## -COMMENTARY—

Volume 14 Issue 4 2022

DOI: 10.21315/eimj2022.14.4.9

#### **ARTICLE INFO**

Received: 16-01-2022 Accepted: 13-06-2022 Online: 27-12-2022

# Multiple Mini Viva as an Online Assessment Tool for Postgraduate Anatomy Programme: The USM's Experience Amidst COVID-19 Pandemic

Siti Nurma Hanim Hadie, Fazlina Kasim, Zul Izhar Mohd Ismail, Mohd Asnizam Asari, Nurul Aiman Mohd Yusof, Anna Alicia Simok, Shamsi Amalina Shamsuddin, Mohamad Syabil Ikhwan Mohd Amin

Department of Anatomy, School of Medical Sciences, Universiti Sains Malaysia, Kelantan, MALAYSIA

**To cite this article:** Hadie SNH, Kasim F, Mohd Ismail ZI, Asari MA, Mohd Yusof NA, Simok AA, Shamsuddin SA, Mohd Amin MSI. Multiple mini viva as an online assessment tool for postgraduate anatomy programme: the USM's experience amidst COVID-19 pandemic. Education in Medicine Journal. 2022;14(4):99–112. https://doi.org/10.21315/eimj2022.14.4.9

To link to this article: https://doi.org/10.21315/eimj2022.14.4.9

#### ABSTRACT\_

Assessment is fundamental to student learning as it shapes student learning behaviour. Designing a holistic assessment is a demanding task because it involves evaluations of both cognitive and non-cognitive competencies. The unprecedented outbreak of COVID-19 has led to many changes in the assessment practice of higher education institutions. To ensure the sustainability of education provision to all students, assessment activities in higher education institutions are mainly conducted through online platform, and the task becomes more challenging. Hence, we introduce a new holistic assessment method, the multiple mini viva (MMV), that is used in the assessment of the Master of Science (Clinical Anatomy) programme in Universiti Sains Malaysia. The MMV was adopted from the framework of multiple mini interview that is commonly used for the student selection process in medical and allied health sciences programmes. This form of assessment was first implemented to address the drawbacks of the classical viva voce, and it could assess students' cognitive skills, including various interpersonal competencies such as communication skills, critical thinking and professional behaviour. In this article, we describe the practice of the classical face-to-face and online MMV with regard to its purpose, process, advantages and challenges. The implications and suggestions for the future practice of anatomy assessment are also elaborated.

Keywords: Multiple mini viva, Online assessment, Viva voce, Cognitive competency, Affective skill, Holistic assessment

CORRESPONDING AUTHOR

Mohamad Syabil Ikhwan Mohd Amin, Department of Anatomy, School of Medical Sciences, Health Campus, Universiti Sains Malaysia, Kubang Kerian, 16150 Kota Bharu, Kelantan, Malaysia

E-mail: subilikhwan@usm.my

## INTRODUCTION

Anatomy education at a postgraduate level is aimed at enabling the students to achieve higher levels of competency, namely cognitive, practical and affective skills. Even more, the graduates from these programmes would become the future anatomy educators for the medical and allied health students, who are expected to practice in their fields in a safe manner. The educational objectives of a postgraduate anatomy programme should be reflected in the process and tools of student assessment. Several factors need to be considered while designing assessment tools, namely the purpose of assessment, and the learning competencies to be achieved (1). It is agreed that no single assessment tool is capable of assessing educational objectives from all domains of learning taxonomy (2). Therefore, the use of a variety of assessment tools is recommended to match diverse competencies and learning styles (1, 3).

Assessment is an important tool that drives student learning (4-5). Hence, designing a good assessment that shapes student learning behaviours is vital in the achievement of expected competencies (6). However, it is argued that anatomy assessment is often confined to testing cognitive competencies with less emphasis on the achievement of other functional and affective skills (6). It is not uncommon to test low-order cognitive skills in anatomy, as it is difficult to design an assessment tool that could fully assess the integration and application of knowledge, especially in the undergraduate medical curriculum (6). Having said that, assessing higherorder cognitive, psychomotor, affective and other functional skills is imperative for a postgraduate curriculum.

