

Developing an Online-Testing Attitude Scale for University Students*

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Abstract: Although researchers have developed a number of tools which measure students' attitudes toward using computers in general, a few of them, especially in the West, have developed scales to assess university students' attitudes toward online testing. However, no attempts have been made to develop such scales in the Arab world. Therefore, the goal of this study was to develop a valid and reliable online testing attitude scale for university Arab students. In order to create the items of the scale, the researcher collected his data from the following sources: Reviewing previous literature about students' attitudes toward computer, eliciting information from students about their beliefs, attitudes, and feelings toward using computers in testing, and adapting and creating new items. The original scale consisted of 34 items a long affective, cognitive and behavioral domains. After subjecting the scale to a confirmatory factor analysis, three items were deleted because they met the criterion of item deletion (below 0.25). The final scale was made up of 31 items, and it was administered to 638 male and female undergraduate students at Yarmouk University/Jordan. The results of this study supported the validity and reliability of this instrument. The scale had high degree of validity which was demonstrated by content validity, construct validity, internal validity and discriminating power. Alpha coefficients of 0.87, 0.85, and 0.79 were good indicators of the reliability of the three dimensions. A coefficient of 0.78 showed a test-retest reliability. (**Keywords:** Online testing, Attitude, University students, Assessment, Language skills courses).

Introduction

As computer technology applications have become an important factor in teaching, learning, and assessing processes, much attention has been paid to incorporating the computer and information technology into college educational curricula and into the classroom due to their advantages in the teaching/learning process. Roblyer (2003) identified two changes caused by the integration of technology. The first is an increase in the amount of technology resources that are available to instructors and learners. The second is the shift in the learning strategies that the flexibility of computer technology affords. The North Central Regional Educational Laboratory (NCREL) organization (NCREL 2002) believes that computer technology can promote higher order thinking critically, analyze, make inferences, and solve problems when technology is used to situate learning in the context of challenging complex and realistic problems. Milliken and Barnes (2002) found that students view computerized lectures to outweigh the traditional teaching methods and feel that the use of computer technology in class helped their comprehension of the subject matter. Shuell's and Farber's (2001) study revealed that computer technology is beneficial in facilitating learning and increasing motivation to learn.

* الشكر والتقدير لعمادة البحث العلمي والدراسات العليا في جامعة اليرموك لدعمها هذا البحث

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تطوير مقياس لاتجاهات طلبة الجامعة نحو الامتحان المحوسب

صياح الأحمد، مركز اللغات، جامعة اليرموك، اربد، الأردن.

ملخص: مع أن الباحثين طوروا عدداً من الأدوات التي تقيس اتجاهات الطلبة نحو استخدام الحاسوب بشكل عام، إلا أن عدداً قليلاً منهم، وخاصة في الغرب، طور مقياس تقيس اتجاهات الطلبة نحو الامتحان المحوسب. وعلى أية حال، لم تكن هناك محاولات لتطوير مثل هذه المقاييس في العالم العربي. ولذلك هدفت هذه الدراسة إلى تطوير مقياس ذي صدق وثبات يقيس اتجاهات طلبة الجامعة العرب نحو الامتحان المحوسب. ولبناء فقرات المقياس، جمع الباحث بياناته من المصادر التالية: مراجعة الدراسات السابقة حول اتجاهات الطلبة نحو استخدام الحاسوب، استخلاص معلومات من الطلبة حول آرائهم واتجاهاتهم وشعورهم نحو استخدام الحاسوب في الامتحانات، وتعديل وتأليف فقرات جديدة. تكون المقياس الأصلي من 34 فقرة موزعة على أبعاد عاطفية ومعرفية وسلوكية. وبعد إخضاع المقياس للتحليل العاملي التوكيدي، تم شطب ثلاث فقرات وذلك لتحقيقها شرط شطب الفقرات وهو أقل من 0.25 والذي اعتمده الباحث. ولهذا أصبح المقياس الحالي يتكون من 31 فقرة، وقد طبق على 638 طالب و طالبة يدرسون في مرحلة البكالوريوس في جامعة اليرموك/ الأردن. تؤكد نتائج هذه الدراسة صدق وثبات هذه الأداة، حيث يتمتع هذا المقياس بدرجة عالية من الصدق والتي ظهرت من خلال صدق المحتوى وصدق البناء والصدق الداخلي والقوة التمييزية. معاملات ارتباط ألفا 0.87 و 0.85 و 0.79 هي دلالات جيدة على ثبات أبعاد المقياس الثلاثة. وأظهر معامل الارتباط 0.78 ثبات إعادة الاختبار. (الكلمات المفتاحية: امتحان محوسب، اتجاه، طلاب الجامعة، تقييم، مساقات مهارات اللغة).

