



A Study on the Performance and Perception of Medical students in Online Spotter versus Traditional Spotter Examinations

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Abstract

Introduction: Medical institutions around the world are exploring various newer modes of teaching and assessment methods to incorporate into the teaching curriculum. In this changing situation, e-learning methods are being widely used. For determining the effectiveness of a new learning method, assessment should be done since learning and assessment are intricately associated. One such newer method of testing practical anatomy knowledge is online spotter examination. The present study was conducted to correlate the students' performance between traditional and online spotter exam and analyse the students' perception about both exam patterns.

Methods: A cross-sectional descriptive study was conducted among 120 first year medical students after obtaining ethical approval from the Institute Research and Ethics committee. Students were selected using simple random sampling method. Two modes of practical examination, traditional and online spotter, were conducted. After the examination, mean scores of OSE and TSE were compared using independent sample *t*-test. A questionnaire was given to collect data on their perception about the exam pattern, and the responses were scored using Likert scale.

Results: The performance mean score in online spotter exam was higher compared to traditional spotter exam. Analysis of the students' perception about the exam pattern revealed that they preferred the online examination. This could be attributed to advantages of online teaching and learning using audio-visual aids with good quality images (84=70%), easy to answer in multiple choice question (78=65%), quick results (108=90%), absence of bias in evaluation (108=90%), easy for future online postgraduate entrance exams (114=95%), and overall time limit and its advantages (84=70%); the only drawback was anxiety about internet connectivity (96=80%).

Conclusion: Online spotter exam can be conducted for routine formative assessment under controlled conditions to improve the students' knowledge and enhance their confidence and adaptability for future online exams.

Keywords: Anatomy, Assessment, Performance, Medical students

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Introduction

In the past few years, several studies have reported various e-learning teaching modes in the field of medical education. Each mode has its own advantages and drawbacks. In this changing trend, adapting to the newer methods and testing its effectiveness are crucial for implementation (1, 2). Human anatomy is one of the subjects in medical curriculum which is important for clinical practice. The anatomy courses for undergraduate medical students are taught using traditional regional approach. Conventionally, gross anatomy is divided into region wise – upper/lower limbs, abdomen, thorax, head and neck, and neuroanatomy. Each region is spread over 6 weeks, and it is taught by didactic lectures followed by cadaver-based demonstrations. Apart from cadaveric demonstrations, alternative methods of practical demonstrations using videos, and virtual reality modes are also used (3-6). During the Covid-19 pandemic, practical demonstration was completely cut down. Owing to this situation, globally all educators moved to online mode of teaching and learning (7). One of the established e-learning modes for anatomy practical demonstration was dissection videos of cadavers recorded by anatomy faculties with specific learning needs and objectives (8, 9). These videos were made available through learning management systems. This mode of teaching helped the students to learn the objectives similar to face-to-face learning with cadaveric demonstrations. Studies have reported that using such multimedia e-learning resources is better than virtual reality videos (10, 11). These newer methods enhance the knowledge in computer-based learning and self-directed learning skills.

Traditionally, anatomists believe that the decline in knowledge is attributed to modern methods of teaching and learning (12). However, medical educationists perceive modern approaches offer contextual knowledge and give similar results in assessment as compared to traditional teaching methods and assessments (1, 2).

In implementing a newer method, three aspects have to be considered: i-when to teach, ii- how to teach, and iii-how to assess the knowledge (12-14). In regular face-to-face teaching, two types of assessment are done: region-wise formative assessment followed by summative assessment. Assessments include theory and practical examination. As a part of practical evaluation, spotter exam is conducted in dissection laboratory using prosected cadaveric specimens and bones. During the pandemic, since teaching and learning were conducted

through the online mode, traditional practical examinations could not be conducted. Hence, only online spotter examination was conducted using prosected cadaveric images and colour atlas images. Since the online spotter exam is gaining popularity, especially after the pandemic, it is essential to further evaluate the process and validate its routine usage. In this scenario, the students' performance and perception about both traditional spotter examination (TSE) and online spotter examination (OSE) are necessary for future planning and designing the assessment methods. Hence, the present study was conducted to 1) correlate the students' performance in traditional spotter examination and online spotter examination and 2) analyze the students' perception about both exam patterns.

