The Effect of Computer-based Tests on Nursing Students' Test Anxiety: a Quasi-experimental Study

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ABSTRACT

Background: Test anxiety often leads to poor academic performance. This study aimed to determine the effect of computer-based tests on nursing students' test anxiety. **Methods:** This quasi-experimental study was conducted in 2016 on 39 nursing student with anxiety score under 128 on Spielberger's State-Trait Inventory (STAI). They were randomly allocated to computer-based tests (CBT) and paper-based test (PBT) group. Prior to exam, all students completed Sarason's Test Anxiety Scale (TAS). We administered CBT for students in experimental group. Data were analyzed using independent t-test and one-way ANOVA. **Results:** Students mean test anxiety score was 11.94 and 11.32 in CBT and PBT groups, respectively. 47.4% of students in CBT group and 29.4% of those in PBT group experienced higher test anxiety, while the difference was not significant ($p=0.56$). **Conclusions:** Despite, there was no significant difference between anxiety score of two groups; but students' test anxiety score was higher in CBT group. With the current increase in computer-based assessment, educational administrators must be aware of and plan for the possible unfavorable effects of computer assisted testing, such an anxiety. Future studies are needed to evaluate and compare the effect of different type of student testing such as distance testing or CBTs using new information technologies such as laptop, tablet or mobile phone on students' test anxiety and performance.

Keywords: Anxiety, Test Anxiety Scale, Students, Nursing, Computers, Online Systems, Computer-Based Tests.

1. INTRODUCTION

Assessment is a crucial responsibility of medical education systems for determining the effectiveness of teaching and giving feedback to learners and faculty members (1, 2). In this situation, learners anticipate for negative outcomes, as a result anxiety emerges as a most common achievement feeling (3). Test anxiety, as a type of trait anxiety, is a most common achievement feeling in related to specific situation, which students experience frequently. These unpleasant responses can affect on students' academic performances and their personal well-being (4-7). In other words, it is often leading to negative cognitive evaluation, lack of concentration, poor academic performance, and undesirable physical responses (8-9). A study in the US showed that students with higher test anxiety score experience somatic problems such as severe perspiration, stomachache, and palpitation during exams (10). Students

with test anxiety experience negative thoughts and worry about their performance. As a result, they fail to focus on the main subject and cannot easily recall what they have learned (11). Test anxiety may cause the increase of learning ability, but sever one may negatively affect on their academic performances (6, 8, 12-15). Students with higher test anxiety have usually more irrelevant responses in their exam, as a result in poorer test performance (16-21).

Test anxiety is related to various factors, including method of evaluation and exams. Some factors are related to test preparation and discomfort with testing situation and test-taking skills and their perception regarding technology use (22). Emergence of technology increases using new technology such as computers to transform traditional Paper-Based Test (PBT) into electronic Computer-Based Test (CBT) in the educational systems (23). Technology is a good alternative to tra-

ditional evaluation and exams, facilitating the realization of educational goals at lower costs. These technologies can also meet the ever-increasing educational needs of students (24). To implement this approach, students' needs and problems must be considered along with these changes. Computer-based assessment has been defined as the use of information technology for any activity pertaining to evaluation, with the most prevalent form being CBT (25-26). CBT requires equipment such as computers, laptops, smart phones, and iPads (27) for designing, presenting, saving, and reporting students' activities, scores, and feedbacks (28). Research finding indicated that some student prefer CBT, although test takers prefer traditional methods for evaluation the learners' knowledge (23, 29-30).

Although traditional evaluation methods is still acceptable in educational systems, considerable effort has been made in recent decades to replace traditional methods with novels ones based on students' needs and compatible using technology. Medical sciences universities have a short history of using CBT. In addition, anxiety is an important factor determining the educational and occupational future of students. Therefore, the aim of this study was to determine the effect of CBT on nursing students' test anxiety on Physiology exam.

