Multiple Choice Questions Versus Very Short Answered Questions in the Evaluation of Students of Veterinary Pathology.

Preguntas de opción múltiple versus preguntas de respuesta muy breve en la evaluación de estudiantes de patología veterinaria

Khaled Radad[1], Mokhtar Taha[1], Wolf-Dieter Rausch[2]

[1]Department of Pathology, Faculty of Veterinary Medicine, Assiut University, Assiut 71526, Egypt, khaledradad@hotmail.com, admiae@yahoo.com
[2]Institute of Medical Biochemistry, Department for Biomedical Sciences, University for Veterinary Medicine Vienna, Veterinaerplatz 1, 1210 Vienna, Austria, wolf.rausch@vetmeduni.ac.at

*Correspondence: Prof. Dr. Khaled Radad, khaledradad@hotmail.com

Abstract.
Background: Well-developed assessment methods have a positive impact on students' performance, and higher education institutes are usually encouraged to establish and use effective assessment methods that effectively enhance the learning process. Objectives: This study was designed to compare students' performance in multiple choice questions (MCQs) including best single answer (BSA) and multiple true and false (MTF) types, and very short answer (VSA) questions, and to evaluate gender differences and feedback from students and faculty. Materials and methods: A test containing three different types of questions, BSA, MTF and VSA questions (10 each), was delivered to eight groups of veterinary pathology students (3rd level, Faculty of Veterinary Medicine, Assiut University, Assiut, Egypt) in April 2022. Students' performance, test reliability and gender differences as well as feedback from students and faculty were evaluated. Results: Students did a significant higher performance in BSA and MTF questions compared to VSA questions. The reliability of BSA, MTF and VSA questions between different groups of students were 0.53, 0.52 and 0.13, respectively. Female students achieved a higher performance in the whole test compared to male students. Both male and female students showed nearly similar performance in BSA and MTF questions. However, female students got significant higher score in VSA questions compared to male students. Students' and faculty opinions were in favor of BSA and MTF questions. Conclusion: Students did much better in MCQs than VSA questions. BSA and MTF questions are preferentially favored by students and faculty.

Keywords: Best answer, multiple true and false, very short answer, questions, higher education

---

1. Introduction

Nobody has officially dated back the birth of assessment in higher education. However, some reports returned administration of exams to the late of the 19th century (1). Assessment in higher education refers to the methods and tools by which teachers collect information regarding the performance and achievement of the students (2). Assessment is a critical step in the learning process as it (i) tests the knowledge of students, (ii) evaluates the effectiveness of learning and teaching, (iii) provides feedback to teachers and students and (iv) helps in setting and modification of the teaching strategies. Moreover, it shows the effectiveness of programs to various audiences including governments, taxpayers, employers and parents (3-4).

Assessment methods in higher education include paper-and-pencil assessment, performance assessment, oral communication, self and peer assessment, computer-based assessment, portfolios and student's notebook. Paper-and-pencil assessment is among the most common used. It refers to multiple choice (MC), true false (TF), multiple true and false (MTF) and very short answer (VSA) questions, essay items, matching and fill-in-the-blank (5). Performance assessment is a useful tool to evaluate students' understanding of a subject and their ability to use their knowledge. This kind of assessment measures how well students apply their knowledge rather recall the knowledge (6). Oral communication assessment uses the students' verbal responses to the assessment task which is in the form of questions and answers in the classroom, conferences with students and oral tests (7). Self and peer assessment is rarely used in higher education, in which, students are involved in evaluating their own work (8). This facilitates utilizing deeper approaches to learning, provides active engagement, and increases competence, motivation, confidence and control over their learning (9). Computer-assisted assessment refers to the use of computers to assess students' progress. It provides immediate feedback on students' level of understanding, increases students' motivation and range of assessed knowledge and reduces grading time (10). A portfolio is the students' work including activities, accomplishments and achievements over a specific period of time. It is considered learning and assessment tools at the same time, and a good way to show students' progress (11). Students' notebooks are reliable assessment tool and highly correlated with other methods of assessments (12).

