

DEVELOPMENT AND VALIDATION OF A TEST ANXIETY INVENTORY FOR ONLINE LEARNING STUDENTS

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ABSTRACT

Test anxiety is a serious problem for many college students. This study examines the development and validation of the Online Test Anxiety Inventory (OTAI) to evaluate test anxiety among online students. In this study, the OTAI is developed and administered to a sample of 157 postgraduate online students: 77 males and 80 females, aged 22 to 51 years. To design the initial version of the 38-item, Sarason's Test Anxiety Scale, Abolghsemi's Test Anxiety Inventory (TAI) and Spielberger's Test Anxiety Scale were studied, and many interviews were conducted with online learning students who had a high level of test anxiety. Confirmatory Factor Analysis was employed to obtain the Goodness of Fit Indices of the model to the data. The final result is a multidimensional, 18-item OTAI comprised of three factors— online, psychological, and physiological—with a high internal consistency ($\alpha = 0.91$) and acceptable criterion validity. Concurrent validity was measured by the association of the OTAI and the TAI ($r = 0.83$).

Keywords: Test anxiety, online learning, college students, higher education, measurement.

INTRODUCTION

Over the last two decades, online learning has become one of the most important subjects in the field of education, and online education enrollment has continued to grow, especially in higher education (Allen & Seaman, 2017; Hernández-Gantes, 2009). Online learning is defined as learning programs using technology, including a computer and the internet (Benson, 2002; Carliner, 2004; Conrad, 2002). Online or virtual learning originated in distance education, and its beginning dates back to the late 1800s when it was used to bridge geographical distance and provide educational opportunities for rural students (Banas & Emory, 1998). In today's world, online education makes it possible for married students and full-time employees to schedule their classes in more flexible programs in higher education to improve their professional qualifications (Allen & Seaman, 2008; Flowers, 2005; Hernández-Gantes, 2009). Online programs are more attractive for students

earning their master's degree and students at the undergraduate level (Hernández-Gantes, 2009).

The proportion of students taking at least one online course was 9.6% in 2002, whereas in the last few years, it has increased as follows: 27.1% in 2013, 28.3% in 2014, and 29.7% in 2015 (Allen & Seaman, 2017). Poor economic conditions have led job seekers to continue their education and increase their chances for getting more appropriate jobs. The lower tuition of online classes compared to traditional, on campus, classes and the high cost of fuel have led to an increase in distance enrollment (Allen & Seaman, 2008). Despite the fact that many academic leaders (i.e., 71.4% in 2015) believe online instruction is as good or better than face-to-face education, some of them rated online education inferior or somewhat inferior to face-to-face education (Allen & Seaman, 2016). Their concerns include lower retention rates, the quality of learning outcomes, and the need for more discipline in online education (Allen & Seaman, 2013).

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New technology plays a fundamental role in the process of teaching and learning, especially in higher education. Many universities in different countries have established online programs to attract more diverse and nontraditional students, such as MIT's OpenCourseWare, edX, and the University of Phoenix. In the last decade, many universities in Iran, including the University of Tehran's E-Learning Center, Isfahan University of Medical Sciences, and K. N. Toosi University of Technology, have started to offer online courses. The basic necessity for e-learning in Iran is an internet connection and at least an average communication infrastructure (Tabatabaie, 2010). In addition, the low speed and relatively high cost of internet connections are other main challenges for the development of e-learning in Iran. To eliminate some of these challenges and develop e-learning programs in Iran, a couple of areas need to improve, including infrastructure technologies and low rate of internet penetration in rural areas (Tabatabaie, 2010).

LITERATURE REVIEW

A short review of the literature on test anxiety shows that it is not a new concept. However, the assessment of the factors affecting test anxiety specifically for online students and the mitigation strategies for such challenges are fairly new. For instance, computer self-efficacy, which is related to the use of new technology in online learning systems, has an important effect on the level of anxiety among online students (Saade & Kira, 2009). Block, Udermann, Felix, Reineke, and Murray (2008) indicated that students enrolled in online education for the first time and those who do not have sufficient knowledge about computers usually have a high level of anxiety. Also, many online students experience a high level of test anxiety when they have to work with modern technology used in online programs (Wang, Newlin, & Tucker, 2001). Helms (2014) reported that online students miss more assessment opportunities and assignments compared to face-to-face students, get significantly lower grade point averages, and typically fail the course more often. Furthermore, the dropout rate for online students is higher than traditional students, which might be due to their lack of familiarity and comfort with that style of instruction and learning (Hammond, 2006; Parker, 1999; Tyler-Smith, 2006).