The Master of Science (MSc) (Clinical Anatomy) programme at the School of Medical Sciences, Universiti Sains Malaysia is a two-year postgraduate programme with the objective of producing lecturers and researchers in anatomy. At the end of the programme, they are expected to apply human anatomy knowledge and practical skills in clinical practice, communicate effectively with students and academic members in delivering knowledge and solving issues related to the human anatomy field in a professional and ethical manner, and demonstrate management and leadership skills as well as lifelong learning for career development. The programme consists of one-year coursework and one-year research work. The first-year coursework is composed of seven courses: (a) Gross and Clinical Anatomy Part 1, (b) Gross and Clinical Anatomy Part 2, (c) Histology and Basic Genetics, (d) Neuroanatomy and Clinical, (e) Embryology, (f) Anatomy Education, and (g) Basic Statistics. The Gross and Clinical Anatomy Part 1 course focuses on the entire human body except for the head, neck and nervous system, while the Gross and Clinical Anatomy Part 2 course covers the head and neck region. Approximately half of the total teaching hours from the courses are dedicated to lectures, while the remaining is allocated for the laboratory work and practical sessions. The practical sessions are conducted through multimodal methods using various tools, namely cadaveric specimens, anatomical models, three-dimensional (3D) application (i.e., the Complete Anatomy application), optical and virtual microscopy, radiographic images and clinical vignettes.

Summative assessment in the first year of the programme is semester-based, whereby it is conducted throughout semester one and semester two in the form of continuous assessment and final examination. Continuous assessments of Gross and Clinical Anatomy, Histology and Basic Genetics, Neuroanatomy and Clinical, and Embryology courses account for 20%, while the final examination constitutes 80% of the total marks of each course. The continuous assessment requires candidates to prepare and present a seminar on a topic and a practical demonstration of anatomical specimens and models to the

class, followed by a question-and-answer session. Meanwhile, the final examination includes written (i.e., single best answer [SBA], multiple-true-false [MTF] and essay questions), practical (i.e., objective structured practical examination [OSPE]), and viva voce, which contribute 40% to 60%, 20% to 25% and 15% of the marks for final examination, respectively. The viva examination is conducted in two formats, namely, the classical viva voce examination for courses that carry two credit units (i.e., Gross and Clinical Anatomy Part 2 and Embryology courses), and the multiple mini viva (MMV) for courses that carry three credit units or more (i.e., Gross and Clinical Anatomy Part 1, Histology and Basic Genetics, and Neuroanatomy and Clinical courses). The MMV is a new assessment method that was first implemented in 2019 as an effort to produce a more holistic assessment of the postgraduate anatomy programme.

The framework of MMV assessment was adapted from the concept of multiple mini interview (MMI), which was introduced by Eva et al. (7) to replace the standard personal interview for medical student selection process. The aim of MMI-which is used as a selection process involving pre-university candidates-is to capture important tacit elements during the interview process, such as interpersonal skills, integrity, critical thinking and professionalism (7). The concept of MMI was devised from the objective structured clinical examination (OSCE) workflow, which incorporates multiple sample approaches to the interview process (7). Each interviewee needs to undergo several interviews stations, which assess different competency constructs, and each station is independently evaluated by one interviewer (7). This form of multiple discussion point rating utilises the global rating scale, thus addresses the issue of interrater reliability of the personal interview (8). Likewise, MMV is a form of viva-voce examination that mimics the process of MMI. MMV allows for a greater sampling of questions and emphasises the evaluation of a higher level of cognitive competencies, interpersonal skills and communication skills. The MMV questions are sampled from the examination question blueprint and these questions are vetted to ensure their validity in measuring the broad array of student competencies.

