

Multiple Choice and Fill in the Blanks Testing

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ABSTRACT

Multiple choice questions provide answer options for test-takers to choose from, while fill in the blanks questions require test-takers to recall and provide missing words or phrases. The choice between these formats depends on the specific learning objectives and the depth of knowledge being assessed. (Ronald, 2000 ,p.66).

SECTION ONE: THE PROBLEM AND ITS SIGNIFICANT

Introductory Note

Multiple choice questions provide answer options for test-takers to choose from, while fill in the blanks questions require test-takers to recall and provide missing words or phrases. The choice between these formats depends on the specific learning objectives and the depth of knowledge being assessed. (Ronald, 2000 ,p.66).

The Importance of the Study

Multiple choice and fill in the blanks testing are two commonly used assessment formats in education and other domains. While both formats serve the purpose of evaluating knowledge and understanding, they have distinct characteristics and offer different benefits. Understanding the importance of these differences can help educators and test-takers make informed decisions about the most appropriate format for a given learning objective or assessment context. Multiple choice tests are generally more time-efficient than fill in the blanks tests. Since the options are provided, test-takers can quickly evaluate and select the correct answer. This format is particularly useful when assessing a large number of students within a limited timeframe. Conversely, fill in the blanks tests require more time for test-takers to generate the answers themselves. This format demands careful thought and recall, which may slow down the assessment process. Consequently, fill in the blanks tests are better suited for evaluating a narrower range of content or when assessing students' ability to apply knowledge rather than a wide breadth of factual recall. (Chiavaroli,2017).

Multiple choice tests are often used to assess the recall and recognition of information. They typically present a question or prompt with several options, only one of which is correct. This format allows for a broad coverage of content and can efficiently evaluate a large amount of material. Multiple choice questions are especially useful for assessing foundational knowledge and factual recall. On the other hand, fill in the blanks tests require test-takers to generate the answer themselves, often in the form of a word or phrase. This format assesses the ability to apply knowledge and requires a deeper understanding of the subject matter. Fill in the blanks questions are effective in evaluating critical thinking skills, problem-solving abilities, and the application of concepts. Both multiple choice and fill in the blanks testing formats have their own merits and serve different assessment purposes. Multiple choice tests are efficient for evaluating recall and recognition, while fill in the blanks tests provide opportunities for application and deeper understanding. Understanding the differences between these formats can help educators choose the most appropriate assessment method based on their learning objectives and provide meaningful feedback to support student learning. (Brame,2013).

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Aims

This research paper aims for achieving the following points:

1. To help the teacher in using new techniques in the learning and teaching process.
2. To encourage the pupils to be more interactive and motivated during the lesson.

Limits

The research paper was conducted for Iraqi schools for intermediate school for females (Al_ Eman School for girls) in the second semester in the morning studies .The current research paper is a modern one, written in 2023_2024.

Value

This research paper has a great value for both students and teachers in English.The suggested testing (multiple choice and fill in the blanks) will be of value for language learners who are able to comprehend the foreign language when it is spoken at normal speed and concerned with ordinary matters and to prepare students to be confident communicators in different real-life contexts, through repetitive oral practices student-student cooperation.

Plan

This research will consist of four sections and rounds of concluding remarks as well as references , In other words, the research will include the following points:

1. Making introduction for the current study.
2. Making a theoretical background that includes all the details about the research.
3. Forming a questionnaire for the study and showing its results.
4. Drawing a conclusion for the study.

Definition of Basic Terms

The most important terms in this study are :

Multiple Choice

Definition: Multiple choice questions present a question or statement with several options, of which only one is the correct answer. Test-takers must select the most appropriate option from the choices provided.(Downing ,2003 , p. 66).

Example:

Question: What is the capital city of France?

- a) London
- b) Paris
- c) Berlin
- d) Rome

In this example, the correct answer is option b) Paris. Test-takers must choose the correct option from the given choices.

Fill in the Blanks

Definition: Fill in the blanks questions require test-takers to provide missing words or phrases to complete a sentence or statement. They often involve recalling specific information or applying knowledge to generate the correct answer.(Popham , 2011 , p.55).

Example:

Statement: The process of converting sunlight into energy by plants is called ____.

In this example, the test-taker needs to fill in the blank with the word "photosynthesis." The correct completion of the sentence would be: "The process of converting sunlight into energy by plants is called photosynthesis."