In Egypt, assessment in higher education depends largely on written open-ended questions including short-answer questions (SAQ), long-answer questions (LAQ) and essay writing, since the establishment of Egyptian Universities. Other assessment methods have been used to a lesser extent in quizzes and mid-semester exams. Online teaching and successful uses of closed-ended questions, most notably multiple choice questions (MCQs) during COVID-19 pandemic, make the higher education authorities think to largely use MCQs in higher education assessment as they easily delivered and electronically evaluated. Accordingly, the current study was designed to compare between MCQs represented by best single answer (BSA) and multiple true and false (MTF), and very short answer (VSA) questions in assessment of students of veterinary pathology, third level, Faculty of Veterinary Medicine, Assiut University, Assiut Egypt. Also, reliability of different question types, gender differences, and feedback from students and faculty were investigated.

2. Methods

Participants in the study

This is a cross-sectional study conducted in the Department of Pathology and Clinical Pathology, Faculty of Veterinary Medicine, Assiut University, Egypt. In which, students of the third level (160 students; 60 male and 100 female) participated. Faculty perspectives were collected from 30 members (15 male and 15 female). Approval was obtained from the research ethical committee in the faculty of Veterinary Medicine, Assiut University.

Study procedures

Students including both males and females were randomly divided into 8 groups (20 students each). All students are nearly with the same level of English language. A test consists of three different question types (10 questions each) including BSA, MTF and VSA was delivered for all groups at the same time. A BSA question consists of a question stem accompanied by a list of four possible answers that students were asked to choose one correct answer. A MTF question consists of a question stem followed by 4 statements that

students should separately evaluate each statement as either true or false. A very short answer question employs directly asked, directly answered question that require students to answer briefly. Evaluation and item analysis of BSA and MTF questions were performed by Smartscan Optical Mark Reader. Very short answer questions were manually evaluated by two instructors that did not participate in the study based on a model answer and a simple grading rubric (Table 1). Exam time was 45 min (1.5 min for each question). Total score was 30 marks (10 for each question type). Students' performance in different question types was compared. Reliability of each question type, and differences between male and female performance were investigated.

Table 1. Short answer grading rubric.

Items	Criteria and marks		
	Unacceptable 0 mark	Need improvement 0.5 mark	Acceptable 1.0 mark
Contents	Did not answer question	Answer question partially.	Answer question completely.
Use of terms		Did not use all terms in the course.	Use all terms in the course.
Language		There are some mistakes in construction of sentences, punctuation and spelling.	Constructed answer and good language.

Students and faculty survey

A survey was designed to collect the students and faculty perspectives on using BSA, MTF and VSA questions in their courses, and the rationale for their preference. Surveys are an inexpensive and appropriate tool for collecting responses from participants to a specific topic (13).

Statistics

Data were presented as means and SEM. The differences between students' performances in BSA, MTF and VSA questions as well as gender performance were tested using ANOVA and post-hoc Tukey test. Reliability of each question type between groups was calculated using Cronbach's Alpha test. IBM SPSS version 22.0 was used. A level of $p < 0.05$ was considered as statistically significant.
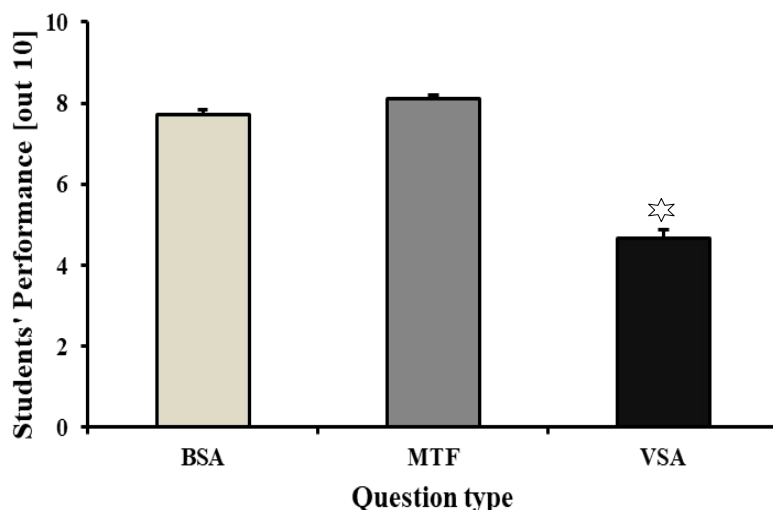
3. Results

*Students' performances in different question types*

The overall students' performance in BSA and MTF questions was significantly higher compared to the VSA questions. The performance in MTF questions was slightly higher than BSA questions. The mean score of all students were 7.72, 8.12 and 4.66 out of 10 in BSA, MTF and VSA questions, respectively (Figure 1). Students' scores appeared shifted towards the left (higher scores) in BSA, normally distributed in MTF and shifted to the right (lower scores) in VSA questions (Figure 2).