Prior to COVID-19, anatomy teaching, learning and assessment in higher education institutions in Malaysia were mainly conducted via a face-to-face approach (9). However, the COVID-19 pandemic has imposed unprecedented change in the anatomy education system, in which teaching, learning and assessment activities are conducted online to ensure continuity of education provision (10). Likewise, the MMV assessment was also conducted online. Therefore, this article describes the practice of the classical and online MMV as assessment tools for the MSc (Clinical Anatomy) programme, of the School of Medical Sciences, Universiti Sains Malaysia. The purpose, process, advantages and challenges of the classical and online MMV are elaborated.

## THE DESIGN OF MMV EXAMINATION

The MMV was first implemented in 2019 to replace the classical viva voce examination for three courses in the MSc (Clinical Anatomy) programme (i.e., Gross and Clinical Anatomy Part 1, Histology and Basic Genetics, Neuroanatomy and Clinical). The purpose of changing the assessment tool was to find an alternative method that could address the drawbacks of the classical viva voce examination. It was argued that the classical viva voce examination lacks standardisation among viva panels and is subjected to bias, which subsequently impairs the objectivity, validity and reliability of the results (11). Furthermore, the classical viva voce examination limits the scope of topics that could be asked within a limited duration, in which the candidate's responses to the questions were eventually used to make

decisions about their performance (12). The classical viva voce examination in our practice exhibited a low objectivity score, whereby the scoring relied on the perceptions of the examiners of the general performance of the candidates rather than their response to different segments of the questions. Moreover, each candidate received different questions from each panel, which were subjectively perceived by the panels as having similar difficulty levels but could possibly be interpreted differently by the candidates. This nonuniformity in the question format could have reduced the reliability of the classical viva voce examination method. Besides that, the interrater reliability could not be objectively determined as the final scoring was discussed among viva panels and tabulated at the end of each viva session. In this situation, a senior panel could be dominant in decision-making; therefore, it was argued that the final score could be subjected to rater bias.

In general, the MMV examination of this programme is conducted according to the principles and workflow of the MMI. The first process begins with the preparation of triggers in the form of clinical vignettes, anatomy models or diagrams, radiographic photographs displaying clinical images, signs, structural anomalies, clinical procedures, photomicrographs of normal histology and histopathology of body tissues. Each trigger is accompanied by five questions that are designed according to the learning outcomes stated in the assessment blueprint. These questions are interrelated and represent different levels of cognitive competency in Blooms taxonomy, ranging from C1 (recall) to C5 (evaluate). Questions standardisation is achieved through departmental vetting attended by qualified clinical anatomists (i.e., medical lecturers with a medical degree and postgraduate Clinical Anatomy qualification). All the anatomists are involved in teaching the major courses and constructing examination questions for the MSc (Clinical Anatomy) programme. The questions are then vetted among anatomists and the key answer for each question is finalised.

The MMV does not only assess students' cognitive skills, but also evaluates other functional skills such as communication skills, decision-making and professional behaviour (13). In this programme, a rubric for MMV assessment was developed, whereby three domains of competencies were assessed, which are cognitive, practical and affective skills. The skills are rated using a 10-point semantic scale based on the predetermined descriptors. Semantic scale is used to reduce acquiescence bias, which is a tendency for raters to highly rate the favourable attributes and ignore the unfavourable outcomes (14). The descriptors for cognitive competency range from describing anatomical structures related to conditions presented in the triggers, to discussing the clinical correlation of the condition, and justifying their stand or decision based on the gathered information. The practical skills that are tested in the MMV assessment of this programme do not refer to psychomotor tasks related to anatomy learning; rather, they refer to the ability of the candidate to convey information to the viva panels. In other words, the practical skill in this context reflects the teaching competency, which is essential for MSc (Clinical Anatomy) graduates, as most of them would be employed as anatomy lecturers or tutors. Hence, the descriptors for practical skills of MMV assessment range from being able to explain their thoughts precisely and clearly, to being able to possess good verbal and non-verbal communication skills. The descriptors of affective skills assessed in the MMV assessment include the ability of the students to show self-confidence and resilience throughout the session.