Test anxiety is defined as an individual's disposition to worry and have interfering thoughts, mental confusion, tension, and a physical reaction in exam situations (Spielberger, Anton, & Bedell, 1976; Spielberger & Vagg, 1995; cited in Zeidner, 1998). Test anxiety is a common and serious problem for many college students, affecting between 10% to 35% of university students and significantly impairing their ability to perform in test situations (Strumpf & Fodor, 1993; Naveh-Benjamin, Lavi, McKeachie, & Lin, 1997; Zeidner, 1998). At all levels, test anxiety has more severe effects on female students than male students (Chapell et al., 2005; Hembree, 1988; Szafranski, Barrera, & Norton, 2012). A majority of findings show that test anxiety impacts students' academic achievements (Culler & Holahan, 1980; Dendato & Diener, 1986; Wine, 1971) and influences students' emotional well-being and cognitive functioning (Chapell et al., 2005; Berk and Nanda, 2006; Cassady & Johnson, 2002). Emotional aspect of test anxiety is characterized by physiological symptoms such as nausea, perspiration, and rapid heartbeat (Huberty & Dick, 2006). The cognitive aspect of test anxiety is associated with embarrassment, negative outcomes, and fear of failure or disappointment, which leads to oversensitivity and memory problems in some students (Huberty & Dick, 2006; Liebert & Morris, 1967). According to the cognitive-attention theory of test anxiety, poor performance of test-anxious students is the main reason for their inability to focus on the task they are doing because they simultaneously distribute their attention to both personal variables and the evaluation task (Wine, 1971, 1982).

Previous studies have proposed various questionnaires to assess the level of test anxiety. However, to the best of our knowledge, all of them have concentrated on conventional testing models and none of them have been directly applicable to the new paradigm. Mandler and Sarason (1953) developed the first questionnaire to measure test anxiety. Sarason (1958) developed a 21-item true-false test anxiety questionnaire, with some revisions made later to eliminate unnecessary items. To enhance the validity and reliability of this test, a 37-item version was developed (Sarason, 1978). Liebert and Morris (1967) considered two important dimensions for test anxiety: worry related to the negative thoughts and negative evaluation

of the test results and emotionality related to the automatic responses to exam situations during a test (see Stöber, 2004). Spielberger (1972, 1983) distinguished between trait and state anxiety; trait anxiety refers to stable features or people's general tendency to react anxiously, whereas state anxiety refers to temporary emotional situations. Unruh and Lowe (2010) considered four separate components of test anxiety: worry, physiological reactions, cognitive inattention, and social humiliation.

Sarason (1984) found four different components for the test anxiety questionnaire. "Bodily reactions" and "Tension" related to the emotional dimension and "Worry" and "Test-irrelevant thinking" related to the cognitive dimension (cited in Zeidner, 2010, p. 59). Spielberger, Gonzales, Taylor, Algaze, and Anton (1978) designed a test anxiety inventory with 20 items and two dimensions: worry and emotionality. It has been translated into many different languages, including Persian (cited in Zeidner, 2010, p. 59).

Despite the vital role computers play in every field of human life, including education, some people suffer from a fear of computers. Lack of experience working with computers may cause computer anxiety in online students. In 1981, Jay defined computer anxiety as a tendency not to talk and think about computers, an anxiety or fear about computers, and aggressive or confrontational thoughts about computers, which affect behavior, emotion, and attitudes (see Kohrman, 2003). A study by Glaister (2007) showed that students with a higher level of computer anxiety have a poorer performance in examination settings when compared to those with a lower level of computer anxiety. In addition to the factors that affect test anxiety in face-to-face students, other factors impact the test anxiety of online students due to the use of computers and the internet (Block et al., 2008; Desai, 2001; Dupin-Bryant, 2002). Therefore, it is expected that universities and colleges employ a test anxiety inventory that is specifically designed for online students instead of simply using the same test anxiety questionnaire developed for traditional students.

With the ever-increasing and widespread development of different online platforms for online education and due to the rapid growth in the number of students participating in online and hybrid programs, this new paradigm of education demands

strong support and relevant studies to make it more effective and improve the quality of online education. Therefore, it is crucial to develop a measure to assess the test anxiety in the online environment and to devise different strategies to combat its effects. The overall aim of this study is to develop a new instrument to measure test anxiety specifically for online students in distance education.

METHODS

This study was carried out in two parts: qualitative and quantitative.

Participants

Participants in this investigation were all postgraduate students ($N = 157$) enrolled in online programs of Computer Engineering and Industrial Engineering in Isfahan University of Technology (IUT) and the Management and Librarianship in the University of Isfahan (UI) (77 male and 80 female) and were 22–51 years of age ($M = 31.57$, $SD = \pm 12.41$).