Reliability and correlation

Using Cronbach's alpha test, the reliability of BSA, MTF and VSA questions between different groups of students were 0.53, 0.52 and 0.13 respectively. Reliability is considered quite high when Cronbach's alpha is 0.50. Accordingly, BSA and MTF questions were more reliable than VSA questions. There was a strong positive correlation between overall students' performance in the three different types of questions ($p < 0.001$).

Figure 1. Overall students' performance in BSA, MTF and VSA questions. Students' performance is nearly similar in BSA and MTF questions, and significantly lower in VSA questions. ☆☆, p<0.001
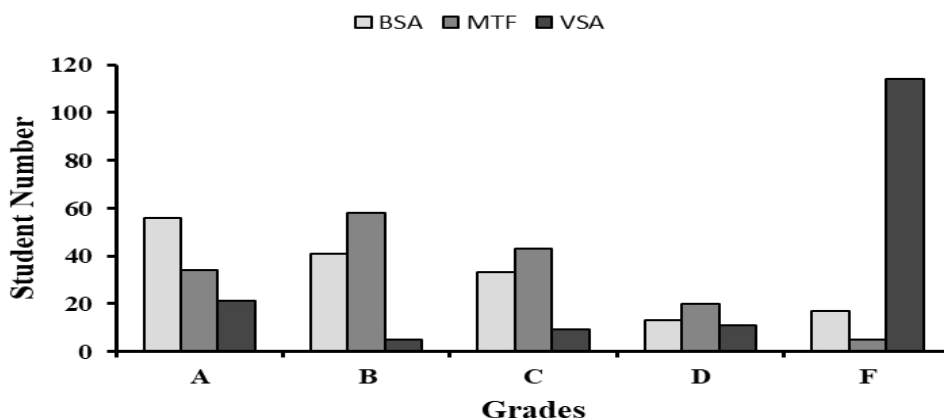
Figure 2. Grade distribution of students in BSA, MTF and VSA questions. Students' scores shifts towards the left (higher scores) in BSA, distribute normally in MTF and shifts to the right (lower scores) in VSA questions.

Gender differences

Regarding gender differences, the overall performance of female students was slightly higher than those achieved by males (Figure 3). Female students significantly scored higher marks in VSA questions compared to male students. However both females and males nearly achieved similar results in both BSA and MTF questions (Figure 4).

Feedback of students and faculty

Students' opinions were in favor of BSA and MTF questions. Nearly, 93% of students who participated in the survey preferred both BSA and MTF questions and 73% of students found that VSA questions were more difficult. According to the students' opinions, they preferred BSA and MTF questions as this type of questions (1) needs short time to be completed, (2) require understanding, not recalling knowledge, (3) depends sometimes on guessing and (4) are free from correction bias (Table 2).