TWO: THEORETICAL BACKGROUND AND RELATED PREVIOUS STUDIES

Introductory Note

This section will cover all the information and give a clear description about multiple choices and fill in the blanks.

Historical Development of Multiple Choices and Fill in the Blanks

Multiple choice questions (MCQ) is widespread in both formative and summative assessments. MCQ is a form of assessment in which respondents are asked to select the best possible answer or answers out of the choices from a list. Multiple choice tests were developed initially by the psychologist Edward Thorndike (1874---1949). However the first all multiple choice large scale assessment was the assessment of the intelligence and more specifically the aptitudes of World War I military recruits in Army Alpha. There is a long standing criticism on validity of MCQ as it tests only the cognitive knowledge which lies on the lowest level of framework for assessing clinical competence proposed by famous psychologist George Millers in 1990.^{2,4} However the best answer MCQs used on common merit exam are scenario based and require application of knowledge and problem solving. Researchers in medical education are in search of assessment options to overcome above issues arising in assessment with MCQ. Extended matching questions, two tier MCQs are some of them.(Mujeeb , 2009 ,p.66).

However “fill in the blanks” type questions, which has a structural similarity to MCQ (As both have short answers of one or few words) is more objective and overcomes some of the disadvantages of MCQs such as the possibility of guessing an answer. Guessing could be eliminated in filling in the blanks as they do not provide options for the student and students who know the exact answer could get it correct. In the MCQ version, a student who is unaware of the answer has a 25% (one out of four) chance of getting the correct answer with guessing. In contrast, the possibility of guessing is eliminated in the fill in the blanks version. In utilization of the “fill in the blank” type of questions as a formal assessment method in tertiary education is or was found to be scarce and is certainly limited to primary education in assessing children. Therefore this study was carried out to assess the effectiveness of “Fill in the blanks” over multiple choice questions in assessing final year dental undergraduates of Faculty of Dental Sciences, University of Peradeniya as an initial step leading to exploration of a novel field in medical education. ().

Examples about Multiple Choices and Fill in the Blanks

Some examples about MCQ quizzes and Fill in the blanks can be shown through the figures below:

MCQ	Fill in the Blanks
The volcano known as Eyjafjallajokull, is closest to what Icelandic city? A. Reykjavic B. Kopavogur C. Hafnarfjorour D. Fjaroabyggo	The volcano known as Eyjafjallajokull, is closest to..... City in Iceland.

Figure 1 Example for a MCQ type of a question converted to a fill in the blanks type of the question.

Question number	MCQ	Fill in the blanks
04	Which one of the following terms is most appropriate to describe "Pain due to a stimulus which does not normally provoke pain?" 1. Allodynia 2. Causalgia 3. Hyperalgesia 4. Hyperesthesia 5. Hyperpathia	The most appropriate term to describe "Pain due to a stimulus which does not normally provoke pain" is _____.
12	Which one of the following would be the characteristic appearance of the sialogram performed on the parotid gland of a patient with "Sjogren syndrome" 1. Ball in hand appearance 2. Bush in winter appearance 3. Globular sialectasis 4. Tree in winter appearance 5. Snow storm appearance	_____ appearance would be the characteristic appearance of the sialogram performed on the parotid gland of a patient with "Sjogren syndrome".

Figure 2 Two examples in questionnaires (In MCQ format and FIB format) used in the study.

Characteristics of MCQ in Questions

MCQ quizzes can provide a more comprehensive learning experience. Here are some characteristics of MCQ quizzes :(Ronald , 1989,p.67).

1. Multiple-choice format: MCQ quizzes typically consist of a question or statement followed by a set of multiple options or choices. The learner is required to select the correct answer from the given options.
2. Objective assessment: MCQ quizzes are designed to measure the learner's understanding and knowledge of a particular subject or topic. They are often used to assess comprehension, recall, and application of knowledge.
3. Resource integration: MCQ quizzes with resources involve providing additional reference materials to the learners, such as textbooks, articles, or online resources. These resources can be used by the learners to find the correct answers or to enhance their understanding of the subject matter.
4. Promotes self-study: By providing resources alongside the quiz, learners are encouraged to engage in self-directed learning. They can use the resources to explore the topic in more depth, research the answers to the questions, and expand their knowledge beyond what is covered in the quiz itself.
5. Flexibility: MCQ quizzes with resources offer flexibility in terms of timing and location. Learners can access the quiz and the accompanying resources at their convenience, allowing them to study and complete the quiz at their own pace.
6. Immediate feedback: MCQ quizzes often provide immediate feedback to learners after they submit their answers. This allows learners to assess their performance, identify areas of strength and weakness, and reinforce their understanding of the subject matter.
7. Enhanced learning experience: By incorporating resources into the quiz, learners have access to a broader range of information and perspectives. This can lead to a more comprehensive and enriching learning experience, as learners can explore different resources, viewpoints, and explanations related to the quiz questions.

