

Evaluation of student performance using a multimedia tool-virtual microscopy versus conventional method in practical teaching for undergraduate medical students.

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Abstract

Context: Virtual microscopy, a computer-based teaching learning method, that promotes digital slides in histopathology teaching-learning, is in growing trends in medical education which may enhance or replace conventional teaching methods. **Aim:** This study was aimed to evaluate the students' performance using virtual microscopy and compare it with conventional practical teaching during histopathology practicals. **Settings and Design:** A prospective cross sectional study design was carried out for a period of two months in the Department of Pathology at a medical college after obtaining institutional ethics committee approval. **Methods and Material:** A total of 125 second year medical students were randomized equally into Group A and Group B. All the students were administered a validated pre-test on the topic. Then, Group A was exposed to virtual microscopy and Group B was exposed to conventional microscopy following which both the groups were administered with posttest. Later, all the students' perception on learning through digital images was assessed by a validated feedback. **Statistical analysis:** The difference in mean score between the pretest and posttest obtained from both the methods were compared statistically using Unpaired t-test. $P < 0.05$ was considered statistically significant. **Results:** Study population selected was II year MBBS class of 147 students, hence age & gender analysis was not made. The differences in mean test scores were significantly higher in the virtual microscopy group than that of the conventional microscopy group. **Conclusions:** Thus, virtual microscopy during histopathology practical classes has provided an overall enriching education experience to the students compared to the conventional method.

Key-words: light microscope, virtual microscopy, undergraduate medical education

Key Messages: Virtual microscopy along with the conventional microscopy facilitates effective skill of self-directed learning as well as aids in better understanding of the subject among the medical undergraduates.

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Introduction

In the medical curriculum, the most important task for teaching professional is to impart meticulous knowledge to learners. Pathology, as a subject, is characterized by its image rich cognitive context, and it plays a crucial role in understanding the concept and pathogenesis of the diseases and also it focuses the patient centred learning and creates the interest among students [1,2]. In Pathology curriculum, practical sessions are an important component in the teaching and learning of histopathology during the routine practical, teaching the students to identify the histopathological features of different tissues correctly. The conventional method of training during histopathology practical class includes a brief lecture on the specimen mounted on glass slide under a light microscope, wherein the slides focused under microscope will have a limited field of vision and magnification. It has its own limitations by preventing to look the other fields of the slide. With these drawbacks, the

virtual microscopy has provided an alternative to conventional light microscope and stained section and it wherein complete digitalization of the glass slides are done and it can be focused on a computer [3-5]. Hence, we aimed to evaluate the students' performance using virtual microscopy and compare it with conventional microscopy during histopathology practicals. And also, to obtain students perception regarding effectiveness of the multimedia tool.

Subjects and Methods

A randomized cross sectional study design was carried out for a period of two months in the Department of Pathology at a medical college after obtaining institutional ethics committee approval. In the practical session, the purpose of the study was explained to the undergraduate second year medical students, out of 147 students around 125 students consented to participate in this study. After obtaining written informed consent, all of 125 students were

randomized equally by using lottery method into Group A (virtual microscopy) and group B (conventional microscopy).

Data collection

All the students were administered a validated pre-test on the topic, then the group A (virtual microscopy) in addition to brief lecture teaching, microscopic images were shown virtually as digital images through computer; whereas, group B was exposed to traditional teaching of brief lecture and conventional microscopy of the planned existing practical classes in the consecutive two months practical period of eight classes. At the end of their respective study period, both the groups were assessed on the knowledge acquired as a validated posttest. Later, the students in group B (conventional microscopy) were also introduced to the multimedia tool-virtual microscopy. Finally, all the students' perception of both multimedia tool and conventional method teaching were assessed with a validated feedback form using a Likert scale ranging from 0 to 4. The Cronbach Alpha coefficient reliability score of the questionnaire used for the feedback survey was 0.87.

Statistical Analysis

Data collected was entered in Epi info version 7.2.1.0. Data analysis was done using SPSS software version 24.2. The difference in mean score between the pre-test and posttest of group A and group B were compared statistically using Unpaired *t*-test. $P < 0.05$ was considered statistically significant.

Results

A total of 125 students were included in the study with 63 students in Group A (Virtual microscopy) and 62 students in Group B (conventional microscopy) who were administered with pre and post-test. Later, all the students' perception on learning through digital images was assessed by a validated feedback.

Evaluation of students' performance of the virtual as well as conventional microscopy was done by comparison of pre- and

post-test scores of each group by Student's paired *t*-test and was found that both Group A (Virtual microscopy) as well as in Group B (conventional microscopy), the difference in scores were statistically significant ($P < 0.001$) (Table 1).

Comparison of the difference the mean test scores between the virtual microscopy group and the conventional method group was highly significant as well ($P < 0.001$) (Table 2).

Feedback on learners' perception about teaching method through virtual microscopy on 5-point Likert's scale revealed that more than two third of the participants either 'strongly agreed' or 'agreed' that the content in digital images were interesting, increased their understanding and their knowledge and as a preferred method to learn pathology (Table 3).

Discussion

Virtual Microscopy produces high-resolution digitalized images of a traditional glass slide and with the feasibility to highlight, annotate, pan, and zoom. With the ease of use, adoption of Virtual microscopy is on the rise [6]. Moreover, in the year 2017, the U.S. Food and Drug Administration permitted the first whole slide imaging (WSI) system, wherein the tissue slides are read digitally to make the diagnoses, rather than viewing directly at a tissue sample mounted on a glass slide under a conventional light microscope [7].

