Modified Essay Question in Medical Education: A Tool for Assessment of Highest Order Cognitive Skills of Students

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1.0   Introduction

The main aim of undergraduate medical education in the region is to produce doctors who are capable to meet the health needs of the community while also being able to continue medical education (Laidlaw et al., 1995; Salam et al., 2008). Medical professionals' ability comprises a set of knowledge, skills and attitudes necessary to competently accomplish the practice of medicine (Villegas-Alvarez et al., 2007). Assessment in medical education is an important aspect to determine the extent of students' learning over the course of study in terms of knowledge, skills and attitudes (Ferris & Flynn, 2015; Elshama, 2020; Salam et al., 2024).

Learning is classified under three domains such as (1) cognitive domain, related to thinking or knowledge(K), (2) affective domain, related to feeling or attitudes(A), and (3) psychomotor domain, related to doing/skills or practice(P). Cognitive domains of learning are characterised as a hierarchy of (i) knowledge (recall), (ii) comprehension (understand), (iii) application, (iv) analysis, (v) evaluation, and (vi) creation which is collectively known as the Blooms' Taxonomy of cognitive skills or cognitive domains' learning (Bloom et al., 1956; Anderson & Krathwohl, 2001; Salam et al., 2020). Buck Walters' Taxonomy characterised learning at three levels, such as: (1) Level I: Recall of information, (2) Level II: Comprehension and application, and (3) Level III: Problem solving ability -involving analysis, evaluation and creation (Jamaludin et al., 2012). Table-1 shows the capabilities of MCQ and MEQ in testing Blooms' cognitive taxonomy level and Buck Walters' cognitive taxonomy level of learning at different levels.

Table-1. Capabilities of MCQ and MEQ in testing Blooms' cognitive taxonomy and Buck Walters' cognitive taxonomy at different level /order of learning.

Blooms' Cognitive Taxonomy Level	Learning Level /Order	Buck Walters' Cognitive Taxonomy Level	Tools that Test Higher and Lower Order Learning
Level-VI: Creation	Higher order learning	**Level-III**: Problem solving: analysis, evaluation and creation	Higher order learning that can only be tested by essays such as MEQ
Level-V: Evaluation			
Level-IV: Analysis	Higher order learning		Higher order learning that can be tested by MCQ
Level-III: Application		**Level-II**: Comprehension and application	
Level-II: Comprehension	Lower order learning		Lower order learning is what the most MCQs test
Level-I: Recall		**Level-I**: Recall	

2.0 Teaching, assessment and learning

In the educational system, teaching and assessment are the two sides of the same coin and teaching without appropriate testing or assessing is similar to cooking without tasting (Zainol & Salam, 2021; Salam, 2021). It is the assessment that drives learning, and it is the learning that ultimately drives practices (Yousuf & Salam, 2021). Learning is defined as a relatively permanent change in the behaviours of students as result of teaching, practice and experience (Vergis, 2009; Sharma et al., 2016), while teaching is an interaction between teacher and learner in order to

provide opportunities for learning (Pianta, 2016; Salam & Mohamad, 2020). Teaching, learning and assessment are very much interrelated with each other. For learning to occurr or to bring students' behavioural changes in terms of knowledge, skills and attitudes, the teaching and the assessment strategies play a very important role. To ensure that all aspects of the course contents and educational domains are covered in assessment, the planned curriculum, taught curriculum and learned curriculum must overlap each other. Constructive alignment must be ensured by resemblance between learning outcomes, teaching-learning activities and assessment task, the three pillars of education.

3.0 Assessment tools used to measure the behavioural changes of students

To test the changes in the behaviours of students or based on the outcomes to measure the changes, medical schools use a variety of assessment tools such as: Multiple choice questions (MCQ), Essay questions, Modified essay questions (MEQ), Short answer questions (SAQ), Objective structured clinical/practical examination-OSCE/OSPE, Clinical long and short cases, Orals etc. (Salam et al., 2005; Salam et al., 2022). However, no single tool is adequate for testing knowledge, skills and attitudes together in medicine. Different assessment tools assist to assess the skills, knowledge, and attitudes necessary for the clinical competence of medical students. So, a combination of assessment tools is always required to test the students perfectly (Chimea et al., 2020). The MEQ is now widely used as a written assessment tool in medical education. It tests the capability of creating, expressing, organising, judging, reasoning or problem-solving skills of the students. It is the only tool that can test the highest level of Blooms' cognitive taxonomy level of learning (Table-1).

