Brief Communication

Test Item Order in Relation to Course Plan Content Sequence: Does it Affect Nursing Students' Grades in Pharmacology Exam?

Ahmad Mohammadi Farani Ph.D.

Novel Drug Delivery Research Center, School of Pharmacy, Kermanshah University of Medical Sciences, Kermanshah, Iran.

Address for Correspondence: School of pharmacy, Daneshgah St., Parastar Blvd., Kermanshah, Iran. Zip-code: 67346-67149, Tel (Fax): +988334276493, Email: amohammadifa@kums.ac.ir

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Abstract

Proper sequencing of multiple choice test items is a matter of concern for many constructors. In this study we compared the variances of three different pharmacology test formats for nursing students. The aim of the study is to see if changing the order of questions will have any effect on the grades of the students. One way analysis of variance (ANOVA) was used to compare the mean score of the three groups and Levenes test was used to evaluate the equality of variances between them. The results confirm that the variances of the grades in all formats are homogeneous (P=0.141) and there is not a statistical difference between the mean scores in each of the three question formats (P=0.566). It is conclusive that the performance of the nursing students in a pharmacology course does not change if item sequencing is not according to the course plan content sequence.

Keywords: Multiple Choice Questions, Sequence, Performance

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Introduction

Medical students are commonly assessed by multiple choice questions (1). It is believed that item sequence in multiple choice (MC) questions affects student performance in this kind of exam (2-6). Usually there is a reason behind these observations. For instance topically-sequenced examinations lead to higher scores in comparison to random versions. The reason is that students can more easily recall information in the same order in which they learned it (2). Some other studies mention that anxiety states of the students may change in differently sequenced examinations and this may directly affect the performance of the students (5).

For the best arrangement and to avoid getting grades similar to that of a chance grade it is mostly recommended that the total number of positions of the correct option should be equal for all positions in the whole exam and the questions (items) and should be arranged randomly (4). Sometimes the tester needs to develop different formats of a test with different sequences of the items. This is for example to avoid sneaking or collaboration of students. A tester may simply ask if there is any difference in the mean of student grades if the arrangement of the tests is similar to the arrangement of the course plan content (chapters) for one group and vice versa for other.

In cases where students of the same group are asked to do tests with different sequences of questions they may argue that the sequence of questions was biased against them. So the aim of the present study was to find if changing the order of test items would change the grades of the pharmacology exam in nursing students who take 3 different formats of a test.

Methods

In the 6 consecutive academic terms 2011-2013 a total of 259 nursing students were studied at Kermanshah Nursing and Midwifery school. Each term the examinations had 3 different item sequencing formats and the exams consisted of four-option multiple-choice items. So for each format students of 6 terms were included. In the first format (format A) the sequence of the questions was according to the sequence of the course plan contents. In the second format (format B) the sequence of the questions has been just opposite to the sequence of the course plan contents and in the third format (format C) the questions were randomly sequenced using the RAND function in Microsoft Excel 2010.

The same method of randomization was used to divide students into 3 groups (A, B and C). Conditions of the tests, like time to answer the questions and the number of questions, were equal for all groups. Levenes test was used to evaluate the equality of variances between the same formatted questions. Normality was checked by Kolmogorov–Smirnov test and the results of the three formats were compared by one way analysis of variance. SPSS 11.5.0 was used for statistical analyses.

Results

The Data was available for 259 students. Each group of students had one of the three question formats. Results for the Kolmogorov-Smirnov test for normality showed that the test score distribution did not deviate statistically from a normal distribution in all formats (D=0.087, P=0.114). Levenes test of homogeneity of variance confirmed that the variances in all three question formats were statistically equivalent (P=0.141).The results of the ANOVA test show that statistically there is not any difference between the mean of the grades in each of the three question formats [F (2, 256)= 0.565, P=0.566]. The results for mean and standard deviation of each group are presented in Table 1.

Table 1. Mean and standard deviations (SDs) of the three formats (A, B, C) of pharmacology exam in nursing students.

Question format	Student number	Min	Max	M±SD
A	83	3	20	12.34±3.37
B	89	6	19	12.85±2.77
C	87	7	19	12.68±3.15

Discussion

The results of our study show that the variance of the scores do not change in three different pharmacology test formats (two of which do not follow the course plan sequence) and the mean score of the students is not significantly different between them. So it seems that a test construction is fair for all students even if the sequences of the questions do not match the course plan content sequence in all formats.

Assessment is considered to be a critical component of instruction (7). Multiple choice tests are a form of assessment that has many advantages for both the instructor and examinee. Concerns about this type of evaluation are well reviewed by Simkin and Kuechler (2005) (8). It is a main concern that the method used for evaluation is not open to discrimination. It seems logical if we categorize the source of discrimination to intrinsic and extrinsic sources. Extrinsic source refers to those variables that are not related the format and structure of the evaluating method.

It is proved for instance that gender and ethnicity have discriminatory effects on medical students' performance on summative written and objective structured clinical examinations (OSCEs). The cause is attributed to difference in communicating skills, personality and study style (9). In another study Kelly et al. (2009) have demonstrated that True-False-Abstain medical examinations bias against female students (10). The authors have described this phenomenon by the greater risk taking behavior of males. Intrinsic sources are defined here as those factors which involve the structure of the test.

There are some reports claiming that sequencing of the test items from difficult to easy will decrease the motivation of the student and increased disappointment and anxiety of the examinees may influence their score in difficult to easy type item sequencing (5,11). Here we have endeavored to see if sequencing of the items in relation to the course contents, as another intrinsic factor, influences the mean level of student performance. This is an important issue because if this factor could change the performance of the examinee it is by itself a source of discrimination among students. As mentioned earlier some studies show that different item sequencing can change the performance of the students if the sequencing changes the order of difficulty of the items (5, 6).

In our study we found that there is not a difference between groups and the reason might be the fact that we did not intentionally change the order of difficulty of the questions. A main drawback in our study is that we did not consider the order of difficulty of the items in our

investigation. A detailed analysis of the tests according to classic test theory and determining item difficulty or facility can better remove this concern.

Conclusion

In this study we conclude that when an examiner is obliged to design different formats of questions he should not necessarily use the same test item sequence in relation to the course plan title sequence in order to keep the exam conditions fair for all students. It is always a matter of concern that different formats may have different orders of difficulty of their items which may affect the performance of the students.

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