The duration of the MMV examination for this programme is one and a half hours, which covers five MMV stations and one rest station. The MMV stations are conducted separately in five examination rooms located near each other. Students

#### **COMMENTARY** | Multiple Mini Viva as an Online Assessment Tool

are required to rotate from one station to another according to the examination flow prepared by the coordinator. Each station is represented by a trigger and a set of questions, which are handled by a viva panel. Fifteen minutes are allocated for each station, whereby the first one minute is allocated for students to read or analyse the trigger that is placed outside the room. Once the one-minute has ended, the timekeeper will ring the bell and the students are required to enter the rooms for the viva session. In each room, there will be a viva panel and an observer that acts as a chaperone. Once the fifteen minutes have ended, the student needs to leave the room and proceed to the next station. Figures 1 and 2 show the assessment environment during the classical MMV examination. Figure 3 shows the examples of triggers and questions that were asked during the MMV examination. Figure 4 illustrates the flow of the online MMV examination for MSc (Clinical Anatomy), Universiti Sains Malaysia during the 2020/2021 academic session.



Figure 1: Students reading their respective triggers in the hallway.



Figure 2: Question and answer session with the viva panel in the room.

#### Education in Medicine Journal 2022; 14(4): 99-112



This is a picture of a 40-year-old lady who complains of having continuous tearing, of the left eye, decreased sweating over the left side of the face and left nasal congestion. She also experiences facial flushing and left arm weakness.

1. Briefly describe the abnormalities seen in the photograph

2. Relate the abnormal signs seen in the photograph with continuous tearing, decreased sweating, nasal congestion and facial flushing

- 3. Describe the component of nervous system and its anatomical structures that are affected in this patient
- 4. Describe why the patient is having partial ptosis instead of complete ptosis

5. What is the most possible diagnosis of this patient





**Figure 4:** Flow of online MMV examination conducted during the 2020/2021 academic session. Classical MMV examination requires 15 minutes for each round (1 minute for trigger reading and 14 minutes for Q&A session). There will be some rest stations according to the number of students participating in the examination.

104

## IMPLEMENTATION OF ONLINE MMV

The unprecedented outbreak of COVID-19 has led to many changes in the academic process of higher education institutions. To ensure the sustainability of education provision to all students, teaching, learning and assessment activities in higher education institutions are mainly conducted through online platform (9). Likewise, the implementation of the MMV assessment for the MSc (Clinical Anatomy) programme was also performed online, whereby the assessments were conducted using the Webex by Cisco video teleconferencing application (Cisco Webex, California, United States). This application allows file sharing and team messaging, which are essential for MMV execution. To ensure the smooth running of the online MMV assessment, all panels, students and assistants were required to use a laptop or desktop with the latest operating system either Windows or MacOS. The use of mobile phones as a tool for online MMV assessment is prohibited as it could not provide a good view of MMV exhibits or triggers. The viva panels and students are reminded to ensure that their internet connection is stable and that they have backup internet support (i.e., mobile data and Wi-Fi extender) during the examination.

The online MMV assessment is coordinated by one invigilator who controls the overall flow of the session. The invigilator is assisted by six support staff, who will be involved as a timekeeper for each station and co-hosts for managing the Webex application. One or two days before the session, the viva panels, students, lecturers and assistants will receive a meeting link to the session. On the day of assessment, the students are required to attend the meeting room 20 minutes earlier for a 360-degree virtual tour of remote proctoring, troubleshooting and briefing session. A briefing on the flow of MMV assessment and general examination instruction is delivered by the invigilator. One assistant creates several breakout rooms that cater for five stations and one rest station. One viva panel and an assistant will be assigned to each active breakout room (Station 1 to Station 5), while an assistant will be assigned to the rest breakout room (rest station). The invigilator is responsible for assigning each student to the respective breakout rooms, and the MMV session begins only when all assistants who continuously communicate with the invigilator through a WhatsApp group application receives approval from the invigilator.