Faculty opinions (66%) were also in favor of BSA and MTF questions. They found that these types of questions efficiently evaluate students understanding rather than recalling knowledge, are easily corrected using electronic tools and can cover most of the course subjects. Some faculty complained that BSA and MTF questions need much time to be prepared than VSA questions (Table 3).
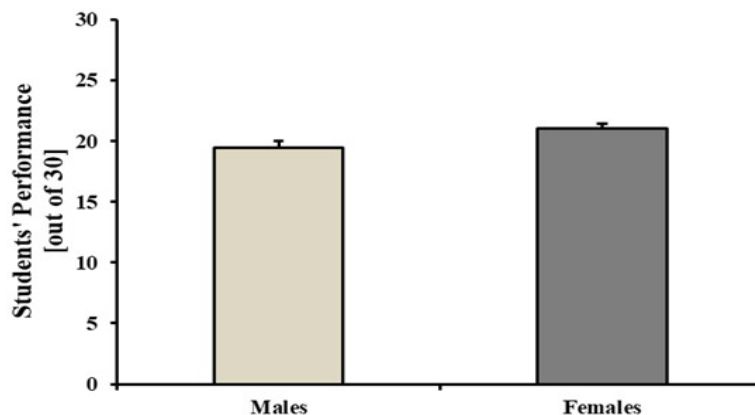
Figure 3. Overall performance of male and female students in the whole exam. Female students do slightly higher than male students in the whole exam.
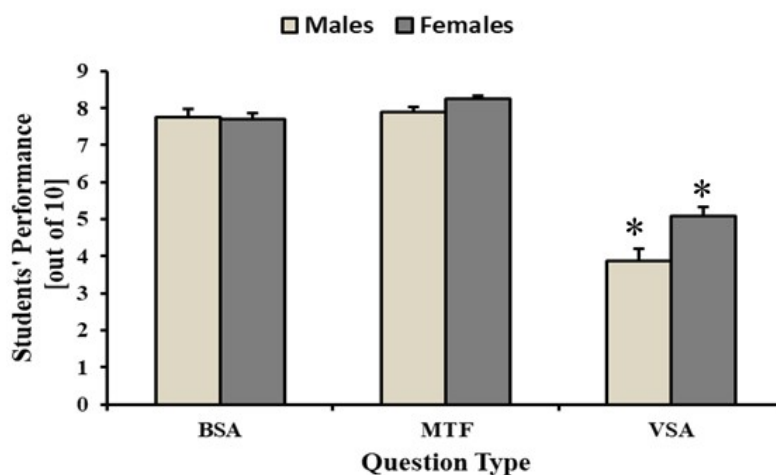
Figure 4. Performance of males and females students in BSA, MTF and VSA questions. Female students significantly score higher in VSA questions than male students. *, $p < 0.001$

4. Discussion

Our cross-sectional study revealed that students' performance was much higher in MCQs (BSA and MTF question types) over VSA questions. Generally, higher performance in MCQs is a trend in many higher education schools. In this context, Pepple et al. (14) reported that pre-medical students got a significant higher score in MCQs than long essay questions. Sam et al. (15) showed that BSA scores were significantly higher than VSA scores. Puthiaparampil and Rahman (4) found that the performance of medical students in BSA questions was skewed towards high scores. The higher students' performance in BSA questions seems to be attributed to some positive and negative reasons. Positive reasons include fast processing time, testing deep thinking and understanding rather than calling knowledge, instant machine scoring and absence of examiner bias, and covering lots of contents (16). Negative reasons which are also considered drawbacks at the same time include guessing the correct answers, test wiseness, looking for question banks and

cheating (4,17). Students' performance in MTF questions in our study was also quite higher. This is inconsistent to the finding of Puthiaparampil et al. (18) who reported low student scores in MTF question exam. In addition to the reasons that push students to prefer BSA questions, partial credit for any corrected choices enabled students to achieve higher scores in MTF.

Students' performance in VSA questions was very low compared to BSA and MTF questions. This is consistent with some studies which found that students usually show lower performance in VSA questions (16). The lower performance in VSA questions seems to be due to most of the students did not study the information well enough to recall them during the exam and depends on their ability to remember the correct answer when they see it in a short list of alternatives. With other words, the lower performance in VSA questions is returned to students' style in learning and preparation for the exam, not to the question type. This is supported by the fact that students who got higher scores in VSA questions always do well in MCQs and not the vice versa. Moreover, many students depend on scoring in MCQs to pass the exam and therefore reduce their studying time. This results in diminishing long-term retention of information and decreases recalling information to score in VSA questions (19).

According to Cronbach's alpha test, our results showed that reliability of BSA and MTF questions is quite higher than VSA questions. Statistically, reliability means that the test is reproducible with similar results when it is used for different groups (20). Moreover, test reliability is higher when it covers wide contents of the subject (20). Similarly, Al-Rukban (21) showed that MCQs were more reliable than essay questions. On the other hand, Sam et al. (16) found that the reliability of VSA questions were higher than MCQs. From our point of view, MCQ type is able to cover wide range of topics within the course more than VSA question type.

Regarding gender bias, female students did slightly higher in the overall exam and significant higher scores in VSA questions. Both males and females did similarly in BSA and MTF questions. Gender bias has been reported in some previous studies. For example, Kelly and Dennick (22) found that male students did well in MTF questions and female students scored higher in short answer questions. The authors suggested that male students did well in MCQs as they are more likely to take risks on negatively marked questions (22). Foster (23) reported that there was no gender effect in the performance of male and female veterinary students on short answer questions. Andrew et al. (24) concluded that the students' performance in an exam of introductory atmospheric course did not skew to favor any particular gender.