Methods

This is a cross-sectional descriptive study which was approved by the Institute Research Ethics Committee (IRB/KMCH/ 011/2021) and written informed consent was obtained from all participants. A total of 120 students in the first medical professional year were selected for the study based on simple random sampling method. Selection was based on their convenience to attend the examination and answer the survey questions. The study was conducted in the department of anatomy over a period of six months (between January 2021 to June 2021).

Two modes of practical examination, i.e. traditional spotter and online spotter, were conducted for each of the following regions: the thorax, abdomen, head & neck, and neuroanatomy. Questions were designed by the authors according to Blooms Anatomy Tool (15). Levels one and two test the student's ability to identify, recall, describe, or distinguish anatomical structures. The third and fourth level questions test their ability to interpreting and analysing. TSE was conducted in the dissection hall following steeplechase pattern using cadaveric specimens. A total of fifteen spotter stations were set up. Each spotter station contained two questions pertaining to identification, location, nerve supply, blood supply, actions, and clinical relevance. Responses were in the free answer format (FAF). Each spotter station was timed for one minute. After the traditional examination, OSE was conducted in the same study group using computers, smart phones, and other electronic devices. Spotter questions were designed using 2D cadaveric images of prosected cadaveric specimens and images from Colour Atlas of Anatomy (16). Similar to traditional exam, each spotter question

had an image with arrows directed to point the structure. Each spotter station was not timed, but the overall time limit was set. The online questionnaire was created using Google form with timer settings and was sent to individual students by email. The entire online examination was monitored. At the end of the exam, the students submitted their Google forms, and the answers were recorded automatically. Students' scores in both examinations were entered into Microsoft excel. The spotter question included multiple-choice questions (MCQs). After the exam, the students were instructed to voluntarily complete a questionnaire (Table 1) to evaluate their perceptions of OSE and TSE. Questions were prepared following international guidelines (17, 18). Questions pertaining to the quality of specimens, image quality, time limit, answering format, time of results, and ease of examination were asked. A total of 15 questions were given. Questions were validated by subject experts and medical educationists.

Statistical analysis

All data were analysed in SPSS statistical package, version 21 (IBM, Armonk, NY) and reported descriptively. The mean scores of OSE vs. TSE were compared using independent sample *t*-test. A *p* value ≤ 0.05 was considered significant. Regarding analysis of the questionnaire pertaining to online and traditional exam pattern, the students answered the questions on a Likert scale ranging from 1-3 with 1-Disagree, 2-Neutral, 3-Agree. The responses were expressed as percentages for each item on the questionnaire. Cronbach's alpha for the items of the questionnaire was 0.82.

Ethical Consideration

This is a cross-sectional descriptive study which was approved by the Institute Research Ethics Committee (IRB/KMCH/ 011/2021) and written informed consent was obtained from all participants.

Results

A total of 120 students were enrolled in the study. All 120 students attended both examinations and then answered the questionnaire. Mean test score was higher for OSE about 8.7 ± 1.1 compared to TSE test score of 6.2 ± 1.3 . Differences observed among the scores were statistically significant ($P < 0.05$, CI 95%).

Students' perception about OSE

Each question was designed to know the students' perception regarding the online and traditional exam patterns. With respect to online examinations, about 70% ($n=84$) of students agreed that OSE with images of prosected specimens and images from colour atlas was easy to identify, 25% ($n=30$) disagreed, and 5% ($n=6$) were neutral. The majority of the participants 65% ($n=78$) felt that SAQ and MCQ were easy to answer, but 15% ($n=18$) disagreed, and 20% ($n=24$) were neutral. Self-navigating the slide, convenience of moving back and forth to answer, and ability to spend more time for difficult spotters compared to easy spotters received positive response 60% ($n=72$) from the participants. No bias in evaluation and declaration of results immediately at the end of OSE received positive response. Moreover, competitive entrance examination for postgraduate courses was conducted in similar lines with OSE. Hence, 90% ($n=108$) of the students felt that OSE