When the session begins, the student is given one minute to read the provided trigger through screen sharing by the panel, before proceeding to the viva session. The assistant in each breakout room is responsible for proctoring the process and keeping track of the viva voce examination duration. The assistant will notify the student and the panel of the time, one minute before the round ends. Unlike the face-to-face MMV, a five-minute extra time is allocated to cater for any technical glitch during the assessment. Within that duration, the viva panel, student and assistant are locked in the rooms until all viva stations have completed each round. The host will then reassign the students into the main room, and eventually assign them to other breakout rooms for the next round. If technical glitches or internet connection problems occur, the affected station will be repeated after the last round has ended. At this point, students who are not involved in the additional round will be locked in the main room together with the invigilator. Figures 5 to 7 show the assessment environment during the online MMV examination. The difference between classical viva voce, classical MMV and online MMV is summarised in Table 1.



Figure 5: Briefing session by chief invigilator in Webex main room.



Figure 6: Trigger shown to student through Webex share screen.

## **COMMENTARY** | Multiple Mini Viva as an Online Assessment Tool



Figure 7: Question-and-answer session begins as soon as one minute for trigger reading ends.

ltem	Classical viva voce	Classical MMV	Online MMV
Purpose	Assessment tool for examination	Assessment tool for examination	Assessment tool for examination
Delivery approach	Conducted face-to-face	Conducted face-to-face	Conducted via online platform
Question structure	Non-structured Criterion for questions is not standardised	Structured Questions are standardised, vetted and validated	Structured Questions are standardised, vetted and validated
Question sampling	Limited scope of topics	Sufficient scope of topics	Sufficient scope of topics
Competency attainment	Focusing on cognitive and affective skills (mainly communication skill)	Holistic assessment tool covering cognitive, psychomotor and affective skills	Holistic assessment tool covering cognitive, psychomotor and affective skills
Assessment rubrics	Lacks uniformity in assessing format, prone to have rater bias	Fixed uniform validated assessment rubric	Fixed uniform validated assessment rubric
Validity evidence	Subjective and have poor validity and reliability	Objective and good validity and reliability	Objective and good validity and reliability

Table 1: Comparison of classical viva voce, classical MMV and online MMV

# ADVANTAGES AND CHALLENGES OF ONLINE MMV

As with most students' assessments, the online MMV method also has its own set of advantages and challenges. Understanding and interpreting these advantages and challenges is important, as it helps us to create strategies for a more effective assessment in the future. During the COVID-19 pandemic, the online MMV is a useful assessment tool for assessing the highorder cognitive skills of students. In addition to that, it serves as a holistic assessment tool that assesses cognitive, psychomotor and affective skills. Despite it being conducted online, the validity and reliability of online MMV are assured as it strictly follows the concept and principles of the conventional MMV that is conducted face-to-face.

Furthermore, the online MMV can accommodate remote assessment as long as there is a good internet connection. Since students are not allowed to be on campus due to the Movement Control Order (MCO) imposed by the government, online MMV allows all students to undergo the assessment simultaneously from their home or any location of choice. Therefore, the chances of students missing out on their assessments can be minimised. In addition, the implementation of online MMV is timesaving as it requires shorter assessment period and simplified procedures compared to the conventional MMV. In addition, the online MMV could reduce the technical and administrative workload before and during the assessment. Unlike the conventional MMV method that requires a certain number of people to perform several tasks for each station (i.e., to prepare placement, protocol and assessment materials), the tasks in online MMV are paperless and require only the coordinator to plan the process and the invigilator to manage the teleconferencing software (15).

Nevertheless, conducting the online MMV is not without challenges. These challenges are closely related to the lack of familiarity and understanding of the MMV process among students and the assessment team. Since online MMV is a relatively new assessment method, the students have minimal references and only obtained the information regarding MMV through self-reading and from their seniors. A study by Alruwais et al. (16) describes online assessment as a challenging task because students and lecturers usually have minimal exposure and experience in attending or managing an online assessment, respectively. Therefore, a formal briefing session is given at the beginning of each assessment, and a mock session is conducted prior to the actual assessment to help the students become familiar with the method.

