Original Article

Integrated virtual teaching, learning and testing in histology: A student's perspective

Fatima Maria De Souza [1], Nandini Milind Karapurkar [1], Quadros Clarista Meleena [1], Jyothi Judith Alvares [1*]

[1]Department of Anatomy, Goa Medical College, Bambolim, Goa–India, 403202.

Article Info

Article history:
Received 24 Mar. 2023
Accepted 16 Aug. 2023
Published 16 Apr. 2024

***Corresponding author:**
Jyothi Judith Alvares, Senior Technician, Department of Anatomy, Goa Medical College, Bambolim, Goa–India, 403202.
Email: alvaresjv@gmail.com

How to cite this article:
De Souza FM, Karapurkar MN, Meleena QC, Alvares JJ. Integrated virtual teaching, learning and testing in histology: A student's perspective. J Med Edu Dev. 2024; 17(53): 72-81.

Abstract

Background & Objective: The Epidemic Act invoked during COVID-19 pandemic restricted the use of traditional methods of face-to-face teaching and learning and entailed a drastic transition of teaching histology by the time-tested traditional mode in the laboratory to that on a virtual platform. Implementation of this virtual platform as the teaching methodology in histology which evolved as a result of the pandemic can now be continued as an important new teaching-learning modality even after COVID-19 restrictions have been lifted. Hence, this article explores the effect of the use of appropriate technology on students for teaching and learning.

Materials & Methods: The study undertaken at Department of Anatomy, Goa Medical College employed a non-interventional (cross-sectional) design. First year medical students participating in the online histology sessions were subjects in this study (n=144). The data collected comprised of perceptions regarding the new teaching-learning study tool which were recorded as a self-administered questionnaire imparted to them through a Google form. The responses were analyzed using chi-square test and p-values were obtained using SPSS.

Results: Results indicated that virtual teaching provided the students with accessibility, flexibility, additional data and better retention of concepts. But the students ultimately were of the opinion that virtual teaching followed by laboratory teaching was the most preferred approach to learning. This preference of the integrated approach used in this study as compared to traditional classroom teaching was confirmed and found to be statistically significant as the p- value was $0.001<0.05$.

Conclusion: While the study aims to evaluate the efficacy of the newly implemented integrated method as a preferred tool in current day teaching-learning versus the traditional teaching method, it also highlights the potential grey areas faced by the students using this virtual learning environment.

Keywords: COVID-19, first year medical students, histology, questionnaire, virtual platform

Introduction

Virtual or e-learning is a platform where students can perform a wide range of exercises with a help of a computer-based environment (1). Moreover, several reports state that a combination of traditional and electronic teaching methods improve the overall outcome of student learning (2). Virtual microscopy and interactive online resources which are the e-learning tools can induce competency, confidence and satisfaction among the students (2). E-learning with its new innovations has brought about a revolution in education by allowing individualised or adaptive learning while at the same time enhancing collaborative learning hence transforming the role of the teachers (3). Various researchers have recorded that the implementation of e-learning in medical schools is also on the rise as it represents most of the educational models applied to improve teaching and learning (3-6). The adoption of virtual microscopy has created a real-world

laboratory for exploring ways of reforming the learning environment (7, 8).

A holistic approach of teaching histology to undergraduate medical students had never been adopted in the Department of Anatomy, Goa Medical College. Prior to the COVID-19 pandemic, the traditional method of teaching histology involved delivering a didactic lecture which was followed by small group teaching of the histology practical wherein the slide under study was viewed through a microscope. A simplified diagram was then made available through a chart that was reproduced in the student's histology journal. The entire exercise of completing a single system in histology took approximately two weeks, given that the student strength is 180.

The disruption of on-campus classes due to the ongoing COVID-19 pandemic resulted in a drastic transition of teaching histology from the traditional to the virtual platform mode, so as to ensure completion of the pending syllabus. This transition saw a holistic approach in teaching undergraduate histology. The present study aimed to evaluate the perception of effectiveness of the integrated teaching trend as an efficient, cost-effective and more approachable tool for learning as compared to conventional/traditional teaching and the possibility of continuing it post COVID-19.

Materials & Methods

Design and setting(s)

This cross-sectional study was conducted by the Department of Anatomy, Goa Medical College, Bambolim, Goa–India. The COVID-19 lockdown implemented from late March 2020 resulted in cessation of classes in the physical mode. The content of this study included the second semester histology portion and utilized the Cisco Webex platform made available by the Institution for conducting online classes.