Table 1: Students' perception about the questionnaire

No.	Questions	Agreed N (%)	Disagreed N (%)	Neutral N (%)
1	Identification of Photographic Cadaveric/Color atlas images was easy.	84 (70)	30 (25)	6 (5)
2	Short answer format and Multiple choice was easy to answer.	78 (65)	18 (15)	24 (20)
3	Self-navigating the slides to answer online exams helps to answer better.	72 (60)	12 (10)	36 (30)
4	Overall time limit helped them to answer lower order questions with less time compared to high order questions.	84 (70)	12 (10)	24 (20)
5	One sitting helps to reduce the anxiety of examination.	84 (70)	12 (10)	24 (20)
6	Quick results is helpful to self-evaluate.	108 (90)	12 (10)	0 (0)
7	Online exam has no evaluation drawback unlike traditional paper assessment.	108 (90)	0 (0)	12 (10)
8	Anxiety about internet connection.	96 (80)	24 (20)	0 (0)
9	Do you feel online exam pattern will help you for online postgraduate entrance exam?	114 (95)	6 (5)	0 (0)
10	It is easy to identify the structures in traditional exam.	60 (50)	48 (40)	12 (10)
11	Moving in steeple chase pattern affected their performance.	60 (50)	60 (50)	0 (0)
12	Easy to answer free answer format.	48 (40)	60 (50)	12 (10)
13	Time limit for each spotter is disadvantage.	108 (90)	12 (10)	0 (0)
14	Do you agree bias in evaluation in traditional exam?	108 (90)	12 (10)	0 (0)
15	Online exam is better than traditional exam.	84 (70)	12 (10)	24 (20)

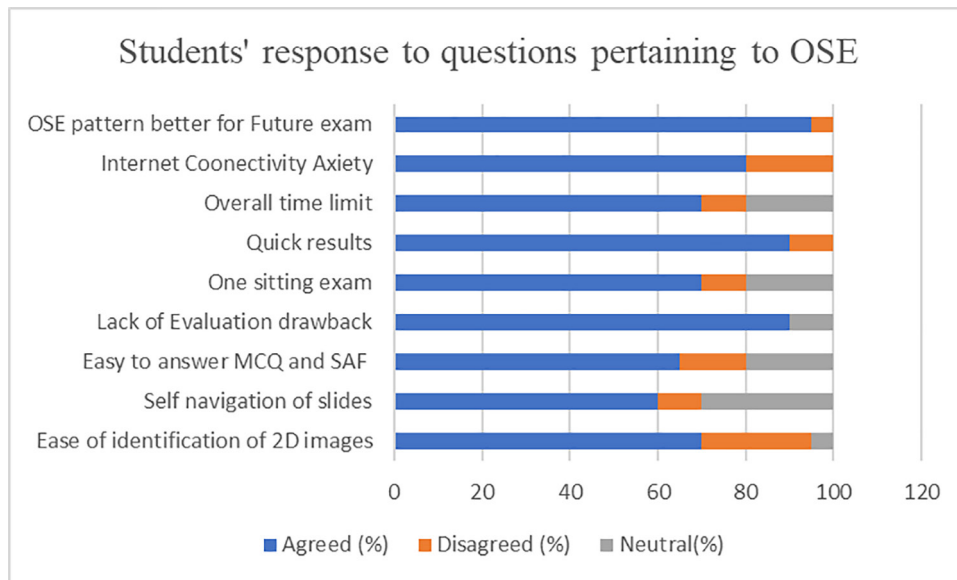


Figure 1: Students' response to questions pertaining to Online spotter exam (OSE) on Likert scale