Academic dishonesty in online assessment, which is also known as e-dishonesty, is another inevitable issue faced by many academic institutions when conducting online assessments (17). Likewise, in the online MMV assessment, it is difficult to ensure that the students are not cheating during the assessment despite a thorough remote proctoring. Students might be able to communicate with their peers via messaging system or refer to any online reading materials despite the tight proctoring method.

In addition, online MMV can be interrupted when there is a problem with the internet connection. Since online MMV is fully dependent on the internet connection, technical glitch due to internet dysconnectivity is sometimes inevitable. Some of the students are living in rural or remote areas where the internet connection is not stable; hence, some disturbances to the process are expected. As a result, students might not be able to perform well during the MMV session and this also may affect the judgement of viva panels in giving marks.

Some minor technical issues were identified during our online MMV session. The invigilator must be the same person who prepared the schedule for the session and must be well-versed with the software used for the assessment. The person must be efficient in assigning and reassigning students and manipulating the features of the breakout room. Other than that, our online MMV was resource-intensive whereby it required multiple assistants at a time to facilitate and monitor the students. The more students are involved in the assessment, the more assistants are required for one assessment session. Furthermore, more rounds are needed, making the assessment period to be longer than usual.

# SUGGESTIONS FOR FUTURE MMV ASSESSMENT PRACTICE

Assessing students' learning in anatomy requires a good assessment tool that is suitable and valid for the evaluation of the expected competencies. It could be argued that MMV is a potentially efficient tool for the evaluation of higher-order cognitive, functional and affective skills in anatomy, as it provides clear descriptors of the assessment rubric, which could be objectively scored. However, the MMV practice in the School of Medical Sciences, Universiti Sains Malaysia, is still in its infancy period; hence, to ensure the practical implication of the MMV assessment practice, more effort is needed to improve its utility in anatomy assessment.

First, there is a need to gather the validity evidence of MMV, especially pertaining to its internal structure, which is essential in ensuring the dimensionality and reliability of the MMV method in assessing the cognitive and non-cognitive competencies. Although there is a substantial body of evidence that MMI, a method from which MMV was devised, could assess various competencies, this evidence was generated mainly from a single institution (18-20). Indeed, a study by O'Neill et al. (21) revealed that the application of MMI in their context did not support the expected multi-dimensionality of competencies. Therefore, it is essential to explore the internal structure of the MMV method in the assessment of the MSc (Clinical Anatomy) programme to support its validity.

Second, the practicality and feasibility of MMV assessment may not be generalised in all anatomy programmes, as it depends on the availability of the support system in the institution. Despite more numbers of candidates can be assessed in a short period of time, the implementation of MMV requires more numbers of staff involved as invigilators and assistants (22). In our programme, the number of MSc (Clinical Anatomy) students was less than 10 for each batch; therefore, the MMV assessment could be done easily with the help of support staff from the anatomy department. For anatomy programmes that have a higher number of students, the MMV assessment may need to be done in several cycles, which indeed requires more invigilators and assistants. Likewise, the process of online MMV could be challenging when assessing a large cohort of students as it requires the assignment of students to various breakout rooms. Furthermore, all invigilators and assistants must be well-versed with the MMV assessment cycle and must be competent in utilising various tools involved in MMV assessment.

Third, the ability of the viva panels in assessing the non-cognitive attributes (i.e., communication skills, resilience and confidence) needs to be explored. Yusoff (23) suggested that interviewer panels in the MMV should be trained on how to rate the candidates so as to prevent construct irrelevance variance, which could jeopardise the validity of MMV assessment. The construct irrelevant variance (that is, the leniency and expectation of the panel) could be due to the bias of the panel in favour of extroverted candidates who appear to do well in answering thoughtprovoking questions within a limited duration (24). Furthermore, panel bias could also be generated from the threat of content underrepresentation, which reflects a specific context of any single question. For instance, a panel that is

specialised in neuroanatomy may be more stringent in giving marks when assessing a neuroanatomy question (25). Hence, it is recommended that all viva panels undergo a training session on how to rate and assess the cognitive and non-cognitive attributes. This form of training would also increase the response process validity of the MMV assessment.