Students' feedback revealed that most students in our study preferred BSA and MTF questions, and found VSA questions more difficult. Kankhare et al. (3) and Kaipa (25) observed that the majority of students strongly preferred MCQs in their regulator exams. The reasons why the students prefer MCQs are (i) they need to recognize the answer and not the details, (ii) they can guess the answer, (iii) they can complete the exam in short time with less writing and (iv) they can employ a surface learning in courses that use MCQs. On the other hand, Puthiaparampil and Rahman (4) found that students' opinions were highly in favor of VSA questions. The students who prefer VSA questions suggested that this type of questions is subjective in nature, recognizes students who are studying hard and allows earning partial credits.

The result of the current study showed that 60% of the faculty preferred BSA and MTF questions. Their preference is driven by the belief that this type of questions efficiently evaluates students understanding rather than recalling knowledge, is easily corrected

using electronic tools and can cover most of the course subjects. Previous studies found that faculty preference was mixed for MCQs versus short answer questions (26). For example, Kaipa (25) found that the faculty who preferred MCQs and short answer questions in their courses were 47.69% and 52.30%, respectively. The author reported that 90% of the faculty who preferred MCQs agreed that this kind of questions is more objective in nature, easier and requiring less writing, could be guessed and easy to be grade (25). While, the faculty who preferred short answer questions explained that this form of assessment requires better writing ability, decreases guessing and promotes higher order thinking (25, 27-28).

Table 2. Students' feedback on BSA, MTF and VSA questions.

Students feedback	BSA	MTF	VSA
Which question type is the easiest?	30	26	4
Which question type is the most difficult?	4	12	44
Which question type do you prefer, BSA or VSA?	50	-	10
Which question type do you prefer, BSA or MTF?	32	24	-
Which question type makes you study hard?	18	20	22
Which question type makes you study all parts of the course?	16	22	18
Which question type can you guess?	28	20	12

Table 3. Faculty feedback on BSA, MTF and VSA questions.

	MCQs (BSA & MTF)	VSA
Which type of questions do you prefer in your exams?	20	10
Which type of questions make the students study hard?	17	13
Which type of questions make students study all parts of your course?	22	8
Which type of question is more efficient in assessment students?	21	9
Which type of question is suitable for veterinary students?	18	12

5. Conclusions.

• MCQs in the form of BSA and MTF questions are more reliable and preferentially favored by veterinary pathology students and faculty than VSA questions.

• Student's performance is much better in MCQs than in VSA questions.

• The study reveals strong positive correlation between overall students' performance in the three different types of questions.

Declaration of conflict of interest: The authors declare that there are no competing interests related to the study.

References.

1. Nettles MT. History of Testing in the United States: Higher Education. The annals of AAPSS, 2019. 683, 38-55. https://http://doi.org/.org/10.1177/0002716219847139

2. Gronlund N. Assessment of Student Achievement. Ninth Edition for the University of Alberta. Toronto: Pearson Education, Upper Saddle River, N.J., 2009.

3. Kankhare SB, Patil AD, Bahetee BH. Perception of students on various format of written assessments in higher education. Indian Journal of Anatomy 2019, 8, 2015-2018. http://dx.http://doi.org/.org/10.21088/ija.2320.0022.8319.13

4. Puthiaparampil T, Rahman MM. Very short answer questions: a viable alternative to multiple choice questions. Medical Education 2020, 20, 141. https://http://doi.org/.org/10.1186/s12909-020-02057-w

5. Alquraan MF. Methods of assessing students' learning in higher education: An analysis of Jordanian college and grading system. Education, Business and Society: Contemporary Middle Eastern Issues 2012, 5, 124-133. http://dx.http://doi.org/.org/10.1108/17537981211251160

6. Shavelson RJ. On an approach to testing and modeling competence. Educational Psychologist 2013, 48, 73-86. https://http://doi.org/.org/10.1080/00461520.2013.779483

7. Chappuis J, Stiggins RJ. Introduction to student-involved Assessment for Learning, 6th ed., Pearson, Columbus, OH, 2017.