This paper briefly describes how to construct a good quality MEQ aimed at educational managers ensuring that the test by MEQ is objective, reliable, valid and it tests the highest order cognition such as creation, organisation, judgment and reasoning or problem solving capabilities of the students.

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4.0 Modified Essay Question (MEQ)

The MEQ is derived from an essay question, the answer of which is a piece of writing that logically analyses and evaluates a topic or issue. Traditionally medical schools used essay questions in written examinations to test the cognitive skills of the students, such as the use of four essay questions with 25 marks each. Essay questions test higher powers of reasoning, judgment and the capability of expression and ability to write systematically. However, there is strong criticism that, it is time-consuming to mark and there is risk of considerable variation in marking, which means essay questions are subjective and not reliable. As a result, MEQ is introduced by modifying and structuring the traditional essays with scoring and time limits in order to ensure the reliability high objectivity. The MEQ is designed in such a way that it is to be in a place between the MCQ and the essay questions. The MCQ, although have a defined standard and scoring system, it often tests little more than recall of fact and cannot test organizing capability of the students, whereas essays test higher order powers of reasoning and judgement. In MEQ, a number of problem-solving questions are posed to the students to test their knowledge retention and higher cognitive skills such as students' ability to think, organize the knowledge, clinical reasoning, problem solving and decision making (Stratford & Perice-Fenn, 1985; Khan & Aljarallah, 2011). It can be used to assess the students in both clinical and pre-clinical phases. Preliminarily, there may needs assistance from clinical faculty to construct an effective MEQ in preclinical phases.

The MEQ was initially developed as an assessment tool for the Royal College of General Practitioners in the UK (Boards of Censors of the Royal College of General Practitioners, 1971). Studies on the reliability and validity of the MEQ showed that a well-developed MEQ has a good reliability coefficient and a greater correlation with in-clinical reasoning compared to multiple choice questions (Stratford & Perice-Fenn, 1985).

5.0 Presentation of MEQ

This paper-based clinical examination includes questions to be presented to the students in stages in the form of short case scenario followed by series of questions that must be answered in the sequence asked and it has a structured format for scoring with a time limit (Al Wardy, 2010; Khan and Aljarallah, 2011). The scenarios are presented sequentially on different pages, describing

the different stages of a clinical problem. The test items include questions regarding history taking, examination findings, investigations, diagnosis, management etc. After presenting the initial case scenario, a few questions are asked, then followed by further information of the case and sequentially further questions are asked. There is a time limit for each stage of questions within which the students need to complete the answers (Palmer & Devitt, 2007; Kim et al., 2019).

The question paper is designed in the form of a booklet with sufficient space for the student to write the answers (Salam et al., 2005). Students are instructed to respond in brief for each section chronologically within the fixed time (Boards of Censors of the Royal College of General Practitioners, 1971). The advantage is that teachers can evaluate the students' knowledge retained and students' thinking and clinical reasoning skills by using this method (Stratford & Perice-Fenn, 1985). It is possible to test a range of disciplinary aspects within one question, as examinations become more integrated (Newble & Cannon, 2001). Here, the scope of guessing the answer is minimal because students cannot select choices to answer as in MCQ. However, it takes a longer time for the students to answer the questions compared to MCQ (Tran, 2014). Modifying or structuring the questions and specifying the marks and time for each part alliance with model answers, gives the instrument a good reliability, validity and objectivity (Javaeed, 2018). The MEQ placed between MCQ and essay question measures the higher cognitive skills, knowledge retained and use of that knowledge to reason and evaluate clinical problems besides the simplicity in marking by comparing with the standard (Palmer & Devitt, 2007).