Instruments

Abolghasemi's Test Anxiety Inventory (TAI) and Online Test Anxiety Inventory (OTAI) were used to collect data (Abolghasemi, Assadi Moghadam, Najarian, & Shokrkon, 1996). TAI is a 25-item self-report measure, comprised of a four-point Likert scale from 0 (never) to 3 (almost always), with test-retest reliability 0.88, internal consistency 0.95, and criterion validity 0.77 (Cheraghian, Fereidooni, Baraz, Bavarsad, & Shapour, 2008). It consists of two subscales, psychological and physiological, represented, for example, by "During an important exam I am worried about my grade" for the psychological dimension and "During an exam my heart rates increase," for the physiological dimension.

The OTAI is an 18-item, self-report measure, consisting of three subscales: psychological, with 6 items; physiological, with 5 items; and online, with 7 items. For example, "During important exams, I am worried about failure," "Just before and during an exam my heart beats fast," "Lack of sufficient skills for working with computer and the internet during my exams, make me feel inefficiency and anxious." Items are measured using a four-point Likert scale from 0 (almost never), 1 (sometimes), 2 (most of the time), to 3 (almost always) with a total score ranging from 0 to 54 in which higher scores indicate the higher level of test anxiety. The OTAI

has a high internal consistency ($\alpha = 0.91$) and a high correlation ($r = 0.83$) with the TAI.

Procedures

In the initial phase, Sarason's Test Anxiety Scale and Spielberger's Test Anxiety Scale were studied. In the next step, the TAI (Abolghasemi, 1996) was completed on the universities' website by all the participants to diagnose those students with a high level of test anxiety. Then, to explore the major causes of test anxiety among online students, a 30-minute interview was conducted by the author with those students who were diagnosed with high test anxiety. After that, an initial pool of 38 items was developed to reflect the author's aims, and it was reviewed by nine psychologists and professional experts from University of Isfahan, who had good reputations for their activities in online environments, such as teaching, researching, and also treating patients. Furthermore, a small sample of students completed the 38-item scale and their comments, as well as the comments of the experts, were used to eliminate redundant and inappropriate items and to enhance both the face validity and the content of the scale.

After that, all of the participants were asked to fill out the 30-item scale. By observing the substantial collinearity structure between some items, an Explanatory Factor Analysis with an oblique rotation was employed to identify the structures of the measurement scale. Bryant and Yarnold (1995) define rotation as "a procedure in which the eigenvectors (factors) are rotated in

an attempt to achieve simple structure" (p. 132). Meanwhile, one may use a scree plot, a graphical representation with a decreasing curve, to come up with the number of factors. The assumption is that "the elbow" tells you how many factors you have to retain, which is when the curve starts to smooth out, and the rule of thumb is eigenvalues higher than one. Figure 1 displays the Scree Plot of the 30-item scale. As can be seen, there are three principal components with eigenvalue greater than one.

There are several types of rotations in factor analysis, which are "Any of several methods in factor analysis by which the researcher attempts to relate the calculated factors to theoretical entities" (Vogt, 1993, p. 91). This is done differently depending upon whether the factors are believed to be correlated (oblique) or uncorrelated (orthogonal). Tabachnick and Fidell (2007) has argued that

Perhaps the best way to decide between orthogonal and oblique rotation is to request oblique rotation with the desired number of factors [see Brown, 2009b] and look at the correlations among factors; if factor correlations are not driven by the data, the solution remains nearly orthogonal. (p. 646)

The exploratory factor analysis identified three factors: online, psychological, and physiological. To obtain a shorter form of the scale a higher factor loading (0.45) was used which leads to a short scale of 18 items. Furthermore, a confirmatory factor analysis was employed to identify the Goodness of Fit Indices of the measurement structure.

It should be noted that in this study, the data have been measured on the Likert scale, which is an ordinal scale. By assigning the numerical values to the items along a range in a Likert scale, the questions in a test are scored so as to lead to the evaluation of interested qualitative and latent variables in a metric system. The total scores obtained from such tests are considered as data in an interval scale and can be analyzed by statistical methods appropriate for such scales. Many statistical methods, including F-test, are robust when the data were obtained based on other scales, such as the ordinal scale (see Carifio & Perla, 2007).