Participants and sampling

Of the 180 first year medical students, (Academic year 2019-2020), a total of 144 participated in the online histology sessions were subjects in this study and formed the inclusion criteria for the study and participation was entirely voluntary and confidential. They were offered a self-administered questionnaire made available through Google Forms. Thus, the exclusion criteria were students who did not submit the self-administered questionnaire which consisted of four sub titles; preview, accessibility, teaching and learning to which the responses were mainly dichotomous. An implied consent was collected from the participants and responses were coded to prevent identity of participants from being revealed. The participants were in the age group of 17-18 years and of varying ethnicity and socio-economic status.

The response rate was calculated by dividing the total number of responses by the number of total questionnaires sent to all the students of the batch (sample size). This was then multiplied by 100 to get the response rate of 80% (Figure 1).

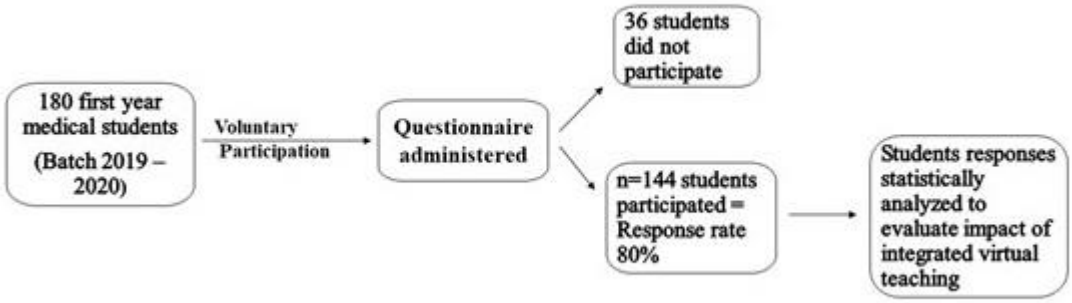

Figure 1. Flow Chart of the study

Tools/Instruments

On completion of the 4 sessions, a single subjective self-administered questionnaire comprising of 22 questions was made available through Google Forms. The consent of the participants was recorded in the Google Form and the students were assured of the confidentiality of their

personal information. The questions in the questionnaire were classified under the following four domains: Preview, Accessibility, Teaching and Learning. The responses were recorded mainly in Yes /No format (Table 1).

Table 1. Questionnaire submitted to the first-year medical students (Batch 2019-2020)

Sr. No.		Item	Response
1	Preview	A) Did you read before the class?	Yes/No
		B) Was the time schedule convenient?	Yes/No
2	Accessibility	A) Were you able to access the content smoothly?	Yes/No /Sometimes
		B) Was the content audible?	Yes/No /Sometimes
3	Teaching	A) Would you prefer didactic lecture followed by the routine histology practical?	Yes/No
		B) Is virtual slide microscopy better for orientation and understanding of histology slides then traditional method?	Yes/No
		C) Is this integrated approach providing a holistic picture of the subject under study?	Yes/No
		D) Was the duration/time allotted enough to understand the concept in virtual teaching?	Yes/No
		E) Is the uniformity of teaching enhanced as only one teacher is involved in teaching the entire class a topic as compared to divided batches in traditional teaching?	Yes/No
		F) Is virtual teaching an effective method to learn and practice histology diagrams?	Yes/No
		G) Does virtual summarizing/quizzes/MCQs stimulate and motivate you better than traditional method?	Yes/No
		H) Will virtual teaching method enhance your performance at the histology Viva?	Yes/No
3	Learning	A) Were the learning resources like slide image, slide description and discussion appropriate and adequate in understanding the topic?	Yes/No
		B) Did virtual teaching improve the level of participation and engagement in the learning process as compared to the traditional histology lecture and practical?	Yes/No
		C) Did you like the "anytime, anywhere" learning method?	Yes/No
		D) Will virtual teaching help you learn histology slides without the need to visit the histology lab or if absent for histology practical?	Yes/No
		E) Will virtual teaching enhance the quality of diagrams in the histology journals?	Yes/No
		F) Would virtual teaching boost your confident during Viva?	Yes/No
		G) Will this approach of virtual teaching enhance retention of concepts?	Yes/No
		H) Is virtual teaching a cost-effective learning method?	Yes/No
		I) Did virtual teaching improve your understanding of basic concepts?	Yes/No
		J) Did you learn any useful additional information by virtual teaching?	Yes/No