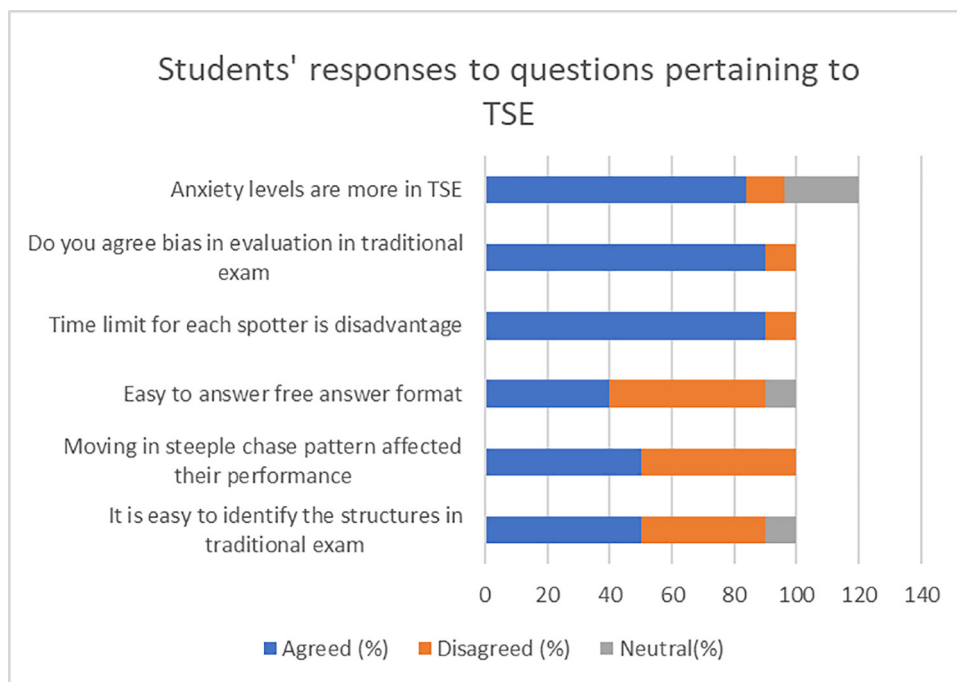


Figure 2: Students' responses to questionnaire on Traditional Spotter Exam (TSE) on Likert scale

would help them in future online exams. On the contrary, 80% (96) of the students agreed they were anxious about Internet connectivity, while 20% (24) disagreed (Table 1, Figure 1).

Students' perception about TSE

About 50% (n=60) of the students agreed that TSE with cadaveric specimens did not affect their performance, while the remaining 40% (n=48) disagreed and 10% (n=12) were neutral. Moving in steeplechase pattern and its effect on the students' performance received mixed responses with 50% (n=60) supporting it and 50% not. Only 40% (n=48) agreed that free answer format (FAF)

of answering in TSE was easy and 50% (n=60) disagreed. Time limit set for each spotter and bias in evaluation was considered to be a disadvantage by 90% (n=108) (Table 1, Figure 2).

Discussion

Learning and assessment are inte-dependent. Assessment helps to design an effective teaching learning method. Gibbs describes choosing an appropriate assessment instrument is crucial to access the learning domains (17). For testing a particular domain, assessment has to link the objectives and learning outcomes. Earlier studies have reported that, in the subject of

human anatomy, practical examination is the most recommended method of assessment and inclusion of newer pedagogical methods such as OSE is the need of the hour (18, 19). A well-established practical method to test the cognitive domain is Spotter exam.

Students' performance in the examinations

In the literature search, it was found that the scores in practical examination were the same in traditional and online spotter examinations conducted among students enrolled in medical and allied medical courses (20, 21). However, the findings of the present study are not in the same line with earlier studies. We found that student's performance was higher (8.7 ± 1.1) in OSE. Performance in an exam is dependent on several factors such as high-stake or low-stake exam, teaching method, learning styles, pattern of the exam, question and answer format, time limit, and evaluation method (21, 22).

In the present study, OSE was conducted as part of formative assessment to test the students' knowledge at periodic intervals. Scores obtained in formative assessments have a cumulative/considerable percentage in summative exam score calculation. Hence, the student's performance in formative assessment is significantly important for securing better scores in summative exams. With introduction of online teaching and assessment methodologies, student's familiarity with online learning has dramatically improved by the virtue of its routine usage. This could be one of the reasons for better scores in the current study. Based on the teaching method, students adopt suitable learning styles. In traditional teaching, students learn with prosected specimens of cadavers and dry bones in dissection laboratory. This type of learning is a deep learning style, whereas in online teaching, learning is done with recorded videos of prosected specimens which is a strategic learning style (23, 24). In this context, choosing an appropriate assessment complimenting the teaching methodology is important for better outcome. During the pandemic, online teaching was the only mode. Hence, the students were assessed online. Since the teaching and assessment modes were aligned with each other, students were able to perform better in OSE.

In traditional exam, the quality of specimen used is highly variable since it depends on dissection technique, preservation, storage, and display. However, in online exam, high resolution pre-validated images are used which provides consistency and reliability to the examination (21, 22). The same has been agreed by 70% of

the students in the current study.