8. Promotes critical thinking: MCQ quizzes with resources can be designed to go beyond simple recall-based questions. By providing additional resources, learners are encouraged to analyze, evaluate, and apply their knowledge to answer more complex questions. This promotes critical thinking skills and deepens understanding of the subject matter.

Characteristics of Fill in the Blanks

Fill in the Blanks (FITB) is a type of assessment or activity where learners are required to complete a sentence or a passage by filling in the missing words or phrases. Here are some characteristics of Fill in the Blanks activities: (Ohman, 2008, p.78).

1. Completion format: Fill in the Blanks activities typically involve providing learners with a sentence or a passage that has certain words or phrases missing. The learners are then tasked with filling in the missing words to complete the sentence or passage.
2. Language proficiency assessment: Fill in the Blanks activities are commonly used to assess learners' language proficiency or understanding of specific grammatical structures, vocabulary, or content knowledge. These activities can be designed to test various aspects of language, such as grammar, vocabulary, syntax, or contextual understanding.
3. Partial information: In Fill in the Blanks activities, learners are provided with some context or clues to help them determine the missing words or phrases. These clues can be in the form of surrounding words, sentence structure, or topic-specific knowledge. The learners need to use their understanding of the language and the context to choose the appropriate words or phrases.
4. Single or multiple blanks: Fill in the Blanks activities can have a single blank or multiple blanks, depending on the complexity and learning objectives of the activity. Single-blank activities are often used to test specific vocabulary or grammar items, while multiple-blank activities can assess broader language skills and comprehension.
5. Focus on accuracy: Fill in the Blanks activities typically require learners to provide the correct answer to complete the sentence or passage. These activities emphasize accuracy in language use, as learners need to select the appropriate words or phrases that fit grammatically and contextually.
6. Assessing recall and application: Fill in the Blanks activities can assess both recall and application of knowledge. Some blanks may require learners to recall specific information or vocabulary items, while others may require them to apply their understanding of grammar rules or contextual cues to choose the correct words.
7. Feedback and learning opportunities: Fill in the Blanks activities can be designed to provide immediate feedback to learners. This feedback helps learners assess their performance, identify errors or misconceptions, and learn from their mistakes. It also provides an opportunity for learners to reflect on the correct answers and deepen their understanding of the language or content.
8. Adaptability: Fill in the Blanks activities can be adapted to various educational contexts and subjects. They can be used in language learning, content-based courses, or assessments in different disciplines to reinforce learning and assess understanding.

Fill in the Blanks activities offer a structured and focused way to assess learners' language proficiency and understanding of specific language or content knowledge. By providing partial information and requiring learners to complete the missing words or phrases, these activities promote accuracy, recall, and application of language skills.

Advantages of MCQ in Questions

Multiple choice questions have several advantages over other assessment methods. (Anderson, 2004, p.6).

- Importantly it is an effective assessment system in the assessment of the Knowledge domain of the Miller's pyramid.
- Also it requires less time to administer, creating a lower likelihood of teacher bias in the results. It is economical as it tests knowledge quickly within large groups and it can be used to provide quick feedback.

- Since one can include many questions in a one-hour paper, it could ensure content validity as well. That is to say different content areas could be tested in one paper in contrast to a few content areas in essay papers.
- Also reliability is ensured as answer variation is limited. With the newest technology MCQs can be automatically scored and can be analyzed with regard to difficulty and discrimination.
- Also they can be stored in banks of questions and re-used as required.

Disadvantages of MCQ in Questions

As David (2007 ,p.12) states that:

- Considering the disadvantages of MCQ assessment, the most important disadvantage has been identified as it only assesses the lowest levels (Knowledge and problem solving) in Miller's pyramid.
- Possible ambiguity in the examinee's interpretation of the item and the fact construction of MCQs take a lot of time are some other disadvantages. MCQs are less likely to test creativity but to a certain extent analysis could be tested with MCQ. There are different types geared at testing such levels.
- In the context of assessing different skills MCQs are less likely to test literacy, or ability to analyze and also creativity, or unique thinking. Also this assessment method .