Advancements in computer technology have led to new methods of students' assessment which benefit both the learner and the instructor. These benefits include obtaining students' results faster, having the ability to place grades into electronic format, measuring learning accurately, focusing on a student-centered environment, and costing less compared to paper-based exams (Bartlett et al. 2000, Dash 2000, Oregon to Administer 2001). Dufresne et al. (2002) compared students' performance on paper-based test with that on computer-based over several years and found that students' exams scores generally improved at a significant level after the introduction of computer-based homework. Schmidt et al. (1978) examined students' reaction to computer-based testing and found that 83% prefer it to traditional paper-and-pencil tests. 69% felt it was fairer than paper-and-pencil examinations.

Hastie and Park (1986) investigated the relationship between memory and judgment (online vs. memory-based). They discovered that there is "distinctively high recall of judgment-relevant items in the online task and no advantage in recall of relevant items in the memory-based task (1986: 265)".

A growing body of research has emerged that examines the effect of computer applications on students' attitudes towards computers in general by developing various computer-related attitude scales. The first instrument used to measure students' attitudes toward computers is the Computer Attitude Scale which was designed by Loyd and Gressard (1984b). This instrument consists of 30 items distributed on three sub-scales: computer confidence, computer anxiety, and computer liking. Each of these consisted of ten items and were presented to 51 male and 104 female students who were asked to express the degree of their agreement with each of the items on a six-point Likert scale. The structure of the sub-scales was largely confirmed by a varimax rotated factor solution. The alpha coefficients of 0.86, 0.91, 0.91 and 0.95 were reported for the computer anxiety sub-scale, computer liking sub-scale, computer confidence sub-scale, and the whole scale, respectively. Furthermore, other correlations were found between the sub-scales: confidence and anxiety, 0.73; liking and anxiety, 0.64; liking and confidence, 0.80.

Loyd and Gressard (1984a) administered the Computer Attitude Scale to 168 college students and 186 high school students using a four-point Likert scale. The results showed that there is a high correlation between the students' computer experience and their positive attitudes on all three scales. However, the study did not provide any information regarding the reliability of the instrument.

Gressard and Loyd (1986) conducted two studies on the Computer Attitude Scale, using a four-point Likert scale. In the first study, the scale was presented to 192 teachers participating in staff development computer-based programs. The data were subjected to factor analysis. The three factor solution proposed by varimax rotation constituted 54% of the total variance. The eigenvalues of the first three factors from the principal component analysis were 13.09, 1.92, and 1.21, respectively. The alpha coefficients of 0.89, 0.89, 0.89, and 0.95 were reported for the computer anxiety, computer liking, and computer confidence sub-scales and for the whole scale, respectively. The following correlations were also found between the three sub-scales: liking and confidence, 0.77; anxiety and confidence, 0.82; liking and anxiety, 0.69. In the second study, 70 teachers responded to the Computer Attitude Scale before and after participation in the staff development program. The study revealed that the teachers are less anxious and significantly more confident about computer after the program.

Jones and Clarke (1994) developed a 40-item attitude scale with three dimensions: cognitive, affective, and behavioral, using a five-point Likert scale. A sample of 562 Grade 9 and 10 students responded to the questionnaire. A Cronbach's Alpha was calculated for each of the three sub-scales and the whole scale: cognitive 0.88, behavioral 0.71, affective 0.95, and the whole 0.95. Correlations were found

between the three sub-scales and the whole scale. The cognitive, the behavioral, and the affective highly correlated with the scale, 0.97, 0.96, and 0.74, respectively. The results also showed correlations between the sub-scales: between the affective and the cognitive 0.90, between the affective and the behavioral 0.59, and between the cognitive and the behavioral 0.60.