Data collection methods

This study comprised of four separate online morning sessions of one-hour duration each over a period of ten weeks, between August 2020 and October 2020. In each session the content was structured as follows: A theoretical session replete with diagrams explained the highlights of the tissue under study. This was reinforced by photomicrographs of the same from diFiore's Atlas of Histology with Functional Correlations (9). An interactive session with the students was held to address any queries. Next, photomicrographs of the various slides available in the department were taken with a 64 Megapixel camera (Samsung M 31 Quad camera) under low power (10X) and an overview of the topic was explained to the students. This was followed by a detailed explanation of the individual components under high power (45X). A schematic histology diagram hand-drawn by the department's artist showing the salient features of the slide was then exhibited and the students were encouraged to practice the same for replication in their histology journals. The procedure was repeated for each slide and the session ended with a virtual quiz. The student's responses to the quiz were received in the chat box and an immediate feedback (correct response) was given by the teacher.

Data analysis

The responses were analysed using the chi-square test and p-value was obtained between the following variables: a) use of virtual slide microscopy compared to traditional method versus integrated approach providing a holistic picture of the subject, b) preference of the "anytime anywhere" learning method along with its cost effectiveness compared to the traditional classroom teaching and c) enhanced retention of concepts using virtual teaching approach and understanding of basic concepts.

Results

Preview

The academic curriculum details the list of lectures and practical for any academic course, so that students are aware of the classes scheduled for them. It was observed that 58 students (40%) prepared for the class by reading the topic, while 86 students (60%) did not (Figure 2A). While the scheduled time of a morning slot was convenient for 119 students (83%) as against 25 students (17%) who found the time inconvenient (Figure 2B).

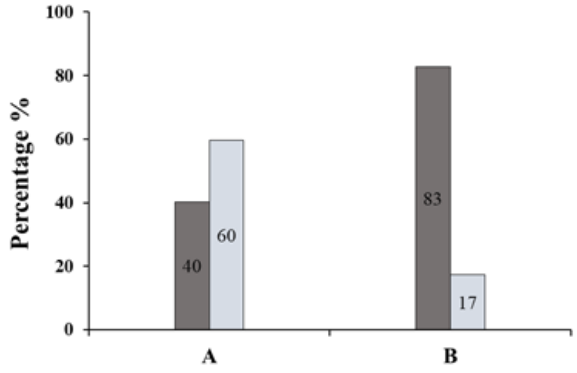

Figure 2. A. Student's preparation before the class: (40%-Prepared; 60%-Not prepared)
B. Convenience of the time schedule: (83%-Convenient; 17%-Not convenient)

Accessibility

Noted in this study was that a total of 67 students (47%) were able to access the online content smoothly at all times, while 62 students (43%) accessed the content smoothly but with intermittent connectivity issues and the remaining 15 students (10%) were unable to access the content smoothly throughout the one-hour session (Figure 3A). Ninety-six students (67%) reported that the complete content was clearly audible to them throughout the sessions while 46 students (32%) had intermittent difficulty in hearing the sessions and to 2 students (1%), the content was inaudible (Figure 3B).

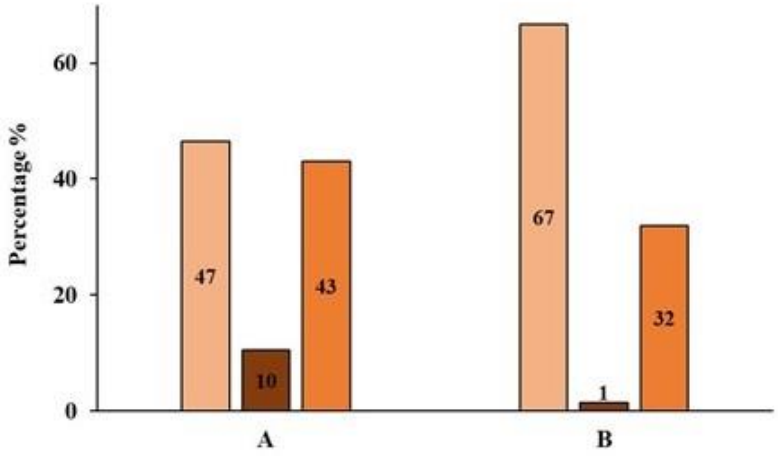

Figure 3. Accessibility to the online lecture
A. Smooth access of the content
B. Audibility of content: Yes (peach), No (brown), Sometimes (orange).