Furthermore, during the steeplechase pattern, chances of mishandling the specimens by students is higher which can affect the outcome (23). Such default can be completely avoided in OSE. Considering the above drawbacks, OSE is superior without any interference by students during the exam.

Answering format depends upon the mode of exam. Short answer question (SAQ) and MCQ in OSE have an advantage over free answer format (FAF) in TSE since it requires less time to type the answer for each question (25). In traditional FAF, the answer sheets are manually corrected by the faculties. This might cause bias among the evaluators, which could be one of the reasons for low score/performance. Evaluation bias is absent in online assessment which reflects the true performance of the student. Hence, traditional exam has reduced validity and reliability compared to online exam. Similar findings are hypothesized in previous studies (21, 23).

Students' perception about the examinations

The majority of the students (70%) believed a single sitting in OSE exam allowed them to quickly scan the entire exam to know the gist of the contents before answering. This helps them to attempt lower order questions quickly and spend more time for higher order questions, thereby significantly reducing exam-related anxiety (21). However, in TSE, exams are conducted in batches following steeplechase pattern with multiple re-runs which invariably causes more anxiety, longer waiting time, and inability to scan all the questions before answering, leading to poor time management. Hence, it is important to find alternative methods/strategies to reduce the students' anxiety levels and optimize performance (26). Since most high-stake competitive exams are conducted online, it is imperative to sensitise and train the students to online exam. Another advantage of online exam is that it can be conducted under various settings around the year, and use of resources for the performance of exam in terms of manpower and materials is minimal, as reported earlier (18). The majority (95%) of the participants agreed that online spotter exam was similar to other competitive exams, and it might help them gain familiarity for future postgraduate entrance exams. When asked about results, 90% of the students opined that online exam had an advantage with instant and non-bias results compared to traditional exam which has delays in reporting the results and bias in evaluation. Instant results help them to quickly self-evaluate

and improvise contrast to delayed results in TSE. Reports of previous studies suggest that time of announcement of the results should not be considered while choosing an assessment tool.

Limitations of the study

Though online assessment is a newer trend, it comes with drawbacks. Students and faculties were concerned about Internet connectivity during the exam. The problems could also arise from hardware, software, or issues with power supply (27). 80% of the participants reported apprehension about Internet connectivity due to difference in location, network providers, and data plan of each participant. This may impact the student's attention span and performance during the exam. This might indirectly reduce the reliability of the assessment method. In this fast-moving era, newer technologies have to be instilled to avoid such issues. Another drawback of online exam is remote proctoring of the exam. Proctoring an exam is important to validate the assessment. This could be addressed by video monitoring and shifting the testing environment to in-campus testing centres, where the exams can be proctored directly (28).

Conclusion

Online assessment will become the mainstream over the next few years. Given this fact and the future trend in medical education, OSE can be included as part of formative assessment to assess the students' knowledge and learning outcomes. Better performance and students' willingness suggests that OSE can be considered as a replacement to TSE in anatomy practical exam. Hence, it is recommended to standardise OSE in different settings to test its reliability and reproducibility for the benefits of students and faculties.

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Authors' contribution

S.A, N.K.S Concept design, data collection, analysis, drafting manuscript; S.J.P: Data collection, proof reading. All authors read and approved the final manuscript. All authors agreed to be accountable for all aspects of the work and ensured that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved.

