MCQ vs. FITB Examination Question Performance in a Human Anatomy Course

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Background

Multiple choice questions (MCQs) are commonly used to assess student achievement in the preclinical sciences and are the predominant question type used in high stakes examinations. MCQs offer the advantages of ease of scoring and provide objective, quantitative indices of student knowledge of material.

To better prepare students at the Virginia Tech Carilion School of Medicine (VTCSOM) for the knowledge demonstration tasks of the clerkship and elective years, we developed assessments for the anatomy component of the preclinical curriculum using short answer, fill in the blank (FITB) format, thereby emphasizing the importance and value of being able to retrieve information previously learned.

Methods

We developed three, 50 question anatomy summative examinations, one for each of three Blocks of instruction focusing on (1) the back and limbs, (2) thorax, and (3) abdomen, pelvis and perineum, respectively. Each examination was composed of a combination of MCQ's with and without images (recognition questions), and single or several word (less than three words) fill in the blank (FITB) questions also with or without images (retrieval questions).

Questions with images were of different levels ranging from lower level questions such as "Name the structure marked by the tip of the arrow." (FITB) or "Which of the arteries listed below supplies the structure marked by the tip of the arrow?" (MCQ), to questions of a higher order such as "Which of the following clinical finding would most likely be observed in a patient with injury involving the structure marked by the tip of the arrow?" (MCQ) or "On which side and in which intercostal space is the pulmonary valve best auscultated?" (FITB).

The majority of both types of questions were formatted as clinical vignettes using National Board of Medical Examiner (NBME) guidelines. All questions were based on stated lecture and laboratory learning objectives included in the VTCSOM Anatomy Guide & Workbook. A practice examination consisting of questions comparable in terms of scope, depth, difficulty and format was administered during the week prior to the summative examination during each Block. Examinations were administered using Exam-Soft© and scored using Exam-Score© technology.

Finally, we compared performance on MCQ with FITB formatted questions. Our hypothesis was that, even with advance notice that the anatomy examinations would include retrieval type questions (FITB) as well as recognition type questions (MCQ's), students would perform less well on the retrieval type questions initially, but would adapt their learning to perform better as the course progressed.

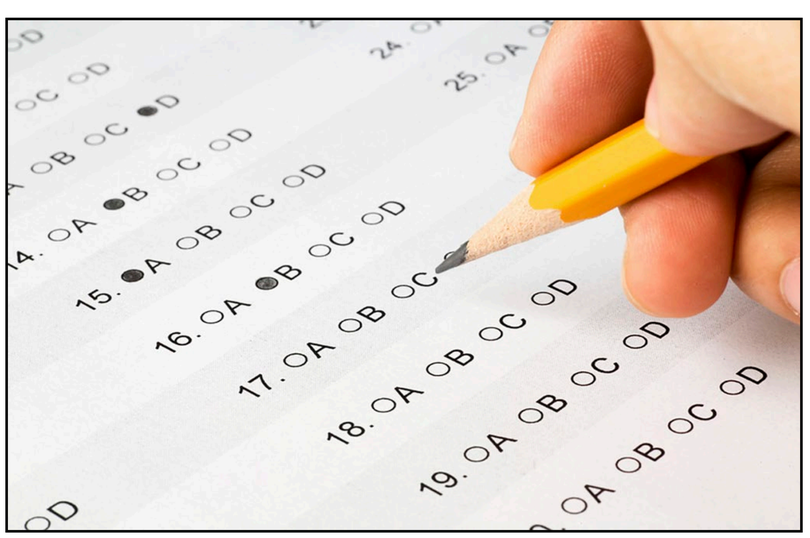


Table 1

Performance on Multiple Choice Questions (Recognition) vs. Fill in the Blank Questions (Retrieval)

	Multiple Choice Questions		Fill in the Blank Questions	
	# examination questions	mean score	# examination questions	mean score
Block I	10	88.6%	42	65.9%
Block II	21	87.5%	30	89.9%
Block III	23	83.8%	29	86.3%

Results

Student examination scores on FITB questions were on average 23% points lower than for MCQ questions for Block I. For Blocks II and III, performance improved with only a 2-3% point difference for the two types of questions.

Limitations of MCQs

Several limitations in the use of MCQ's can be noted in medical education. Although widely used for their ease of objective assessment, simply recognizing a correct answer vs. retrieving thoughtful information may disadvantage students in the long term.

One limitation of the use of MCQ's relates to their value in preparing students for the ways in which knowledge will more likely be "tested" (later) in the clerkship and post graduate years. In these settings, students are typically confronted with open-ended questions where students are not provided with several possible answers to choose from, but rather are called upon to retrieve or recall information that must be synthesized, organized and framed for presentation in a short period of time, frequently in an oral format.