Teaching

Teaching using the didactic lecture followed by the routine histology practical was preferred by 124 students (86%) (Figure 4A). In this study, sixty students (47%) considered virtual slide microscopy better for orientation and understanding of histology slides than traditional method (Figure 4B). We observed that 108 students (75%) in contrast with 36 students (25%) stated that an integrated approach provides a holistic picture of the histology topic under study (Figure 4C). As reflected in the questionnaire, 109 students (76%) agreed that the duration/time allotted to understand the concept in

virtual teaching was adequate and the topic was adequately covered in the allotted time frame (Figure 4D). In this study, 124 students (86%) (Figure 4E) felt that the uniformity of teaching was enhanced as only one teacher was involved in teaching the same topic to the entire class as compared to the smaller batches taught by different teachers in the otherwise traditional method. This study also recorded that 50% of students agreed that virtual teaching is an effective method to learn and practice histology diagrams as against 50% who disagreed on the same (Figure 4F). Further in our study the online multiple-choice questions and virtual quizzes conducted, motivated 111 students (77%) (Figure 4G) and 50% students in this study felt that virtual teaching method would enhance their performance at the histology viva (Figure 4H).

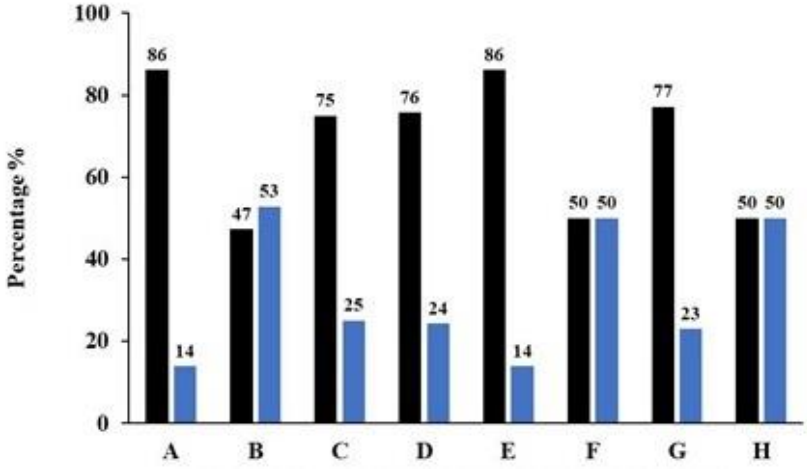

Figure 4. Student's response to online teaching methods: Yes (black), No (blue)

Statistical analysis inferred that, there was no significant difference (p-value = 0.215 > 0.05) in preference for didactic lecture followed by routine histological practice. However, the students preferred the integrated approach used in this study as it provided them with a holistic overview, this result was statistically significant at p-value = 0.001< 0.05.

Learning

In this study, 116 students (81%) found that the learning resources like slide image, slide description and discussion were appropriate and adequate in understanding the topic (Figure 5A). Our observations revealed that virtual teaching improved the level of participation and engagement in the learning process in 50% of the participants as compared to the traditional histology lecture and practical (Figure 5B). As recorded in this study, 106 students (74%) liked the "anytime, anywhere" learning method as against 38 students (26%) (Figure 5C), while 87 students (60%) felt that there was still a need to view the histology slides in the histology lab even after the virtual teaching session (Figure 5D).

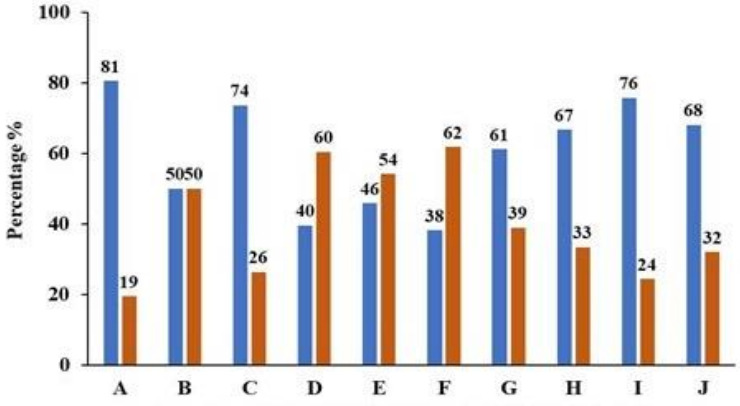

Figure 5. Students response to online learning methods; Yes (blue), No (dark orange)