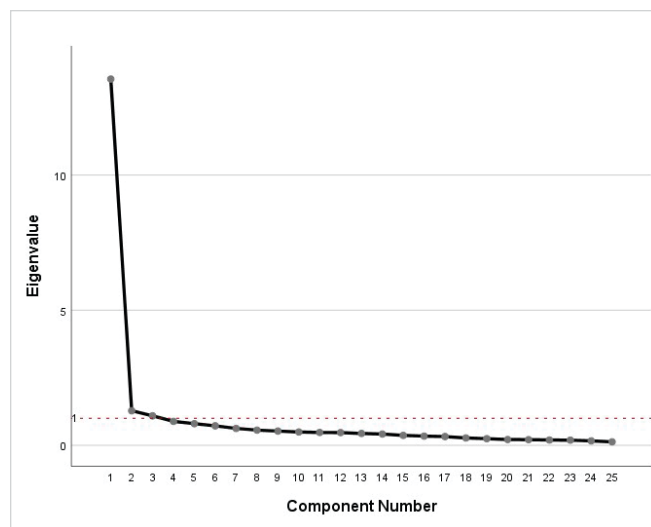


Figure 1. Scree Plot of 30-item Version of Questionnaire

FINDINGS

In the qualitative part of the study, the author conducted a 30-minute interview with the online students having high levels of test anxiety, asking them to describe the most important problems and challenges they faced during online courses and exams. The results revealed that the major problems of online students can be categorized into three factors:

- working with a computer and the internet during their exams,
- a lack of enough discussion, communication, and social interaction between both student-student and student-teacher, and
- the quality of teaching in online environments.

As a result, the online items were developed based on the aforementioned factors.

The adequacy of sample size, based on Kaiser-Meyer-Olkin (KMO) (1974, cited in Dziuban & Shirkey, 1974), is 0.913 (> 0.8) which makes it a good fit for undergoing factor analysis and Bartlett Sphericity test. The results of exploratory factor analysis provided an 18-item scale OTAI, comprised of three diverse factors:

- a psychological component with six items, including questions 1, 2, 4, 5, 8, 11 with high internal consistency ($\alpha = 0.90$);
- a physiological component with five items, including questions 13, 20, 21, 22, 23 with an acceptable internal consistency ($\alpha = 0.84$); and
- an online component with seven items, including questions 9, 12, 24, 27, 28, 29, 30 with high internal consistency ($\alpha = 0.89$).

The internal consistency of each subscale and the overall consistency of the OTAI ($\alpha = 0.91$) was acceptably high with all values above 0.70 (Cronbach, 1955). Furthermore, the results of concurrent validity revealed a high correlation ($r = 0.83$, $p < 0.01$) between the OTAI and the TAI (Abolghasemi et al., 1996).

Table 1 shows the descriptive statistics, mean, standard deviation, and range of each subscale score and total score of the OTAI. The internal consistency, the total correlation of each scale and the correlation of OTAI and TAI, has been given in Table 1.

Table 2 shows the results of factor loading for each item. The items were categorized into three

groups, each indicating a conceptive component of the OTAI. The three eigenvalues with values larger than one in factor analysis provided the 18-item scale with three components named Online, Psychological, and Physiological. Nearly all items in the final questionnaire loaded into relevant factor with a factor loading greater than 0.5, which is considered to be high enough (Tabachnick & Fidell, 2007).

Table 3 shows the three conceptive components with their eigenvalues and the percent of their variances. The variance of psychological, online, and physiological components are 48.42, 9.71, and 6.73, respectively. The total variance explains 64.86% of the observed variance.

Figure 2 shows the structural equation model indicates that the 18-item OTAI consisting of the three primary factors (Psychological, Online, Physiological) inside the factor ovals and a second-order factor (Online Test Anxiety).

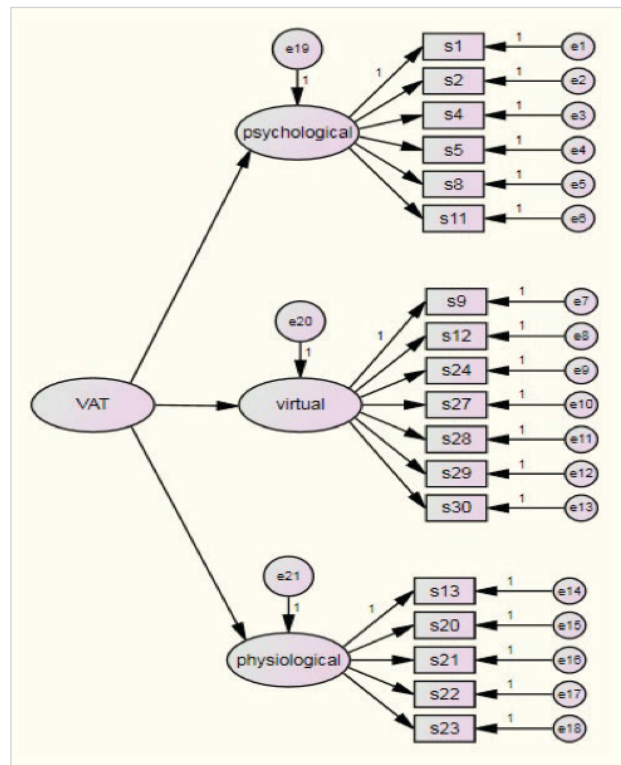


Figure 2. Structural Equation Model

Tables 4 and 5 show the results for the model in Figure 2, although all path coefficients are significant, the model is poor. Therefore, the current confirmatory factor analysis was modified to discover a model that shows a better fit to the data.