2. MATERIALS AND METHODS

This quasi-experimental study was conducted in 2016 in Golestan University of Medical Sciences, Iran. Subjects comprised 39 nursing freshmen recruited by census. The inclusion criteria comprised willingness to participate, absence of any known psychiatric disease, no experience with CBT, taking physiology course for the first time, scoring below 128 on Spielberger's State-Trait Anxiety Inventory (STAI), and no participation in advanced courses of ICDL. After explaining the aim of the study, informed consent forms were obtained from all nursing students. Data were collected using a demographic information questionnaire (including age, sex, birth order, number of siblings, and type of family), Spielberger's STAI, and Sarason's Test Anxiety Scale (TAS).

To assess students' anxiety at the beginning of the study, we used STAI which includes 40 items and is scored on a 4-point Likert scale (from "Almost never" to "Almost always" or from "Not at all" to "Very much"). The state anxiety scale comprises 20 items that evaluate one's emotions at the time of responding to questions. The trait anxiety scale consists of 20 items that evaluate one's general and regular emotions. While responding to the state anxiety scale, respondents must select options which best describe the intensity of their emotions ("Not at all", "Somewhat", "Moderately", or "Very much"). While responding to the trait anxiety scale, respondents must select options, which express their regular emotions ("Almost never", "Sometimes", "Often", or "Almost always"). Each item on STAI receives a weight of 1 to 4, with 4 showing a high anxiety. The total score of 20 items in each scale ranges from 20 to 80. This questionnaire has a Cronbach's alpha of above 90%, indicating its high reliability (31).

Sarason's TAS is a self-report including 25 items used for evaluating and diagnosing test anxiety. "No" is scored 1 on items 3 and 15, while "Yes" is scored 1 on other items. Thus, total scores range from 0 to 25. Higher scores indicate a higher test anxiety, and test anxiety may be low (scores below

8), moderate (scores 8-12), or high (scores above 12). The face and content validity of TAS were confirmed and its Cronbach's alpha is above 88% as reported by various studies, indicating its high reliability (32-33).

At the beginning of the study, STAI was completed by all students. All eligible students ($n=39$) who with STAI score lower than 128 were allocated to CBT ($n=19$) or PBT ($n=20$) groups by simple randomization. Prior to the exam, students in both groups completed a demographic information questionnaire and TAS. Then, the intervention group received training regarding the administration of assessment delivered on computer in a local network. To administer the CBT, students logged on the test website using their user names and passwords. After logging in, each student read test instructions, and began the test. A timer on top of the screen showed the remaining time. The PBT group took the exam at the same time. The physiology exam was a multiple-choice test, equal to the CBT in terms of content, number of question and complexity of questions' level in cognitive domain based on Bloom's taxonomy, and time for answering to questions. In the CBT group, the order of questions and choices were randomly presented to students by the software, which the right answer from multiple choices was not the same as another students, to prevent cheating.

Data were analyzed in SPSS-16 using independent t-test and one one-way ANOVA at the significance level of 0.05. Moreover, the normality of distribution was evaluated using the Kolmogorov-Smirnov test.

3. RESULTS

Students' mean age was 20.15 ± 1.18 years. Majority of them were female (53.8%), single (97.4%), and resided off campus (74.4%). Students in the two groups matched in terms of sex, marital status, age, residence, parents' level of education, parents' occupation and score of information and computer technology course. The finding showed there was no significant difference between the two groups in terms of general anxiety scores. Although, anxiety score was higher in CBT group compared to the PBT group (Table 1).

Group	Mean	SEM	SD	p-value
CBT Group	80.07	4.63	17.33	0.73
PBT Group	78.15	3.27	14.28	

Table 1. Mean scores of students' general anxiety in CBT and PBT groups

Based on the Kolmogorov-Smirnov test, students' test anxiety scores in both groups were normally distributed ($p>0.05$). Based on results, mean scores of students' test anxiety in CBT and PBT groups was 11.94 ± 2.85 and 11.32 ± 4.11 , respectively, and both groups experienced a medium test anxiety. Results of t-test revealed that there was no significant difference between two groups in terms of mean test anxiety scores ($p=0.56$) (Table 2).