This study indicated that virtual teaching would not enhance the quality of diagrams in the histology journals as reported by 78 students (54%) while 66 students (46%) thought that virtual teaching would enhance the quality of diagrams in their histology journals (Figure 5E). Similarly, 89 students (62%) in our study disagreed and only 55 students (38%) (Figure 5F) were of the opinion that virtual teaching would boost their confidence during the formative and summative viva; 88 students (61%) reported that this approach of virtual teaching would enhance retention of concepts (Figure 5G); ninety-six students (67%) (Figure 5H) strongly felt that virtual teaching can be a cost-effective learning method as it decreases commuting and other expenses required to attend in-person classes. Further as per our study, 109 students (76%) of students were of the opinion that understanding of basic concepts was improved by virtual teaching, while 35 students (24%) felt that virtual teaching was not of any help (Figure 5I). From this study it was learnt that 98 students (68%) found virtual teaching useful in providing additional information on the topic as compared to 46 students (32%) who disagreed (Figure 5J). Not only did the students prefer the "anytime anywhere" learning method but they also found it cost effective as it cut down on commuting time and cost. The p-value =0.0000340 < 0.05 was highly significant.

A highly significant p-value = $0.0006 \times 10^{-11} < 0.05$ was also obtained which clearly confirmed that virtual teaching not only improved the understanding of basic concepts but also enhanced retention of the same.

Discussion

During traditional teaching, students generally utilize all their time in class taking notes without paying much attention to the content, leading to accumulation of irrelevant matter that is difficult to understand. According to Sickler (10), such a situation leads to frustration, anxiety and high levels of stress. In order to avoid this, the students must recognize the significance of pre-reading before the class unlike that reported in this study. Pre-reading implies a state of preparedness before learning takes place, while trying to integrate new learning material with previous knowledge (11). The willingness to learn is demonstrated by the fact the student reads before the class and it is one of the nine secrets of learning (12). According to Ausubel, et al. (13), the single most important factor influencing learning is what the learner already knows and this enhances the overall effectiveness of the topic. Yet another aspect of learning is subsumption wherein new material is related to relevant ideas in the existing cognitive structures (14). Pre-reading helps students connect lecture content with prior knowledge and integrates new concepts of a lecture into meaningful generative learning (15-17). In contrast, Qiao & Zhao (18) stated that the learning effect results from the student's prior knowledge in the field and was unrelated to the pre-reading strategy.

Rajashree et al. (19) and Yeung et al. (20) in their research articles, highlighted the importance of internet connectivity for the success of e-learning, while, according to Dhir et al. (21) high speed internet connection is required to ensure proper downloading. In another research study conducted by Lightner & Olson (22), students expressed concern that there were cases of disrupted video or audio connections and some students explicitly identified technical problems as being a difficulty unlike that reported in this study wherein 67% reported complete audibility of the course content. The students preferred didactic lecture teaching followed by routine practical and many considered the virtual slide microscopy better for understanding concepts. This is in keeping with the research conducted by various authors who also reported that both theory and practical go hand in hand in the learning process (23-28). This is similar to a study conducted by Abdollahi et al. (29) who indicated that virtual slide microscopy is as effective as conventional method. Our results are also in agreement with that reported by Chakraborty et al. (30) while disagreed with Al-Neklawy (31), who believed that the traditional didactic lecture cannot provide adequate time for deeper learning activities as compared to virtual teaching. The students through the questionnaire also confirmed the findings of Dhir et al. (21) who highlighted that uniformity in virtual teaching is maintained since identical information is made available to all the participants. This also concurred with the findings of Al-Shorbaji et al. (6) and Hadley et al. (32) who reported that in virtual teaching, equal availability of quality and quantity of information dispersed helps in the uniform attainment of learning objectives.

Our study also recorded that majority of the students agreed that virtual teaching is an effective method to learn and practice histology, as against Das et al. (33) who stated that the preferred way was drawing the diagram after seeing the slide focused under the microscope. The students in this study also revealed that online histology teaching could be used as a motivational tool which would eventually enhance their performance

at the routine histology viva. This corroborated with the findings of Chakraborty et al. (30) who stated that deep learning, retention of knowledge, developing dissection skills, and confidence building were enhanced while utilizing e-learning tools. Ayman & Foad (34) in their research compared students who were taught using conventional light microscopy versus those who were taught with virtual microscopy and found that the students in the latter group performed better in both practical and written exams.