In this study the use of Virtual Microscopy compared to the Conventional method in undergraduate histopathology practical teaching was evaluated. This research reveals a significant greater mean posttest score of the students' performance using the virtual microscopy compared to the conventional practical teaching group during histopathology practicals. Similar study on evaluation of digital microscopy in dental histology has also corroborated virtual microscopy as an efficient additive to the traditional method of teaching dental histology [8]. Traditional method in histopathology teaching involves viewing of glass slides under microscope. This method however comes along with many challenges such as difficulty in providing individual microscope to each student and also hindrances faced with storage and fading of stain of glass slides

Table1: Evaluation of students' performance by comparison of pre- and post-test scores of each group

Variable	Group 1	Group 2	Group 3	Group 4	Group 5	Overall	p value
HADS anxiety score severity (%)							
Normal	25	32	33.3	10	42.9	28.6	0.096
Moderate	40.9	28	50	10	35.7	35.2	
Severe	34.1	40	16.7	80	21.4	36.2	
HADS depression score severity (%)							
Normal	54.5	24	33.3	20	57.1	23.8	0.010
Moderate	27.3	36	41.7	80	14.3	34.3	
Severe	18.2	40	25	0	28.6	41.9	
PSQI sleep severity (%)							
Normal sleep	38.6	8	16.7	20	42.9	27.6	0.035
Moderately disturbed	27.3	20	50	30	28.6	28.6	
Severely disturbed	34.1	72	33.3	50	28.6	43.8	

*Values are expressed as mean $\pm$ SD.

Table2: Comparison of mean difference in test score between the group A and group B.

PSQI	Anxiety category				P value
	Normal	Moderate	Severe	Total	
Normal	13(44.8)	12(41.4)	4(13.6)	29(27.61)	0.013
Moderate	9(30.0)	11(36.7)	10(33.3)	30(28.57)	
Severe	8(17.4)	14(30.4)	24(52.2)	46(43.80)	
Total	30(28.6)	37(35.2)	38(36.2)	105	
PSQI	Depression Category				P value
	Normal	Moderate	Severe	Total	
Normal	20(69.0)	5(17.2)	4(13.9)	29(27.6)	0.001
Moderate	13(43.3)	13(43.3)	4(13.3)	30(28.57)	
Severe	11(23.9)	18(39.1)	17(37.0)	46(43.80)	
Total	44(41.9)	36(34.3)	25(23.8)	105(100)	

*Values are expressed as mean $\pm$ SD.

Table 3: Feedback on learners' perception about teaching method through virtual microscopy on 5-point Likert's scale with rating (% of students, n=124).

S.No	Questions perception method about through virtual microscopy	Strongly agree (1) Frequency n(%)	Agree (2) Frequency n(%)	Neutral (3) Frequency n(%)	Disagree (4) Frequency n(%)	Strongly disagree (5) Frequency n(%)
1	The content in the digital slides was interesting	48 (39.2)	58 (46.4)	18 (15.2)	0	0
2	Increased Knowledge and improved personal confidence	59 (47.2)	25 (20)	35 (28)	1(0.8)	5(4.0)
3	The digital images made the information easier to understand	56(44.8)	55 (44.0)	12 (9.6)	1(0.8)	1(0.8)
4	I enjoy the classes that use the digital images.	51 (40.8)	57 (46.4)	13(10.4)	2(1.6)	2(1.6)
5	Helped me to integrate theory and practicals	34 (27.2)	62 (50.4)	26 (20.8)	2 (1.6)	1(0.8)
6	Session was very interactive	14 (11.2)	49 (39.2)	50(40.8)	8 (6.4)	4(3.2)
7	All the practical topics should be taught by this method	46 (36.8)	56 (44.8)	17 (13.6)	4 (3.2)	2(1.6)
8	We got to know what to focus in the images	48 (38.4)	50 (40.0)	22 (18.4)	3(2.4)	2(1.6)
9	The identification of histopathology was easier in practical sessions	32 (25.6)	48 (39.2)	37(29.6)	7 (5.6)	1 (0.8)
10	Made pathology as easy subject	48 (38.4)	37 (29.6)	17 (14.4)	11 (8.8)	12(9.6)

with time [9]. Computer assisted teaching has been one of the growing trends in medical education which may enhance or replace conventional teaching methods. Virtual microscopy is one such computer-based teaching strategy that promotes digital slides in histopathology education. The advantages with digital slides are being an effective model for either active discussions as small group teaching or self-directed learning and can also be accessed by the students even after their practical hours and the ability to annotate, navigate and familiarize with the slides [10].

Students' feedback is always a major criterion in evaluating newer teaching methods. In this study, feedback evaluation revealed that majority of the students strongly agreed that digital images made the understanding of the subject easier 56(44.8%) and gained more knowledge 59 (47.2%). Also, 62 (50.4%) students agreed that training through Virtual microscopy helped in integration of theory with practicals. This is in accordance to a similar study done by Amer MG et al were about 72% of the students either strongly agreed or agreed using virtual microscopy and its aid in learning histology and applying knowledge [11].

However, some barriers with the use of virtual microscopy are higher cost, lack of standard guidelines involved in validation of the multimedia tool and the sceptical thought of loss of skill in handling a light microscope [12]. The limitation of this study is that it was single institution-based study and its findings cannot be generalized. This entails that further studies are required to be conducted in a number of different topics with cross over, to minimize the selection bias and for better generalization.

Conclusion

Thus, virtual microscopy during histopathology practical classes has provided an overall enriching education experience to the students and hence integration of virtual microscopy along with the traditional method facilitates effective skill of self-directed learning as well as aids in better understanding of the subject among the medical undergraduates. This study emphasize that the use of

virtual microscopy. This study emphasizes that the use of virtual microscopy as a teaching method aid students improve their understanding and incite more interest in histopathology.

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