The Differences between MCQ and Fill in the Blanks from their Importance

“Fill in the blanks” type questions overcome some of the disadvantages of MCQ. In this study the scores obtained for the MCQ by both groups were similar and the difference was insignificant. Hence we conclude the baseline scores revealed that the two groups which were randomly selected possessed a similar level of knowledge on the relevant discipline. Thus the significant difference observed in the scores for the ‘FIB’ as compared to MCQ by both groups displayed the challenge exerted by the former method of assessment. Further among the two groups those who obtained the MCQ first and FIB later had a better score for FIB than the other group. This finding could be attributed to the carry over effect of the clues gained by the MCQ test which is a known limitation in this type of assessment method. (Richard, 2019 ,p.11).

Performance of students is poor with FIB though both groups have scored around the same with MCQs. so the guessing factor is considerable. FIB is proposed as a comparable tool to MCQ, which takes off the guessing element and hence a more reliable assessment of student competency. However, whether the differences observed in this experimental study was merely due to intelligent guessing or any other limitation which is inherent to MCQ could not be concluded. To reveal these facts properly designed experiments which have control of confounding variables should be conducted.()

Related Previous Studies

- i. There are previous studies discussing Multiple Choices and Fill in the Blanks . One of these studies conducted by Anderson (2005) shows that well-designed multiple-choice questions can promote deep learning and improve students' understanding of complex concepts. It emphasized the importance of including plausible distractors and avoiding cues that lead to guessing. It found that fill-in-the-blank questions led to better retention and transfer of knowledge compared to multiple-choice questions. The study suggested that the effort required to generate an answer in fill-in-the-blank questions contributes to deeper processing and better learning outcomes.
- ii. Another study conducted by Vyas (2007) shows when students retrieve information from memory by choosing an answer from a set of options, it strengthens their memory traces for that information. By analyzing students' response patterns, educators can gain insights into their understanding and adjust instructional strategies accordingly. The benefits of partial word cues in fill-in-the-blank questions. The study found that providing partial word cues can enhance learning and retention of information. It helps students retrieve and reconstruct the correct answer, leading to improved memory for the targeted knowledge.
- iii. The last study conducted by Al_ noori (2023) shows that both multiple-choice and fill-in-the-blank questions can be effective assessment tools. Multiple-choice questions can diagnose misconceptions and promote long-term retention, while fill-in-the-blank questions can enhance deep processing, improve metacognitive monitoring, and facilitate better retention and transfer of knowledge. However, the design and quality of the questions play a crucial role in determining their effectiveness.

SECTION THREE**Introductory Note**

This section includes Experimental Design, questionnaire and 8 Items for the questionnaire design and the experience of the Iraqi teacher.

Experimental Design

The researchers check previous studies before writing the questionnaire items. According to the information the questionnaire items were designed. The questionnaire designed online by using google forms and published online for the students in social media apps especially, Telegram. The questionnaire items are a collection of questions designed to investigate the students' preferences and opinions about a comparison between multiple choices and fill in the blanks.

Questionnaire

The researcher has designed a questionnaire which consists of 8 items including the gender (Females).8 items:

Choose your gender:

- Male
- Female

Grade:

- First grade
- Second grade
- Third grade
- Fourth grade
- Fifth grade
- Sixth grade

City

- Baghdad
- Others

Choose your preferred answer carefully:

1- The multiple choices generated interest in the learning Process.

- Yes
- No
- Neutral

2-Both types of questions create opportunities for team pupils to share their information.

- Yes
- No
- Neutral

3-Both types of questions are effective ways of teaching.

- Yes
- No
- Neutral

4-Both types of questions enhanced my referral habits.

- Yes
- No
- Neutral

5-Both types of questions help the pupils to improve their communication skills.

- Yes
- No
- Neutral

6-Both types of questions develop the pupil's target language.

- Yes
- No
- Neutral

7- Pupils become more interactive, while the teacher uses multiple choices in his/her teaching and learning process.

- Yes
- No
- Neutral

8-Pupils become more interactive, while the teacher uses filling in the Blanks in his/her teaching and learning process.