The aforementioned studies among other studies in the Western and non-Western contexts focused on developing reliable and valid computer attitude scales. These scales measure students' attitudes toward using computers in general. Although computer technology has greatly been used as an educational tool in assessing students' performance in different learning situations, no attempts have been made to develop a scale which could measure university students' attitudes toward using computers in exams in the Arab World.

Online testing at Yarmouk University was firstly used by its Language Center in conducting the university English Placement Test. Online testing, here, means using the university intranet network. The Center is responsible for designing, planning, and administering the English Placement Test for all freshman students who join the university as well as teaching the university requirement Basic English Language Courses (BELCs) such as English 99, 100, and 111.

According to the university rules, the students have to take three multiple choice online exams in each language skills course in comprehension, structure, and vocabulary although these courses are not taught online.

The Effectiveness and Security Issues of Online Testing Software

The online testing in this study uses a program called Question Mark Perception. This program has the following characteristics. Firstly, it sets a time limit for assessment and displays time remaining. Secondly, it allows students to view their grades at the end of each exam and their total grades at the end of the final. Finally, it checks students' names and numbers against Perception security database.

Many software test tools include the function of randomly selecting and presenting new questions, thus minimizing the possibility of students memorizing questions and answers. Software test packages not only make online tests easy to administer, but they also reduce the time required to grade the tests.

Designers of online testing programs are working hard to ensure the security-enhanced testing tools. JonesKnowledge.com's *education* proctored test permits tests to begin only after a pre-designated proctor has logged in his or her password (Chronicles). Other approaches include Veridicom (a venture partnership with Lucent Technologies) has developed a fingerprint scanner, which can be used to authenticate students (Galambos 1999).

Problem and Goal of the Study

After having reviewed the literature about online testing, the researcher found that no attempts have been made to develop an Online Testing Attitude Scale (OTAS) for university students at the regional level (Arab World). Therefore, this study aims at bridging the gap in the online testing literature and providing a tool that could be employed by other Arab scholars. In other words, it is intended to develop a reliable and valid scale that could measure university students' attitude toward online testing.

Importance of the Study

Since the academic institutions in the Arab world have not developed any scales which can measure students' attitudes towards online testing, the researcher believes that the present study is significant because it will be the first contribution to literature about Online Testing Attitude Scales. Additionally, the scale will provide us with EFL students' attitudes toward using computers in testing. In case the attitudes are positive, and most often they are, this will encourage instructors and researchers in other university faculties and departments to use this scale with their students to uncover more of their students' attitudes towards computerized testing.

Rationale for the Study

Due to the large number of students who are required to take (BELCs), the successful experience in planning and administering the Placement Test online, and the ambitions of the university administration to cope with the current advancement in computer technology, it was deemed necessary to adopt and extend online testing to include all the (BELCs) offered at the Language Center. Using Computer-Based (CB) tests as assessment tools have a number of advantages over conventional paper-and-pencil tests. First, an ongoing online testing program may actually cost less than conventional testing programs although there is a lot of money spent on buying equipment. The costs of the testing process include hiring a big number of proctors from other departments, using too many exam booklets, stenciling, photocopying, etc. Second, they save teachers' time and efforts in correcting papers (Olson et al. 1986). Moreover, they decrease the chances of students' cheating by providing many different forms of the exam through randomizing the exam items. Furthermore, they offer a greater amount of standardization over the testing environment (Wise and Plake 1990). Test administration procedures such as directions and time limits can be exactly the same for all examinees. Finally, they exclude teachers' subjectivity in assessing students' performance. That is, the instructors have a minor role in assessing students' performance.

Limitations of the Study

The results of the study cannot be generalized because they are restricted to only two BELCs and to one university.

Operational Definitions of Terms

Online testing attitude means university students' attitudes toward taking their exams on the university intranet network. It is what the instrument in this study will measure.