Similar to the findings from this study that learning resources like slide image, description and discussion were appropriate and adequate in understanding the topic, Lichnovská et al. (35) revealed that virtual histology slides would give a better resolution and image quality to the photomicrograph making it a user-friendly and more efficient educational tool for students. Virtual teaching engages the student through different activities like observation, listening, reading, thinking, acting and doing as stated by Mahajan (36). Thus, it caters to a wide range of learning styles as compared to traditional learning methods. The students become more actively involved as learners in virtual teaching as they are not only gathering information but are also taking an active part in the learning process through an interactive session as also reported by Stanley & Edwards (37) in many cohorts. Stonebreaker & Hazeltine (38) described virtual learning as the delivery of learning through electronic media that reduces the gap when the instructor and the learner are separated in either time or place. Virtual learning environments allow the students to learn without physically attending the classes and give the students flexibility to manage their time more effectively (36,39). Our study also showed that students preferred the anytime anywhere learning method. Even though Abdollahi et al. (29) reported that students benefit from virtual class regardless of the availability of laboratory and physical atmosphere, this was not in keeping with the findings in our study.

Maki et al. (40) in his study reported that the pros of virtual learning environments included improvement in the learners' achievements. However, majority of the students in our study disagreed and very few were of the opinion that virtual teaching would boost their confidence during the formative and summative viva. According to Mahajan (36), conceptualization facilitates understanding, recall, integration and application of knowledge. This also corroborates with the results of this study wherein students have reported that this approach of virtual teaching would enhance retention of concepts.

More than half of the students who participated in this questionnaire agreed with reports by Fedynich (41) and Yilmaz (42) that virtual teaching can be a cost-effective learning method as it decreases commuting and other expenses required to attend in-person classes.

A study conducted by Henning & Schnur (43) comparing groups of traditional learning system and a virtual learning environment group in medical education found that the knowledge gained by virtual teaching is twice as great for the e-learning group than for the traditional learners. While, Juliani et al. (44) reported that students gained more knowledge, better skills and felt more satisfied by understanding the topic better, due to increased interaction with the other students, easy accessibility and flexibility.

However, the findings of our study revealed that students found virtual teaching useful in providing only additional information on the subject and this corroborated in a study by Chakraborty et al. (30), who also felt that Anatomy tools for e-learning contributed to basic concept building.

The self-designed integrated virtual teaching, learning method adopted in this study was based and implemented on the learning resources available in the institute. Data from other anatomy topics which were also taught via virtual methods were not considered. The questionnaire entailed mainly dichotomous responses and the data collection tool used in the study was not validated for its reliability and validity which is a limitation of the study. Also, the study was not applied to first year dental, nursing and allied health science courses.

Conclusion

In conclusion, majority of the students were of the opinion that the virtual holistic approach enhanced both the uniformity of teaching and deeper understanding of the subject. The cost effective, anytime-anywhere facility provided them with useful additional data and improved retention of concepts, while the virtual quizzes motivated learning. However, in the student's opinion, virtual teaching followed by a hands-on laboratory session was the preferred approach to learning as this helped in boosting their confidence to answer exams and viva voce. Even though the pandemic did entail a new direction of teaching and definitely changed the whole modality of undergraduate teaching-learning concepts, this hybrid model could be the preferred tool in current day teaching-learning.

Ethical considerations

The study was initiated only after the approval was obtained from the Institutional Ethics Committee Goa Medical College (Approval dated 13/06/2020) and Research Advisory Committee, Goa Medical College, communicated to the authors via No 6/673/2020/E1/ GMC/3089 dated 05/08/2020.

Acknowledgments

Nil.

Disclosure

Nil

Author contributions

Financial interest: Nil.

Conflict of interest

Nil.

Data availability statement

Not applicable.

References

1. Koskela M, Kilti P, Vilpola I, et al. Suitability of a virtual learning environment for higher education. The Electronic Journal of E-Learning. 2005; 3(1): 23-32.