# CONCLUSION

MMV is a promising tool in anatomy assessment in view of its ability to holistically assess various competencies of anatomy learning. Although MMV was developed from a well-designed MMI framework that has been proven to have strong evidence of validity, as a new assessment tool, there is a scarcity of data to support the validity evidence and effectiveness of MMV methods. Hence, it would be advantageous to evaluate the effectiveness of MMV in various anatomy subdisciplines of medical and allied health sciences programmes. It is also beneficial to replicate the assessment method in other centres to generate evidence of effectiveness as a source of validity that could signify the attainment of specific intended outcomes. Given the resource-intensive nature of this assessment method, it is valuable to justify the utility of MMV by conducting studies that evaluate the consequences and relations of MMV with the attainment of cognitive and non-cognitive competencies in anatomy education.

## **ACKNOWLEDGEMENTS**

The authors would like to thank the following individuals for their expertise and assistance throughout all aspects of our study and for their help in writing the manuscript. SAS wrote the abstract for this manuscript. FK and NAMY contributed to the introduction. SNH and MSI wrote the main text on MMV, online MMV and the reflection. AALS prepared figures and tables with the help of Mr. Muhamad Nor Firdaus Ab. Rahman who helped illustrate the diagrams used in the MMV triggers. ZIM and MASA contributed to the introduction, references, proofread and edited the final draft. All the supporting staff of the department were involved in exam preparation and proctoring. Last but not least, thank you to the Master of Science Clinical Anatomy students, who gave their consent to publish their photographs taken during the MMV exam.

# REFERENCES

- Fuentealba C. The role of assessment in the student learning process. J Vet Med Educ. 2011;38(2):157–62. https://doi.org/10.3138/ jvme.38.2.157
- Brenner E, Chirculescu ARM, Reblet C, Smith C. Assessment in anatomy. Eur J Anat. 2015;19(1):105–24.
- Khan SM, Suendermann-Oeft D, Evanini K, Williamson DM, Paris S, Qian Y, et al. MAP: multimodal assessment platform for interactive communication competency. In: Shehata S, Tan JPL, editors. Practitioner Track Proceedings of the 7th International Learning & Knowledge Conference (LAK17). Vancouver, Canada: Simon Fraser University; 2017. p. 6–12.
- Epstein RM. Assessment in medical education. N Engl J Med. 2007;356(4):387–96. https://doi.org/10.1056 /NEJMra054784
- Godfrey RC. Undergraduate examinations

   a continuing tyranny. Lancet.
   1995;345(8952):765–7. https://doi.org
   /10.1016/S0140-6736(95)90644-4
- Hadie SNH. The application of learning taxonomy in anatomy assessment in medical school. Educ Med J. 2018;10(1):13–23. https://doi.org/10.21315/eimj2018.10.1.3

- Eva KW, Rosenfeld J, Reiter HI, Norman GR. An admissions OSCE: the multiple mini-interview. Med Educ. 2004;38(3) :314–26. https://doi.org/10.1046/j.1365-2923.2004.01776.x
- Harasym PH, Woloschuk W, Mandin H, Brundin-Mather R. Reliability and validity of interviewers' judgments of medical school candidates. Acad Med. 1996;71(1):S40– 2. https://doi.org/10.1097/00001888-199601000-00038
- Yusoff MSB, Hadie SNH, Mohamad I, Draman N, Al-Aarifin IM, Rahman WFWA, et al. Sustainable medical teaching and learning during the COVID-19 pandemic: surviving the new normal. Malaysian J Med Sci. 2020;27(3):137. https://doi .org/10.21315/mjms2020.27.3.14
- Tg Fatimah Murniwati Tg Muda, Rushaidhi M, Woon CK, Dhamodharan J, Ghafar NA, Wong KH, et al. Anatomy teaching and learning in Malaysia during the COVID-19 pandemic. Educ Med J. 2021;13(2):71–81. https://doi .org/10.21315/eimj2021.13.2.6
- Kaur N, Manzoor S, Kaur S, Goyal A. Comparative evaluation of structured vivavoce examination and conventional vivavoce examination in II MBBS students. Int J Med Sci Educ. 2019;6:1–5.
- Bode CO, Ugwu BT, Donkor P. Viva voce in postgraduate surgical examinations in Anglophone West Africa. J West African Coll Surg. 2011;1(1):40.
- Knorr M, Schwibbe A, Ehrhardt M, Lackamp J, Zimmermann S, Hampe W. Validity evidence for the Hamburg multiple mini-interview. BMC Med Educ. 2018;18(1):1–12. https://doi .org/10.1186/s12909-018-1208-0