Although the MEQ is now widely used, perhaps a little misleading because the format more closely resembles a series of short answer questions rather than essay (Newble & Cannon, 2001). To construct an effective MEQ, teachers need to be very specific about the learning outcome to be tested or assessed. However, preparing an effective MEQ is a difficult task. Lots of effort need to be given to construct MEQ and certain skill is mandatory in order to avoid giving the answers to earlier questions and to avoid student being penalized for the same error. Faculty requires expertise and skill through trainings to prepare an effective MEQ (Newble & Cannon, 2001; Khan & Aljarallah, 2011; Javaeed, 2018).

6.0 Conclusion

The MEQ is a problem-solving instrument, presents typical problem used in daily clinical practice. It is presented in the form of short case-scenario in stages like history taking, examination findings, investigations, diagnosis, management etc, followed by a series of questions after each stage which must be answered sequentially. In each stage, mark /score and time limit are mentioned to complete the answers to the questions. The question paper is designed as a booklet with sufficient space for the student to write the answers. Student are not allowed to go back to the previous details on the patient. So, an updated summary is provided in each page. A well-constructed MEQ can serve as an efficient assessment tool for assessing the creation, organisation, expression, and judgement ability or problem-solving higher order cognitive skills of medical students both in clinical and pre-clinical phases. Increasingly medical schools now use MEQ to assess students' higher order cognitive skills. However, the format used looks closely resembles a series of short answer questions that tests lower order cognitive skills of the students rather than essay that tests creation, organisation, expression or higher order cognition of the students. Objectivity, reliability and validity are important issues in the assessment system. The teachers need to be proficient and capable of preparing an effective assessment tool that is objective, reliable and valid. Therefore, faculty training is very important on the construction of an effective MEQ, and medical schools /educational planners should give due importance on it, aimed to produce doctors who are capable to meet the health needs of the community.

References

Al Wardy, N.M. (2010). Assessment Methods in Undergraduate Medical Education. *SQU Med J*, 10(2),203-209.

Anderson, L.W., and Krathwohl, D.R. (2001). A taxonomy for learning, teaching, and assessing. Abridged Edition, Boston, MA: Allyn and Bacon, 2001.

Bloom, B.S., Engelhart, M.D., and Committee of College and University Examiners. (1956). Taxonomy of educational objectives: The classification of educational goals. London: Longmans.

Boards of Censors of the Royal College of General Practitioners. (1971). The modified essay question. *J Roy Coll Gen Practit*, 21: 373-376.

Chimea, T., Kanji, Z., Schmitz, S. (2020). Assessment of clinical competence in competency-based education. *Can J Dent Hyg*, 54(2),83-91.

Elshama, S.S. (2020). How to Use and Apply Assessment Tools in Medical Education? *Iberoamerican Journal of Medicine*, 04,351-359.

Ferris, H., Flynn, D.O. (2015). Assessment in Medical Education; What Are We Trying to Achieve? *International Journal of Higher Education*, 4(2),139-144.

Jamaludin, R., Ja'afar, R., Kaur, S. (2012). Training module series: student-centered learning (SCL), approaches for innovative teaching. Module 3: Learning Taxonomies. Centre for Development of Academic Excellence (CDAE). Universiti Sains Malaysia.

Javaeed, A. (2018). Assessment of Higher Ordered Thinking in Medical Education: Multiple Choice Questions and Modified Essay Questions [version 1]. *MedEdPublish*, 7,128 (https://doi.org/10.15694/mep.2018.0000128.1)

Khan, M., Aljarallah, B. (2011). Evaluation of modified essay questions (MEQ) and multiple choice questions (MCQ) as a tool for Assessing the Cognitive Skills of Undergraduate Medical Students. *International Journal of Health Sciences*, 5,39-43.

Kim, S., Choi, I., Yoon, Y.B., Kwon, M.J., Choi, S.J., Kim, S.H., Lee, J.T., Rhee, B.D. (2019). Medical students' thought process while solving problems in 3 different types of clinical assessments in Korea: clinical performance examination, multimedia case-based assessment, and modified essay question. *J Educ Eval Health Prof*, 16,10. https://doi.org/10.3352/jeehp.2019.16.10

Laidlaw, J.M., Harden, R.M., Morris, M.G. (1995). Needs assessment and the development of an educational program on malignant melanoma for general practitioners. *Med Teach*, 17,79-87.

