" and "any place" (Wilson *et al.* 2016, Hoar 2017), and minimizes most of the frustration and inefficiency of optical microscopy.

So, it is necessary to update the traditional system with modern techniques including digital slide projectors and projecting microscope for effective and enhanced learning.

CONCLUSIONS

Even though Conventional optical microscope was necessary for viewing histological preparations in the histology lab prior to the current digital age, the manifold advantages of virtual microscopy in terms of access, use, pedagogy, and its effectiveness in online learning, makes it the clear choice today. The movement away from conventional optical microscopy and towards virtual microscopy in both the professions and academia has been accelerating. Numerous

virtual microscopy websites are now available online and readily accessible to educators and students. It is also evident that the pattern of histology teaching should be updated as per need of the hour. So, to conclude as per this study, best approach that should be followed is identifying slide at first on slide projector for basic details followed by light microscopy for more details. Further such type of studies should be conducted at various places with more number of participants to assess and validate its effectiveness in enhanced teaching learning and assessment method.

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