#### **COMMENTARY** | Multiple Mini Viva as an Online Assessment Tool

- 14. Friborg O, Martinussen M, Rosenvinge JH. Likert-based vs. semantic differential-based scorings of positive psychological constructs: a psychometric comparison of two versions of a scale measuring resilience. Pers Individ Dif. 2006;40(5):873–84. https://doi.org/10.1016/j .paid.2005.08.015
- Joshi A, Virk A, Saiyad S, Mahajan R, Singh T. Online assessment: concept and applications. J Res Med Educ Ethics. 2020;10(2):49–59. https://doi .org/10.5958/2231-6728.2020.00015.3
- 16. Alruwais N, Wills G, Wald Μ. Advantages and challenges of Int J Inf using e-assessment. Educ Technol. 2018;8(1):34-7. https://doi .org/10.18178/ijiet.2018.8.1.1008
- 17. Holden OL, Norris ME, Kuhlmeier VA. Academic integrity in online assessment: a research review. Front Educ. 2021;6:639814. https://doi.org/10.3389/ feduc.2021.639814
- Eva KW, Reiter HI, Rosenfeld J, Norman GR. The ability of the multiple mini-interview to predict preclerkship performance in medical school. Acad Med. 2004;79(10):S40–S42. https://doi .org/10.1097/00001888-200410001-00012
- Eva KW, Reiter HI, Rosenfeld J, Trinh K, Wood TJ, Norman GR. Association between a medical school admission process using the multiple mini-interview and national licensing examination scores. Jama. 2012;308(21):2233–40. https://doi .org/10.1001/jama.2012.36914
- 20. Eva KW, Reiter HI, Trinh K, Wasi P, Rosenfeld J, Norman GR. Predictive validity of the multiple mini-interview for selecting medical trainees. Med Educ. 2009;43(8):767–75. https://doi.org/10.1111/ j.1365-2923.2009.03407.x

#### Education in Medicine Journal 2022; 14(4): 99–112

- O'Neill LD, Lykkegaard E, Kulasageram K. Intended and unintended test constructs in a Multiple-Mini admission Interview. A validity study. Dansk Univ Tidsskr. 2019;14(26):66–81. https://doi.org/10.7146/ dut.v14i26.106217
- 22. Humphreys C. Successes and pitfalls in running a small program MMI. Canada: McMaster University; 2016.
- 23. Yusoff MSB. Multiple mini interview as an admission tool in higher education: insights from a systematic review. J Taibah Univ Med Sci. 2019;14(3):203–40. https://doi .org/10.1016/j.jtumed.2019.03.006
- 24. Donato AA, Alweis RL, Fitzpatrick C. Rater perceptions of bias using the multiple mini-interview format: a qualitative study. J Educ Train Stud. 2015;3(5):52. https://doi .org/10.11114/jets.v3i5.818
- Downing SM. Threats to the validity of locally developed multiple-choice tests in medical education: construct-irrelevant variance and construct underrepresentation. Adv Heal Sci Educ. 2002;7(3):235–41. https://doi.org/10.1023/A:1021112514626