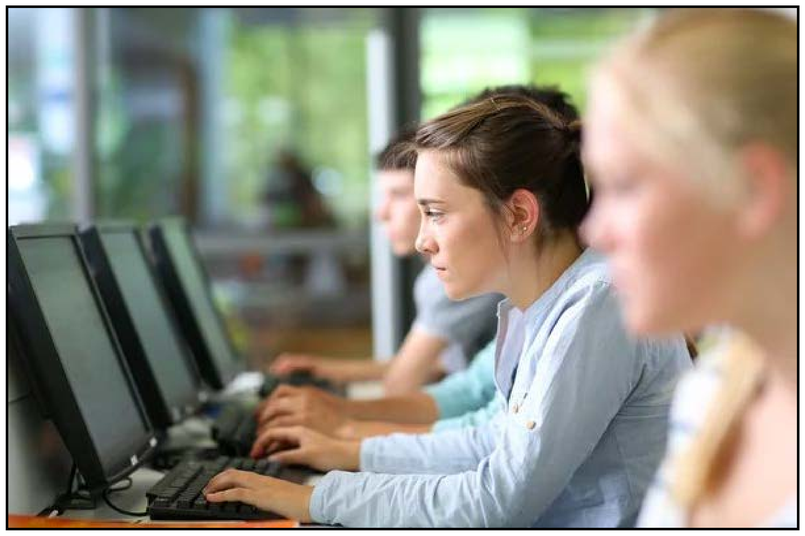
Another limitation of the use of MCQ's is that knowledge in the clinical setting is more often based on a student's ability to answer questions posed by faculty, residents and even patient's in the short answer, narrative format. This form of assessment relies on the retrieval and use of learned information rather than on the recognition of one or more correct answers from a provided list of possible responses.

Discussion & Conclusion

Most medical students entering medical school are experienced test takers. Most of the examinations these students have taken have been of the MCQ type format, partly because of their relative ease in grading and their objective and quantitative reliability. Understandably, students have developed learning habits and study approaches that favor success on these types of examinations.

Additionally, a large variety of resources are available in many subject areas to aid students in acquiring useful strategies for preparing for MCQ types of examinations. By contrast, most students may have less experience and familiarity with examinations and other methods for assessing knowledge that rely on straight forward information retrieval rather than on answer recognition.

Our results indicate that early in their academic experience students perform less well on examination questions requiring retrieval of information than on questions involving recognition. We also observed that over time, performance improves to levels similar to those for MCQ's. These data suggest that on their first exposure to retrieval formatted questions, despite practice opportunities with these



Discussion & Conclusion Continued

types of questions, performance is still not as good as for questions where several answer options are presented. Our results suggest that familiarity with recognition questions appears to contribute to better performance on those types of questions. We believe that a relative lack of familiarity and experience with retrieval type questions may have contributed to the lower performance scores for these types of questions.

We noted that performance on FITB questions improved on the two subsequent examinations and appeared to be comparable to performance on MCQ questions which suggests that students were able to adapt their study habits to the answer retrieval questions more effectively. We believe that preparing students for the types of formal and informal assessments they will encounter during the clinical phases of the curriculum is an important goal for faculty to undertake during the foundational, largely preclinical years. This was an objective we had hoped to achieve by inserting these types of questions on our anatomy examinations.

Although not necessarily unique to medical education, the need exists to challenge students in the broader sense to think deeper. *Our mission at VTCSOM is to train physician thought leaders through developing the knowledge, attitudes and skills of research, inquiry, and discovery. The development of a thought leader is a deliberate process that extends well beyond the classroom.* With that in mind, encouraging the retrieval of information that is organized and synthesized, and well-communicated, was one of our goals.

References

1. R.M. Sumudu Himesha B Medawela, Dugganna Ralalage Dilini Lalanthi Ratnayake, Wijeyapala Abesinghe Mudiyanselage Udari Lakshika Abeyasinghe, Ruwan Duminda Jayasinghe, Kosala Nirmalani Marambe, Effectiveness of "fill in the blanks" over multiple choice questions in assessing final year dental undergraduates, Educación Médica, Volume 19, Issue 2, 2018, Pages 72-76, ISSN 1575-1813, https://doi.org/10.1016/j.edumed.2017.03.010.

2. Stanger-Hall KF. Multiple-choice exams: an obstacle for higher-level thinking in introductory science classes. CBE Life Sci Educ11: 294–306, 2012. doi:10.1187/cbe.11-11-0100.

3. Tiemeier AM, Stacy ZA, Burke JM. Using multiple choice questions written at various Bloom's taxonomy levels to evaluate student performance across a therapeutics sequence. Innov Pharm2: 5, 2011. doi:10.24926/IIP.V2I2.224.

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