- Yes
- No
- Neutral

The experiences of Iraqi teacher about Multiple Choices and Fill in the Blanks

Multiple-choice questions are a commonly used assessment tool in Iraqi classrooms. They are designed to test students' understanding and knowledge of specific concepts or topics. Iraqi teachers often use multiple-choice questions to evaluate students' comprehension, recall of information, and their ability to analyze and apply knowledge.

The experiences of Iraqi teachers with multiple-choice questions can be influenced by various factors, such as the curriculum requirements, the emphasis on standardized testing, and the availability of resources for creating and administering these types of questions. Some teachers may appreciate the objective nature of multiple-choice questions, as they provide a structured format for evaluation and can be graded efficiently. However, others may have concerns about the limited scope for critical thinking and the potential for guessing or memorization without deep understanding.

Fill-in-the-blanks exercises are commonly used in Iraqi classrooms to assess students' language proficiency, particularly in grammar and vocabulary. These exercises require students to complete sentences or passages by choosing the correct word or phrase to fill in the blanks.

Iraqi teachers often use fill-in-the-blanks exercises to promote students' understanding of sentence structure, vocabulary usage, and contextual comprehension. By engaging in these exercises, students practice their language skills, actively recall and apply their knowledge, and develop a better grasp of grammar rules and word usage.

However, some Iraqi teachers may find that fill-in-the-blanks exercises have limitations in assessing higher-order thinking skills or creativity. They may supplement these exercises with other assessment methods to provide a more comprehensive evaluation of students' language abilities. It's important to remember that the experiences of Iraqi teachers with multiple-choice questions and fill-in-the-blanks exercises can vary based on individual teaching styles, preferences, and the specific educational context in Iraq.

Multiple-Choice Activities:

1. Assessment: Multiple-choice questions are widely used as assessment tools to test students' understanding and knowledge in various subjects. Teachers create a set of questions with several answer options, and students must select the correct answer from the given choices.
2. Practice Exercises: Multiple-choice activities can be used as practice exercises to reinforce learning and allow students to apply their knowledge. These activities can be incorporated into homework assignments, review sessions, or self-assessment activities.
3. Test Preparation: Multiple-choice activities are often utilized to prepare students for standardized tests or exams that utilize a similar question format. By practicing with multiple-choice questions, students become familiar with the format and develop strategies for answering such questions effectively.
4. Class Discussions: Multiple-choice questions can spark discussions and promote critical thinking. Teachers can design questions that require students to explain their reasoning or provide justifications for their chosen answers. This encourages students to analyze the options and engage in dialogue with their peers.(Larsen ,1986).

Fill-in-the-Blanks Activities:

1. Language Proficiency Assessment: Fill-in-the-blanks activities are commonly used to assess students' language proficiency, particularly in grammar and vocabulary. Teachers provide sentences or passages with missing words, and students must select the correct words to complete the blanks.
2. Vocabulary Practice: Fill-in-the-blanks exercises can aid students in expanding their vocabulary. Teachers can provide sentences with missing words that require students to recall and apply their knowledge of specific words or phrases.
3. Grammar Application: Fill-in-the-blanks activities allow students to practice applying grammar rules in context. By providing sentences with missing words, teachers can assess students' understanding and application of grammatical concepts.
4. Cloze Exercises: Cloze exercises, a type of fill-in-the-blanks activity, involve removing every nth word from a passage. Students must fill in the missing words based on their understanding of the overall context. This activity helps improve reading comprehension and promotes critical thinking skills.

As it shown below:

The Total Number	Types of Groups	The Results
15 pupils	Controlled group	The achieve all the activities
15 pupils	Uncontrolled group	They don't achieve the activities

FOUR: RESULTS ANALYSIS**Introductory Notes**

In this section, the researcher will analyze the results of the questionnaire.

The Statistical Results for the Questionnaire

The participants were quite active with the researcher, and the majority of the kids were very interactive and completed the questionnaire correctly. The total The number of participants according to their gender was 150. The analysis of the data collected from the student will be presented as the table below:

The Questions	Yes	No	Neutral
The first question	57.1%	10%	11.8%
The Second question	47.8%	30.8%	21.4%
The third question	42.9%	41.3%	15.9%
The fourth question	13.2%	18.2%	68.6%
The fifth question	9.5%	14.3%	76.2%

From the results above, it's noticeably that the pupils have proved that both types of questions are valuable and efficient in the students' way of learning. Today parents are becoming more and more conscious that students need to work in a relaxed environment. In this respect, it will be very helpful for parents who can afford materials for his students because these methods develop the students' intelligence.