Group	Mean	SEM	SD	p-value
CBT Group	11.94	0.65	2.85	0.56
PBT Group	11.32	0.70	4.11	

Table 2. Mean scores of students' test anxiety in CBT and PBT groups

Results also demonstrated the lower incidence of higher

test anxiety in the PBT group compared to the CBT group (Table 3).

Level of anxiety Group	Low		Medium		High	
	Freq.	%	Freq.	%	Freq.	%
CBT	0	0	10	52.6	9	47.4
PBT	5	14.7	19	55.9	10	29.4

Table 3. Level of students' test anxiety in CBT and PBT groups

A comparison of the level of test anxiety between the groups showed that 47.4% of students in the CBT group and 29.4% of those in the PBT group experienced a higher test anxiety. The effect of anxiety on academic achievement (scores) showed that mean physiology score was 35.42 ± 9.28 and 35.09 ± 8.36 in CBT and PBT groups, respectively, indicating no significant difference between the two groups.

4. DISCUSSION

In this study there was no significant difference between anxiety score of CBT and PBT groups, but students' test anxiety score was higher in CBT group which is in line with the results of Wingenbach (34). Students usually spend a long time on their mobiles, tablets or laptops every day, as they are skilled in using them. Therefore, the absence of any significant difference between the two groups can be justified.

Furthermore, results suggested a medium test anxiety for students, with the CBT group scoring higher than the PBT group, although the difference was not significant. This is consistent with the results of other studies reporting a medium test anxiety (8, 35-36). It, however, contradicts the results of other studies reporting a low (37) and high (33) test anxiety among university students. This difference in the level of test anxiety may attribute to the difficulty of some subjects, different items designed by professors, interest in the subject, negative attitudes regarding the major or cultural differences. Results also showed a difference between CBT and PBT groups in terms of the level of anxiety. Nearly half of students in the CBT group experienced a high anxiety, while high anxiety was present in only 29.4% of students in the PBT group. The finding of Martin et al. study, indicated that CBT had positive influence on motivation and engagement of students in exam (38).

Results also indicated no significant difference between the two groups in terms of physiology mean score, in contrast with the study by Vitasari et al. (21). This difference can attribute to mediating factors such as familiarity with items designed by a professor in class quizzes and the professor's explanations regarding the scoring scheme before the exam. In this study, no significant correlation was observed between demographic characteristics and test anxiety. Similarly, other studies reported no significant correlation between test anxiety and age or marital status (8, 35, 39, 40). In addition, Darabiet al. and Mosavi et al. observed no significant correlation between test anxiety and sex (36). Nevertheless, there was a significant correlation between anxiety level and place of residence by Darabi et al. where most non-local students experienced anxiety (36). This difference can explain by the fact that the students in the present study were local. In line with the present study, Pourghane and Cheraghian et al. reported no significant correlation between students' level of anxiety and their marital status, their parents' occupation, or their

parents' level of education (8, 17).

The present study had a number of limitations. It was not possible to design essay questions on the CBT. Therefore, no essay questions were designed on the PBT to keep the two equal. Therefore, the question was designed more complex considering higher level in cognitive domain based on Bloom's taxonomy to counter this issue. Other limitations included the small number of freshman students and lack of proper facilities for administering CBT or a pre-designed area for administering simultaneous exams to a higher number of students.

5. CONCLUSION

In this study, there was no significant difference between CBT and PBT groups in terms of mean anxiety scores. Thus, students' anxiety on CBT can be decreased using new educational strategies in which students are familiarized with electronic technology and equipment in learning and testing, in addition to administering class quizzes using electronic methods. Future studies are needed to evaluate and compare the effect of different type of student testing such as distance testing or CBTs using new information technologies such as tablets or mobile phones on test anxiety and performance of students.

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