2. Ariana A, Amin M, Pakneshan S, et al. Integration of traditional and e-learning methods to improve learning outcomes for dental students in histopathology. Journal of Dental Education. 2016; 80(9): 1140-1148. [PMID: 2758758]

3. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of e-learning in medical education. Academic Medicine. 2006; 81(3): 207-212. [https://doi.org/10.1097/00001888-200603000-00002]

4. George PP, Papachristou N, Belisario JM, et al. Online e-learning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction. Journal of Global Health. 2014; 4(1): 10406. [https://doi.org/10.7189/jogh.04.010406]

5. Ellaway R, Masters K. AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment. Medical Teacher. 2008; 30(5): 455-473. [https://doi.org/10.1080/01421590802108331]

6. Al-Shorbaji N, Atun R, Car J, et al. E-learning for undergraduate health professional education - a systematic review informing a radical transformation of health workforce development. World Health Organization, Geneva. Available from: [https://apps.who.int/iris/handle/10665/330089]. 2015

7. Helle L, Nivala M, Kronqvist P, et al. Traditional microscopy instruction versus process-oriented virtual microscopy instruction: A naturalistic experiment with control group. Diagnostic Pathology. 2011; 6:8. [https://doi.org/10.1186/1746-1596-6-S1-S8]

8. Nivala M, Saljo R, Rystedt H, et al. Using virtual microscopy to scaffold learning of pathology: A naturalistic experiment on the role of visual and conceptual cues. Instructional Science. 2012; 40(5): 799-811. [https://doi.org/10.1007/s11251-012-9215-8]

9. Eroschenko VP. DiFiore's Atlas of Histology with functional correlations. 12th ed, Wolters Kluwer/Lippincott Williams & Wilkins. 2013.

10. Sickler AZ. Study strategies for before, during, and after class. faculty focus, higher ed teaching strategies from magna publications. 2017. [https://www.facultyfocus.com/articles/teaching-and-learning/study-strategies-class/]

11. Zhang CX. Educational psychology. (Lond) Taiwan, Taipei: Tunghua. 2001.

12. Wade C, Tavris C, Garry M. The Nine Secrets of Learning. Psychology (11th ed.). 2014. [https://www.apa.org/ed/precollege/psn/2013/09/learning-secrets]

13. Ausubel D, Novak J, Hanesian H. Educational psychology: a cognitive view. (2nd ed) Holt, Rinehart & Winston, New York. 1978. [https://books.google.co.in/books/about/Educational_Psychology]

14. Kearsley G. The Theory into Practice Database. [http://tip.psychology.org/ausubel.html. 2000]

15. Peper RJ, Mayer RE. Note-taking as a generative activity. Journal of Educational Psychology. 1978; 70: 514-522. [https://doi.org/10.1037/0022-0663.70.4.514]

16.Ausubel DP. The influence of experience on the development of intelligence. In: Aschner MJ, Bish CE. (2eds.), Productive Thinking in Education, Washington, DC: National Education Association. 1968

17. Wittrock MC. Learning as a generative process. Educational Psychologist. 1974; 11: 87-95. [https://doi.org/10.1080/00461527409529129]

18. Qiao XT, Zhao ZX. Design of the test system for experiment preparation through internet. Journal of Zhongyuan University of Technology. 2008; 19(4): 64-67.