Methodology and Procedures

Study Population

The population of the study consisted of 4115 (1640 male and 2475 female) undergraduate students enrolled in 70 sections of (BELCs): 100 and 111 at Yarmouk University in the spring semester of 2006-2007 distributed according to gender and academic year level as summarized in Table 1.

Table 1: Distribution of the Study Population According to Gender & Academic Year Level

Independent Variable	Levels of Independent Var.	Frequency		At Levels	Total
		At Levels	Percent		
Gender	Male	1640	4115	39.9	100.0
	Female	2475		60.1	
Academic-Year Level	Freshman	1169	4115	28.4	100.0
	Sophomore	1037		25.2	
	Junior	1318		32.0	
	Senior	591		14.4	

*The information in this table was obtained from the Department of Admission and Registration at the university

Study Sample

Since the unit of sampling was the classroom section, the researcher randomly drew a sample of ten sections consisting of 638 students (184 male and 454 female), who were taking two university required language courses at the Language Center. This sample represented 10% of the study population.

Scale Developing Stages

The following stages were followed in developing the scale:

Stage 1: Writing the Items and Identifying the Dimensions

To create the items of the scale, the researcher obtained a pool of items from a number of sources: First, from responses to a question asked to 100 students, who previously took three online exams in (BELCs): 100 and 111, about their attitudes, beliefs, and feelings toward having online testing. The students' responses were collected, analyzed and properly worded. Second, the researcher adapted and created some new items based on his review of literature on computer attitude scales. For example, the item "I feel unhappy walking into a room filled with computers," is adapted to "I feel tense and nervous upon entering the online testing room" (Jones and Clarke, 1994).

The researcher distributed the questionnaire items on a tripartite model of attitudes. The affective dimension, which has 10 items, assesses students' feelings and anxiety when using computer (Edwards 1990, Millar and Tesser 1986); the behavioral dimension, which consists of 8 items, contains behavioral intentions, verbal statements regarding

behavior and overt behavior in response to an attitude object (Breckler 1984); and the cognitive dimension, which contains 16 items, includes beliefs, knowledge structure, and thoughts held concerning the object (Breckler 1984, Millar and Tesser 1986). The scale used a five-point Likert format, and the responses to the statements were coded as follows: *Strongly Disagree* = 1, *Disagree* = 2, *Not Sure* = 3, *Agree* = 4, and *Strongly Agree* = 5. The values of the responses to the negative statements are reversed in order to keep a unified direction on the scale where high values represent positive attitudes and low values represent negative ones.

Stage 2: Scale Validation

Content Validity

The original study instrument consisted of 34 items, 17 of which have negative polarity and 17 have positive polarity. In order to verify the content validity of the scale, the items were scanned by 12 highly qualified and experienced referees. 98% of them agreed that the items were clear and appropriate to the dimensions they were set for.

Construct Validity

The construct validity of the scale was calculated by adopting the following two approaches:

1. The original scale had 34 items, and Corrected Item-Total Correlation was used to measure the correlations between these items and their dimensions on the one hand, and then between the items of the dimensions and the whole scale on the other to make sure that these correlations have exceeded the criterion of items deletion (0.25), adopted by the researcher as seen in Table 2. As a result, three items, namely, 3, 4, 10 were deleted because they got below 0.25, and the final scale had 31 items as shown in Appendix 1. The results showed that the correlations among the items of the affective dimension range between 0.39 and 0.78, and those between the same dimension and the whole scale range between 0.31 and 0.73. In addition, the correlations among the items of the cognitive dimension, and then between the same dimension and the whole scale range between 0.31 and 0.63 and between 0.29 and 0.63, respectively. Finally, the correlations among the items of the behavioral dimension, and then between the same dimension and the whole scale range between 0.27 and 0.67 and between 0.27 and 0.68, respectively.