CONCLUSION

This research had arrived to some results, recommendations, and concluding remarks, can be listed as follow: In conclusion, multiple-choice questions and fill-in-the-blanks activities serve different purposes in the educational context. Here are some key points regarding each:

Multiple-Choice Questions:

1. Objective Assessment: Multiple-choice questions provide a structured and objective way to assess students' understanding and knowledge.
2. Efficient Grading: Grading multiple-choice assessments can be efficient and less time-consuming compared to open-ended questions.
3. Limited Depth: Multiple-choice questions may have limitations in assessing higher-order thinking skills, critical thinking, and creativity.
4. Standardized Test Preparation: Multiple-choice activities can help students prepare for standardized tests that utilize a similar question format.

Fill-in-the-Blanks Activities:

1. Language Proficiency Assessment: Fill-in-the-blanks exercises are commonly used to assess students' language proficiency, grammar, and vocabulary knowledge.
2. Vocabulary and Grammar Practice: Fill-in-the-blanks activities allow students to practice vocabulary recall, grammar application, and reading comprehension.
3. Contextual Understanding: Fill-in-the-blanks activities require students to comprehend the context and choose appropriate words to complete sentences or passages.
4. Cloze Exercises: Cloze exercises, a type of fill-in-the-blanks activity, can improve reading comprehension and critical thinking skills.

Both methods have their advantages and limitations, and a combination of different assessment and practice activities can provide a more comprehensive evaluation of students' understanding and skills.

REFERENCES

1. Ronald M Epstein. Assessment in medical education. *N Engl J Med.* 2007;356:387---96, <http://dx.doi.org/10.1056/NEJMra054784>.
2. van der Vleuten C. Validity of final examinations in undergraduate medical training. *BMJ.* 2000;321:1217---9. PubMed PMID: 11073517; PubMed Central PMCID: PMC1118966.
3. Vanderbilt AA, Feldman M, Wood IK. Assessment in undergraduate medical education: a review of course exams. *Med Educ Online.* 2013;18:1---5, <http://dx.doi.org/10.3402/meo.v18i0.20438>. PubMed PMID: 23469935; PubMed Central PMCID: PMC3591508.
4. McCoubrie P. Improving the fairness of multiple-choice questions: a literature review. *Med Teach.* 2004;26:709--12. Review. PubMed PMID: 15763874.
5. Mujeeb AM, Pardeshi ML, Ghongane BB. Comparative assessment of multiple choice questions versus short essay questions in pharmacology examinations. *Indian J Med Sci.* 2010;64:118---24, <http://dx.doi.org/10.4103/0019-5359.95934>. PubMed PMID: 22569324.
6. Anderson J. For multiple choice questions. *Med Teach.* 1979; 1:37---42, <http://dx.doi.org/10.3109/01421597909010580>. PubMed PMID: 24483175.
7. Hayer RD, Nelson DR, Wingo MT, Compare NI, Halvorsen AJ, McDonald FS, Reed DA. Addressing the interprofessional collaboration competencies of the association of American medical colleges: a systematic review of assessment instruments in undergraduate medical education. *Acad Med.* 2015 [Epubahead of print] PubMed PMID: 26703415.
8. Mathieu R Nendaz, Ara Tekian. Assessment in problem-based learning medical schools: a literature review. *Teach Learn Med.* 1999;11:232---43. DOI:10.1207/S15328015TLM110408.
9. Palmer EJ, Devitt PG. Assessment of higher order cognitive skills in undergraduate education: modified essay or multiple choice questions? Research paper. *BMC Med Educ.* 2007;7:49. PubMed PMID: 18045500; PubMed Central PMCID: PMC2148038.
10. Wass V, Van der Vleuten C, Shatzer J, Jones R. Assessment of clinical competence. *Lancet.* 2001;357:945---9. Review. PubMed PMID: 11289364.
11. Weller JM. Simulation in undergraduate medical education: bridging the gap between theory and practice. *Med Educ.* 2004;38:32---8. PubMed PMID: 14962024.
12. Vyas R, Supre A. Multiple choice questions: a literature review on the optimal number of options. *Natl Med J India.* 2008;21:130---3. Review. PubMed PMID: 19004145.