In Figure 3, the confirmatory model indicates that the 18-item OTAI consists of the three primary factors (Psychological, Online, Physiological) inside the factor ovals and a second-order factor, Online Test Anxiety (OTA). Standardized Coefficients located on the arrows and the number of questions is given in the squares. Tables 6 and 7 show the

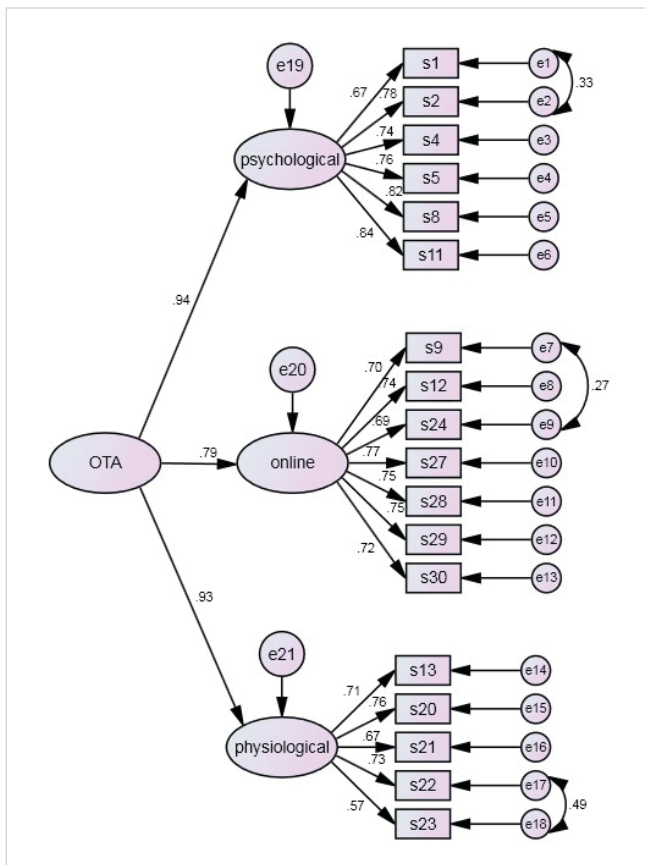


Figure 3. Confirmatory model

results for the model in Figure 3.

Confirmatory Factor Analysis (CFA) recognized an adequate fit of the 18-item OTAI. CFA revealed that the three factors conformed well to the structure of the model and fitted to the data, with indices of CFI = 0.942 (Brown, 2015; Hu & Bentler, 1999), AGFI = 0.828 (Tabachnick & Fidell, 2007), RMSEA = 0.069 (Brown, 2015; Homan, 2005; Kline, 2011; Tabachnick & Fidell, 2007), and a statistically significant chi-square $\chi^2/df = 1.738$ (Tabachnick & Fidell, 2007; Wheaton, Muthen, Alwin, & Summers, 1977). In general, the results of the confirmatory factor analysis and the model with significant routes are consistent with the theoretical research model.

DISCUSSION

An 18-item inventory, the Online Test Anxiety Inventory (OTAI), was developed to reliably evaluate the test anxiety specifically for online students. The CFA of the OTAI confirmed that the underlying multidimensional scale comprised of three factors—psychological, physiological, and online—with high Goodness of Fit indices and high factor loadings. The result of correlation analysis showed that the OTAI had a high correlation ($r = 0.83$, $P < 0.01$) with the TAI.

The results of the current study are consistent with previous studies that show that test anxiety is a multidimensional construct (Sarason, 1984; Unruh & Lowe, 2010). The physiological dimension of the OTAI overlaps with two scales of Sarason's questionnaire (1984), bodily reactions and tension, which refer to the emotional aspect of test anxiety. The psychological dimension of the OTAI also overlaps with the other two scales of Sarason's questionnaire, worry and test-irrelevant thinking, which describe the cognitive aspect of test anxiety. Moreover, the physiological and psychological subscales of the OTAI have a high correlation ($r = 0.83$) with the TAI, which is comprised of two components: psychological and physiological. The physiological component of OTAI consists of five items with a total score of 15 for this category and a high internal consistency ($\alpha = 0.84$). The psychological component of the OTAI consists of six items with a total score of 18 for this domain and a high internal consistency ($\alpha = 0.90$). The online component consists of seven items with a total score of 21 for this dimension and a high internal consistency ($\alpha = 0.89$). Higher scores in each dimension indicate higher anxiety in the dimension.