8. Falchicov N. Improving Assessment Through Student Involvement: Practical Solutions for Aiding Learning in Higher Education and Further Education, Routledge, New York, NY, 2005. https://http://doi.org/.org/10.4324/9780203220993

9. 9. Alquraan MF, Bsharah MS, Al-Bustanji MA. Oral and written feedback and their relationship with using different assessment methods in higher education. International Journal of Applied Educational Studies 2010, 7, 1-16.

10. Ozden Y, Ertuk I, Sanli R. Students' perceptions of online assessment. Journal of Distance Learning 2004, 19, 77-93.

11. White C. Student portfolios: an alternative way of encouraging and evaluating student learning. New Directions for Teaching & Learning, 2004, 100, 37-42.

12. Ruiz-Primo M, Min L, Ayuala C, Shavelson, R.J. Evaluating students' science notebooks as an assessment tool. International Journal of Science Education 2004, 8, 1477-506. https://http://doi.org/.org/10.1080/0950069042000177299

13. Thomas RM, Kaipa R. The use of non-speech oral-motor exercises among Indian speechlanguage pathologists to treat speech disorders: an online survey. South African Journal of Communication Disorders 2015. 62, 1-12. http://dx.http://doi.org/.org/10.4102/sajcd.v62i1.82

14. Pepple DJ, Young LE, Carroll RG. A comparison of student performance in multiple-choice and long essay questions in the MBBS stage I physiology examination at the University of the West Indies (Mona Campus) Adv Physiol Educ 2010, 34, 86-89. http://doi.org/10.1152/advan.00087.2009

15. Sam AH, Field SM, Collares CF, van der Vleuten CP, Wass VJ, Melville C, Harris J, Meeran K. Very-short-answer questions: reliability, discrimination and acceptability. Med Educ 2018, 52, 447-55. http://doi.org/10.1111/medu.13504

16. Sam AH, Hameed S, Harris J, Meeran K. Validity of very short answer versus single best answer questions for undergraduate assessment. BMC Med Educ 2016. 16, 266. http://doi.org/10.1186/s12909-016-0793-z

17. Manoharan S. Cheat-resistant multiple-choice examinations using personalization. Computer & Education 2018, 13, 139-151. http://doi.org/10.1016/j.compedu.2018.11.007

18. Puthiaparampil T, Gudum HR, Rahman MM, Saimon R, Lim IF. True-false analysis reveals inherent flaws in multiple true-false tests. Int J Community Med Public Health 2019, 6, 4204-8. http://doi.org/10.18203/2394-6040.ijcmph20194476

19. Funk SC, Dickson KL. Multiple-Choice and Short-Answer Exam Performance in a College Classroom. Teaching of Psychology 2011, 38, 273-277. http://doi.org/.org/10.1177/0098628311421329

20. Burton RF. Multiple-choice and true/false tests: myths and misapprehensions. Assess Eval High Educ 2005, 30, 65-72. http://doi.org/10.1080/0260293042003243904

21. Al-Rukban MO. Guidelines for the construction of multiple choice questions tests. Journal of Family & Community Medicine 2006, 13, 125-133.

22. Kelly S, Reg D. Evidence of gender bias in True-False-Abstain medical examinations. BMC Medical Education 2009, 9, 32. http://doi.org/10.1186/1472-6920-9-32

23. Foster N. Analysis of Short-Answer Question Styles versus Gender in Pre-Clinical Veterinary Education. JVME 2011, 38, 67-73. http://doi.org/10.3138/jvme.38.1.67

24. Lin HH. Gender Differences in Science Performance, Journal of Students in Education 2015, 5, 181. http://doi.org/10.5296/jse.v5i4.8526

25. Kaipa RM. Multiple choice questions and essay questions in curriculum. Journal of Applied Research in Higher Education 2021, 13, 16-32. http://doi.org/.org/10.1108/jarhe-01-2020-011

26. Bird JB, Olvet DM, Willey JM, Brenner J. Patients don't come with multiple choice options: essay-based assessment in UME. Medical Education Online 2019, 24, 1649959. http://doi.org/10.1080/10872981.2019.1649959

27. Parmenter DA. Essay versus multiple-choice: student preferences and the underlying rationale with implications for test construction. Academy of Educational Leadership Journal. 2009, 13, 57-71.

28. Mullen K, Schultz M. Short answer versus multiple choice examination questions for first year chemistry. International Journal of Innovative Science and Modern Engineering 2012, 20, 1-18.