19. Rajashree R, Parineeta P, Ravishankar MV. Effective use of E- learning in basic medical sciences. National Journal of Basic Medical Sciences. 2012; 2(4): 320- 324.
20. Yeung JC, Fung K, Wilson TD. Prospective evaluation of a web- based three-dimenttional cranial nerve stimulation. Journal of Otolaryngology - Head and Neck Surgery. 2012; 41: 426-436.
21. Dhir SK, Verma D, Batta M, et al. E-Learning in Medical Education in India. Journal of Indian Paediatrics. 2017; 54: 871-877.
[https://doi.org/10.1007/s13312-017-1152-9]
22. Lightner S, Olson C. Offering a globally-linked international accounting course in real- time: a sharing of experiences and lessons learned. Journal of Accounting Education. 2001; 19(4): 247-263.
23. Holmström I, Larsson J. A tension between genuine care and other duties: Swedish nursing students' views of their future work. Nurse Education Today. 2005; 25(2): 148-155.
[https://doi.org/10.1016/j.nedt.2004.11.005]
24. Seacomb J. A systematic review of peer teaching and learning in clinical education. Journal of Clinical Nursing. 2008; 17(6): 703-716.
[https://doi.org/10.1111/j.1365-2702.2007.01954.x]
25. Avis M. Freshwater D. Evidence for practice, epistemology, and critical reflection. Nursing Philosophy. 2006; 7(4): 216-224.
[https://doi.org/10.1111/j.1466-769X.2006.00267.x]
26. Binding LL, Morck AC, Moules NJ. Learning to see the other: a vehicle of reflection. Nurse Education Today. 2010; 30(6): 591-594.
[https://doi.org/10.1016/j.nedt.2009.12.014]
27. Tveiten S, Severinsson E. Communication - a core concept in client supervision by public health nurses. Journal of Nursing Management. 2006; 14(3): 235-243.
[https://doi.org/10.1111/j.1365-2934.2006.00536.x]
28. Welch L, Jeffries PR, Lyon BL, et al. Integrating theory and research into practice. Nurse Educator. 2001; 26(5): 240-243.
[https://doi.org/10.1097/00006223-200109000-00014]
29. Abdollahi A, Salarvand S, Saffar H. Comparing the efficacy of virtual and conventional methods in teaching practical pathology to medical students. Iranian Journal of Pathology. 2018; 13(2): 108-112. PMID: 30697279
30. Chakraborty S, Sharma S, Biswas S. Perceptions of 1st year MBBS students regarding utilization of e-learning tools for collaborative learning in Anatomy. International Journal of Scientific and Research Publications. 2020; 10(7): 344-351.
[http://dx.doi.org/10.29322/IJSRP.10.07.2020.p10341]
31. Al-Neklawy AF. Online embryology teaching using learning management systems appears to be a successful additional learning tool among Egyptian Medical Students. Annals of Anatomy. 2017; 214: 9-14.
[https://doi.org/10.1016/j.aanat.2017.07.001]
32. Hadley J, Kulier R, Zamora J, et al. Effectiveness of an e-learning course in evidence-based medicine for foundation [internship] training. Journal of Royal Society of Medicine. 2010; 103(7): 288-294.
33. Das S, Saha N, Chakraborty T, et al. Perception of students on histology learning method. Journal of Dental and Medical Sciences. 2019; 18(6): 11-18.
[https://doi.org/10.9790/0853-1806081118]
34. Ayman FA, Foad MD. Comparing the use of virtual and conventional light microscopy in practical sessions: Virtual reality in Tabuk University. Journal of Taibah University Medical Sciences. 2017; 12(2): 183-186.
[https://doi.org/10.1016/j.jtumed.2016.10.015]
35. Lichnovská R, Krajčí D, Erdösová B, et al. Our experience with e-learning method of teaching practical histology. Mefanet Journal. 2015; 3(2): 48-53.
36. Mahajan A. A research paper on virtual learning environment. AIMA Journal of Management and Research. 2016; 10(2/4).
[https://apps.aima.in/ejournal_new/articlesPDF/Arvind-Mahajan.pdf]
37. Stanley T, Edwards P. Interactive multimedia teaching of accounting information system (AIS) cycles: students‟ perceptions and views. Journal of Accounting Education. 2005; 23(1): 21-46.
[https://doi.org/10.1016/J.JACCEDU.2005.04.001]
38. Stonebreaker PW, Hazeltine JE. Virtual learning effectiveness: an examination of the process. The Learning Organization. 2004; 11(2/3): 209-225.
[https://doi.org/10.1108/09696470410532987]
39. Sawaan A. Studying the implications of hidden learning styles by tracing learners' behaviors in an e-learning system. Published dissertation, University of Lousville. Accessed from google books. 2006
40. Maki RH, Maki WS, Patterson M, et al. Evaluation of a web-based introductory psychology course: learning and satisfaction in online versus lecture courses. Behavior Research Methods, Instruments and Computers. 2000; 32(2): 230-239.
[https://doi.org/10.3758/bf03207788]
41. Fedynich LV. Teaching beyond the classroom walls: The pros and cons of cyber learning. Journal of Instructional Pedagogies. 2014; 13: 1.
[https://www.aabri.com/manuscripts/131701.pd]

42. Yilmaz AB. Distance and face-to-face students' perceptions towards distance education: A comparative metaphorical study. Turkish Online Journal of Distance Education. 2019; 20(1).
43. Henning, P and Schnur A. E- learning in continuing medical education: a comparison of knowledge gain and learning efficiency. Journal of Medical Marketing. 2009; 9(2): 156-162. [https://doi.org/10.1057/jmm.2009.5]
44. Juliani CMCM, Corrente JE, Dell' Acqua MCQ. Comparing the teaching-learning process with and without the use of computerized technological resources. Computers Informatics Nursing. 2011; 29(4): 212-220. [https://doi.org/10.1097/ncn.0b013e3182285c2e]