In the current study, most of the online students overwhelmingly agreed with the statement, "During final exams, working with computer and the internet, makes me feel uncomfortable and inefficient." They claimed that they have to deal with the computer and the internet during their exam instead of concentrating on the exam. A study by Li and Lee (2016) showed that computer literacy is the major factor for online learning environments and higher computer literacy correlates with higher online learning attitude. The majority of the participants strongly agreed with the item, "Little experience of some instructors

with online instructions is stressful for me.” They argued that their instructors may not have enough experience teaching in online environments. Lane (2013) also argued that teaching in an online setting may require different skills than face-to-face teaching, and faculty members need to be trained for teaching online classes. In the current study, the results of the qualitative research also indicated that student-teacher and student-student interactions in online setting were low. Many participants strongly agreed with the item, “Lack of enough social interaction and discussion with other students in online courses is more stressful for me.” The student-teacher and student-student interaction in the online environment may be lower than in the face-to-face classes (Peterson, 2016). Despite the importance of such interactions, some studies have shown that there may not be enough interactions in online environments (Garrison & Cleveland-Innes, 2005), which necessitates design in more effective ways to encourage and establish interactions in such settings. In addition, based on Vygotsky’s (1978) sociocultural theory, social interactions play an important role in cognitive development (Pea, 1994). Thus, collaborative and group activities demanding social interactions should be considered in online learning (Garrison, 2016; Moore & Marra, 2005).

The OTAI provides counselling centers at universities with online learning programs, and researchers and clinicians, with a set of valid and reliable criteria that can be used to measure test anxiety in online students. As online education continues to grow rapidly, the need for more studies to improve online instruction becomes more evident.

LIMITATIONS AND SUGGESTIONS

Several study limitations should be noted. First, the data were collected from four different majors of two universities (IUT & UI). The inclusion of more majors from diverse universities that have more online learning programs would increase the test validity. Second, the qualitative part of the study provided some major problems that online students may face during their exams and courses. More research is needed to find out additional factors that may impact the test anxiety of online students. Third, while the current study developed a reliable and valid test, future studies

can possibly provide a cut-off point based on total score to diagnose the rate of the anxiety of online students suffering from test anxiety. To the best of our knowledge, no prior studies have tried to assess online students’ test anxiety; therefore, research is needed to examine the instrument in different cultures, different academic settings, and diverse ages to test its validity and reliability.

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Appendix A

University of Isfahan Department of Psychology Scales of Online Test Anxiety Inventory (OTAI)

There is a description of the scales of the Online Test Anxiety Inventory (OTAI) and a complete version of the full 18-item instrument. There is no charge for using the OTAI.

Psychometric Properties: The items for three scales of the OTAI developed to measure the dimensions of psychological, physiological, and online of test anxiety of online learning students. The items for each scale include psychological, 1, 2, 3, 4, 5, 6; physiological, 1, 2, 3, 4, 5; online, 1, 2, 3, 4, 5, 6, 7. Correlations of the OTAI with Abolghasemi's test anxiety inventory (TAI) has also been explained in the article, 'Development and Validation of a Test Anxiety Inventory for Online Learning Students.'

Presentation Format and Scoring. Items from each scale are **mixed**. Participants respond using a four-point Likert format: almost never = 0, sometimes = 1, most of the time = 2, almost always = 3. **All the items scored positively and no items** have been negatively or reverse scored. High scores indicate the high level of test anxiety.

The items for each scale include psychological with six items, physiological with five items, and online with seven items.

The definition of each dimension of the 18-item of Online Test Anxiety Inventory given as follow:

PSYCHOLOGICAL

High Scorer: Has irrelevant and negative thoughts; fear of failure; feeling of inadequacy; low concentration; poor performance; thinking about the consequences of failing, low self-efficacy.

Low Scorer: Lack of negative and irrelevant thoughts during important exams; not worried about the outcomes of exams; high performance.

1. During important and difficult exams, I get anxious and agitated.
2. Before and during an important exam, I have negative self-statements about the outcomes of my exam.
3. During final or important exams, I think about failure.

4. During difficult exams, I am mentally confused and disturbed.
5. Just before important exams, I feel more anxious and worried.
6. Difficult exams make me feel ineffectiveness about my performance.