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References

1. Van der Vleuten CP. The assessment of professional competence: developments, research and practical implications. *Adv Health Sci Educ Theory Pract.* 1996;1(1):41-7.
2. Schuwirth LW, van der Vleuten CP. Programmatic assessment: from assessment of learning to assessment for learning. *Med Teach.* 2011;33(6):478-85.
3. McKeown PP, Heylings DJ, Stevenson M, McKelvey KJ, Nixon JR, McCluskey DR. The impact of curricular change on medical students' knowledge of anatomy. *Med Educ.* 2003;37:954-61.
4. Shaffer K. Teaching anatomy in the digital world. *N Engl J Med.* 2004;351:1279-82.
5. Heylings DJA. Anatomy 1999-2000 the curriculum who teaches it and how. *Med Educ.* 2002;36:702-10.
6. Older J. Anatomy: a must for teaching the next generation. *Surgeon.* 2004;2:79-90.
7. Rohen JW, Yokochi C, Lutjen-Drecoll E. *Color Atlas of Anatomy: A Photographic Study of the Human Body.* 6th Ed. Stuttgart, Germany: Schattauer GmbH. 2006; pp. 532.
8. Pei L, Wu H. Does online learning work better than offline learning in undergraduate medical education? A systematic review and meta-analysis. *Med Educ Online.* 2019;24:1666538.
9. Romanov K, Nevgi A. Do medical students watch video clips in eLearning and do these facilitate learning? *Med Teach.* 2007;29:484-8.
10. Erolin C, Reid L, McDougall S. Using virtual reality to complement and enhance anatomy education. *J Vis Commun Med.* 2019;42:93-101.
11. Estai M, Bunt S. Best teaching practices in anatomy education: A critical review. *Ann Anat.* 2016;208:151-7.
12. Yammine K. The current status of anatomy knowledge: Where are we now? Where do we need to go and how do we get there? *Teach Learn Med.* 2014;26:184-8.
13. Daly FJ. Use of electronic anatomy practical examinations for remediating "at risk" students. *Anat Sci Educ.* 2010;3:46-9.
14. Friedman Ben-David M. Principles of assessment. In: Dent, Harden, editors. *A Practical Guide for Medical Teachers.* 3rd ed. London: Churchill Livingstone; 2009.
15. Thompson AR, O'Loughlin VD. The blooming anatomy tool (BAT): A discipline-specific rubric for utilizing Bloom's taxonomy in the design and evaluation of assessments in the anatomical sciences. *Anat Sci Educ.* 2015;8(6):493-501.
16. Artino AR Jr, La Rochelle JS, Dezee KJ, Gehlbach H. Developing questionnaires for educational research: AMEE guide no. 87. *Med Teach.* 2014;36:463-74.
17. Gibbs G, Simpson C. Conditions under which assessment supports student learning. *Learning and Teaching in Higher Education.* 2005;1:3-31.
18. Tirpude AP, Gaikwad M, Tirpude PA, Jain M, Bora S. Retrospective analysis of prevalent anatomy spotter's examination: an educational audit. *Korean J Med Educ.* 2019;31(2):115-24.
19. Sadeesh T, Prabavathy G, Ganapathy A. Evaluation of undergraduate medical students' preference to human anatomy practical assessment methodology: a comparison between online and traditional methods. *Surgical and Radiologic Anatomy.* 2021;43:531-5.

20. Meyer AJ, Innes SI, Stomski NJ, Armson AJ. Student performance on practical gross anatomy examinations is not affected by assessment modality. *Anat Sci Educ.* 2016;9:111–20.
21. Inuwa IM, Airawahy M, Taranikanti V, Habbal O. Anatomy “steeplechase” online: Necessity sometimes is the catalyst for innovation. *Anat Sci Educ.* 2010;4:115–8.
22. Inuwa IM, Taranikanti V, Al-rawahy M, Habbal O. Anatomy practical examinations: how does student performance on computerized evaluation compare with the traditional format? *Anat Sci Educ.* 2012;5:27–32.
23. Inuwa IM, Taranikanti V, Al-Rawahy M, Habbal O. Perceptions and attitudes of medical students towards two methods of assessing practical anatomy knowledge. *Sultan Qaboos Univ Med J.* 2011;11:383–90.
24. Wilkinson T, Boohan M, Stevenson M. Does learning style influence academic performance in different forms of assessment? *J Anat.* 2014;224:304–8.
25. Busan AM. Learning styles of medical students - implications in education. *Curr Health Sci J.* 2014;40:104–10.
26. Shaibah HS, Van der Vleuten CP. The validity of multiple choice practical examinations as an alternative to traditional free response examination formats in gross anatomy. *Anat Sci Educ.* 2013;6:149–56.
27. Neuderth S, Jabs B, Schmidtke A. Strategies for reducing test anxiety and optimizing exam preparation in German university students: A prevention-oriented pilot project of the University of Wurzburg. *J Neural Transm.* 2009;116:785–90.
28. Walsh K. Online assessment in medical education—current trends and future directions. *Malawi Medical Journal.* 2015;27(2):71-2.