Newble, D.I., Cannon, R.A. (2001). A Handbook for Medical Teachers. 4th edition, pp125-162

Palmer, E.J, Devitt, P.G. (2007). Assessment of higher order cognitive skills in undergraduate education: modified essay or multiple choice questions? research paper. *BMC Med Educ*, 7,49. https://doi.org/10.1186/1472-6920-7-49

Pianta, R.C. (2016). Teacher-Student Interactions Measurement, Impacts, Improvement, and Policy. *Policy Insights from the Behavioral and Brain Science*, 3(1), 98-105.

Salam, A., Rahim, A.F.A., Aziz, R.A., Fakir, N.M.R.M., Ja'afar, R. (2005). Assessment of the students: Tools used in Universiti Sains Malaysia. *Bangladesh Medical Journal*, 34(1),11-13.

Salam, A., Zainuddin, Z., Latiff, A.A., Ng, S.P., Soelaiman, I.N., Mohamad, N. (2008). Assessment of Medical Graduates Competencies. *Annals Academy of Medicine*, 37(9), 814-816.

Salam, A., Mohamad, M.B. (2020). Teachers Perception on What Makes Teaching Excellence: Impact of Faculty Development Programme. *International Medical Journal*, 27(1),1- 4.

Salam, A., Yousuf, R., Bakar, S.M.A. (2020). Multiple Choice Questions in Medical Education: How to Construct High Quality Questions. *International Journal of Human and Health Sciences*, 04(02),79-88.

Salam, A. (2021). Best teaching method used, very good in teaching, the best lecturer ever: secrets of teaching online during COVID-19 pandemic. *International Journal of Human and Health Sciences*, 05(04),377-380. DOI: http://dx.doi.org/10.31344/ijhhs.v5i4.346

Salam, A., Yousuf, R., Allhiani, R.F., Zainol, J. (2022). Continuous Assessment in Undergraduate Medical Education Towards Objectivity and Standardization. *International Journal of Human and Health Sciences,* 06(03),233-236.

Salam, A., Y-Surahaya Mohd Yusof., Zainol, J. (2022). Management of Teaching-learning in Classroom Setting. *Journal of Science and Management Research,* 9(1),126-136.

Salam, A., Alsharkawy, A., Abdelhalim, A.T., Satwi, S., Taibi, M.K.B.M., Hassan, K.M. (2024). Use of Objective Structured Clinical Examinations (OSCE) as a Valid and Reliable Assessment Tool in Medical Education. *International Journal of Human and Health Sciences*, 08(01),3-8. DOI: http://dx.doi.org/10.31344/ijhhs.v8i1.612

Sharma, D.A., Chevidikunnan, M.F., Khan, F.R., Gaowgzeh, R.A. (2016). Effectiveness of knowledge of result and knowledge of performance in the learning of a skilled motor activity by healthy young adults. *J Phys Ther Sci*, 28(5), 1482-1486.

Stratford, P., Perice-Fenn, H. (1985). Modified essay question. *Physical Therapy*, 65,1075-1079.

Tran, K.N. (2014). Should Modified Essay Questions Be the Primary Method to Assessing Performance? https://edtheory.blogspot.com/2014/10/should-modified-essay-questions-be.html.

Vergis, A., Hardy, K. (2009). Principles of Assessment: A Primer for Medical Educators in the Clinical Years. *The Internet Journal of Medical Education*, 1(1),1-9.

Villegas-Alvarez, F., Polaco-Castillo, A.J., González-Zamora, J.F., García-Pineda, A.M., Madrid-Zavala, M.R. (2007). Surgical/medical competences, self-perception among a group of students recently graduated. *Cirugia y cirujanos*, 75,43-7.

Yousuf, R., Salam, A. (2021). Teaching medical education during the era of COVID-19 pandemic: challenges and probable solutions. *Bangladesh Journal of Medical Science*, 20 (Special Issue), S3-S6. DOI: https://doi.org/10.3329/bjms.v20i5.55394

Zainol, J., Salam, A. (2021) Audit on Mentor-Mentee Program: Mentees Perceptions on Mentors. *Bangladesh Journal of Medical Science*, 20(04), 840-847.