Internal consistency (coefficient alpha) = 0.90
Correlation with 25-item Abolghasemi's test anxiety inventory = 0.83

PHYSIOLOGICAL

High Scorer: Has fast heart beat; sleep disorders; muscle spasms; hands trembling; drying mouth; shifting in body temperature; poor performance.

Low Scorer: Being relaxed; normal heart beat; normal body temperature; getting good sleep.

1. I feel dryness in my mouth just before or during important exams.
2. I have muscle spasms just before or during an important exam.
3. The night before important exams, get to sleep is more difficult for me.
4. I almost always feel my heart beating very fast just before or during an important exam.
5. Before or during important exams, I feel warm or cold and my palms sweat.

Internal consistency (coefficient alpha) = 0.84
Correlation with 25-item Abolghasemi's test anxiety inventory = 0.83

ONLINE

High Scorer: Lack of enough knowledge about computer; don't like dealing with new technology; having social interaction with other students is very important; having communication with faculties and instructors is very important.

Low Scorer: Has enough knowledge of computer; enough skills to work with computer; to enjoy working with new technology and computer; not completely rely or depend on others for his/her studies.

1. Lack of enough social interaction and discussion with other students in online courses is more stressful for me.
2. During my exams, working with computer and the internet, make me feel uncomfortable and inefficient.

Appendix A (cont.)

3. Lack of student-instructor enough communication in online courses is stressful for me.
4. Little experience of some instructors with online instructions is stressful for me.
5. In online courses, it is stressful for me that I don't know how much other students are brighter than me.
6. Online exams are more stressful for me than traditional face-to-face exams.
7. Less tutoring hours availability in online courses compared to face-to-face courses is very stressful for me.

Internal consistency (coefficient alpha) = 0.89

Appendix B

A sample of mixed items of the OTAI for public using

ONLINE TEST ANXIETY INVENTORY (OTAI)

This test comprises a series of statements. Please read each statement and circle the answer that best applies to you:

AN (Almost Never), S (Sometimes), MT (Most of the Time), AA (Almost Always)

1- Lack of enough social interaction and discussion with other students in online courses is more stressful for me.

AN S MT AA

2- During important and difficult exams, I get anxious and agitated.

AN S MT AA

3- I feel dryness in my mouth just before or during important exams.

AN S MT AA

4- During my exams, working with computer and the internet, make me feel uncomfortable and inefficient.

AN S MT AA

5- Before and during an important exam, I have negative self-statements about the outcomes of my exam.

AN S MT AA

6- I have muscle spasms just before or during an important exam.

AN S MT AA

7- Lack of student-instructor enough communication in online courses is stressful for me.

AN S MT AA

8- During final or important exams, I think about failure.

AN S MT AA

9- The night before important exams, get to sleep is more difficult for me.

AN S MT AA

10- Little experience of some instructors with online instructions is stressful for me.

AN S MT AA

11- During difficult exams, I am mentally confused and disturbed.

AN S MT AA

12- I almost always feel my heart beating very fast just before or during an important exam.

AN S MT AA

13- In online courses, it is stressful for me that I don't know how much other students are brighter than me.

AN S MT AA

14- Just before important exams, I feel more anxious and worried.

AN S MT AA

15- Before or during important exams, I feel warm or cold and my palms sweat.

AN S MT AA

16- Online exams are more stressful for me than traditional face-to-face exams.

AN S MT AA

17- Difficult exams make me feel ineffectiveness about my performance.

AN S MT AA

18- Less tutoring hours availability in online courses compared to face-to-face courses is very stressful for me.

AN S MT AA

TABLES - 1, 2

Table 1. Descriptive Statistics of the OTAI

ANTOTAI (18-item)	No. of items	M	SD	Range	Reliability ()	Correlation with TAI
Psychological	6	9.87	4.66	0-18	0.90	-0.76**
Physiological	5	5.75	3.69	0-15	0.84	-0.81**
Online	7	11.23	5.54	0-21	0.89	-0.65**
Total	18	26.85	12.18	0-54	0.94	-0.83**

**Correlation is significant at the 0.01 level (two-tailed).

Table 2. Means, Standard Deviations, and Factor Loading

Items	Factor loading			Online	Psychological	Physiological
	M	SD				
Q1 anxious & agitated	2.00	.91			.749	
Q2 Negative thoughts	1.82	.97			.812	
Q4 Fear from results	1.33	.90			.670	
Q5 Confused and disturbed mind	1.50	.98			.649	
Q8 More stress just before exam	1.72	.94			.774	
Q9 Lack of social interaction	1.62	1.00	.730			
Q11 Ineffectiveness feeling	1.47	.95			.677	
Q12 Work with computer during exams	1.56	.97	.593			
Q13 Dry mouth	1.29	.89				.485
Q20 Muscles spasm	1.13	.94				.601
Q21 Sleeping problems	1.38	.99				.543
Q22 Heart rates	1.08	.97				.818
Q23 Cold or sweaty hands or feet	.84	.93				.832
Q24 Lack of access to faculties	1.31	.98	.786			
Q27 Faculties' unfamiliarity with online instructions	1.59	.97	.778			
Q28 Unfamiliarity with my competitor	1.81	1.01	.639			
Q29 Online exams are more stressful	1.52	1.11	.760			
Q30 Less tutoring in online classes	1.78	1.03	.648			

TABLES - 3, 4, 5

Table 3. *Extraction Sum of Squared Loadings*

	Eigenvalues	% of Variance	Cumulative %
Psychological	8.72	48.42	48.42
Online	1.75	9.71	58.13
Physiological	1.21	6.73	64.86

Table 4. Direct Standardized and Nonstandardized Coefficients Path in Confirmatory Model

Path in Confirmatory Model	Nonstandardized Coefficient (B)	Standardized Coefficient ()	Critical Rate (C.R)	P	
1) Psychological	S1	1	0.699		
2) Psychological	S2	1.212	0.799	9.322	<0.001
3) Psychological	S4	1.053	0.744	8.718	<0.001
4) Psychological	S5	1.158	0.755	8.847	<0.001
5) Psychological	S8	1.206	0.82	9.558	<0.001
6) Psychological	S11	1.247	0.837	9.733	<0.001
7) Online	S9	1	0.722	8.702	<0.001
8) Online	S12	0.976	0.728	8.51	<0.001
9) Online	S24	0.966	0.712	9.174	<0.001
10) Online	S27	1.026	0.768	8.928	<0.001
11) Online	S28	1.045	0.747	8.965	<0.001
12) Online	S29	1.153	0.75	8.565	<0.001
13) Online	S30	1.024	0.717	8.474	<0.001
14) Physiological	S13	1	0.699	7.528	<0.001
15) Physiological	S20	1.138	0.751	8.905	<0.001
16) Physiological	S21	1.047	0.66	7.536	<0.001
17) Physiological	S22	1.237	0.795	6.5	<0.001
18) Physiological	S23	0.991	0.661	6.651	<0.001
19) OTA	Psych	1	0.937		
20) OTA	Online	0.931	0.77		
21) OTA	Phy	0.918	0.884		

Table 5. Model Fit Indices

Normed Chi-square												
Model	X2	df	GFI	AGFI	CFI	TLI	IFI	PGFI	PNFI	PCFI	RMSEA	2/df
	279.892	132	0.845	0.799	0.909	0.895	0.91	0.652	0.727	0.784	0.085	2.12

TABLES - 6, 7

Table 6. Direct Standardized and Nonstandardized Coefficients Path in Final Model

Path in Confirmatory Model	Nonstandardized Coefficient (B)	Standardized Coefficient ()	Critical Rate (C.R)	P	
1) Psychological	S1	1	0.667		
2) Psychological	S2	1.233	0.776	10.364	<0.001
3) Psychological	S4	1.101	0.743	8.24	<0.001
4) Psychological	S5	1.219	0.76	8.396	<0.001
5) Psychological	S8	1.261	0.819	8.937	<0.001
6) Psychological	S11	1.318	0.845	9.159	<0.001
7) Online	S9	1	0.696	8.416	<0.001
8) Online	S12	1.023	0.736	9.247	<0.001
9) Online	S24	0.964	0.686	8.734	<0.001
10) Online	S27	1.062	0.767	8.596	<0.001
11) Online	S28	1.092	0.754	8.546	<0.001
12) Online	S29	1.192	0.749	8.26	<0.001
13) Online	S30	1.068	0.722	8.718	<0.001
14) Physiological	S13	1	0.715	7.685	<0.001
15) Physiological	S20	1.126	0.76	8.426	<0.001
16) Physiological	S21	1.031	0.665	6.55	<0.001
17) Physiological	S22	1.116	0.733	6.34	<0.001
18) Physiological	S23	0.833	0.569	6.8	<0.001
19) OTA	Psych	1	0.938		
20) OTA	Online	1.958	0.786		
21) OTA	Phy	1.037	0.934		

Table 7. Overall Model Fit Indices

Normed Chi-square												
Model	X2	df	GFI	AGFI	CFI	TLI	IFI	PGFI	PNFI	PCFI	RMSEA	2/df
	224.192	129	0.87	0.828	0.942	0.931	0.942	0.652	0.657	0.794	0.069	1.738