Table 2: Corrected Item-Total Correlation

Dimension	Id of Item	Content Of Item	Corrected Item-Total Correlation	
			on dimension	on scale
Affective	1	I feel anxious about the mysterious conditions prevailing in the online testing atmosphere	0.64	0.56
	2	I feel tense and nervous upon entering the online testing room	0.78	0.73
	3	I am afraid that the time allotted for online testing would pass quickly before finishing the test	0.60	0.53
	4	I feel confused when having online testing	0.74	0.68
	5	I feel frightened during online testing	0.59	0.54
	6	I think that the time allotted for online testing is insufficient	0.46	0.43
	7	I feel scared about the occurrence of any technical errors in the computer I would be taking my test on	0.39	0.31
	8	I feel comfortable upon entering the online testing room	0.66	0.67
	9	The quickness of the computer in giving the result of the test upsets me	0.47	0.47
	10	I feel at ease while taking online testing	0.60	0.64
Cognitive	11	Online testing weakens the spirit of creativity in students	0.60	0.55
	12	Online testing affects my intellectual abilities negatively	0.59	0.54
	13	Online testing results in losing much of the information I have	0.63	0.63
	14	My concentration becomes lower during online testing	0.60	0.59
	15	Online testing weakens the relations between the instructor and the student	0.55	0.56
	16	Online testing tires the student's eyes	0.56	0.56
	17	Online testing creates competition among students	0.49	0.47
	18	Online testing does not take into consideration the individual differences among students	0.40	0.38
	19	I have difficulty in doing and revising the online testing questions	0.54	0.54
	20	Online testing helps in developing my scientific thinking abilities	0.46	0.44
	21	I can do a perfect job in online testing	0.57	0.59
	22	Online testing makes the student more dependable on his/her own efforts	0.31	0.29
	23	I can access the online testing items very easily	0.34	0.34
Behavioral	24	I can use my computer skills efficiently during online testing	0.56	0.49
	25	I can understand the online testing instructions very easily	0.53	0.49
	26	I have a great confidence in using my computer skills successfully during online testing	0.49	0.43
	27	I can do online testing very efficiently	0.67	0.68
	28	I like the careers that require using computer skills	0.47	0.38
	29	Online testing saves the student's time and effort	0.47	0.46
	30	My scores in online testing are high	0.53	0.63
	31	The computer correction of the test is more accurate and objective than the instructor's	0.27	0.27

2. Pearson Simple Correlation was used to measure the correlations between the items and their dimensions on the one hand, and then between the

items and the whole scale on the other as illustrated in Table 3.

Table 3: Pearson Simple Correlation

Id of Item	Content of Item	Dimension			Scale
		Affective	Cognitive	Behavioral	
1	I feel anxious about the mysterious conditions prevailing in the online testing atmosphere	0.72	0.43	0.38	0.60
2	I feel tense and nervous upon entering the online testing room	0.84	0.58	0.54	0.76
3	I am afraid that the time allotted for online testing would pass quickly before finishing the test	0.68	0.43	0.34	0.57
4	I feel confused when having online testing	0.81	0.55	0.48	0.72
5	I feel frightened during online testing	0.68	0.43	0.37	0.58
6	I think that the time allotted for online testing is insufficient	0.57	0.33	0.33	0.48
7	I feel scared about the occurrence of any technical errors in the computer I would be taking my test on	0.50	0.23	0.18	0.36
8	I feel comfortable upon entering the online testing room	0.74	0.55	0.52	0.70
9	The quickness of the computer in giving the result of the test upsets me	0.60	0.37	0.38	0.52
10	I feel at ease while taking online testing	0.69	0.53	0.52	0.67
11	Online testing weakens the spirit of creativity in students	0.43	0.68	0.36	0.59
12	Online testing affects my intellectual abilities negatively	0.39	0.67	0.40	0.58
13	Online testing results in losing much of the information I have	0.53	0.71	0.45	0.67
14	My concentration becomes lower during online testing	0.50	0.68	0.42	0.63
15	Online testing weakens the relations between the instructor and the student	0.46	0.64	0.42	0.60
16	Online testing tires the student's eyes	0.50	0.64	0.37	0.60
17	Online testing creates competition among students	0.32	0.58	0.41	0.51
18	Online testing does not take into consideration the individual differences among students	0.32	0.50	0.25	0.43
19	I have difficulty in doing and revising the online testing questions	0.46	0.63	0.39	0.58
20	Online testing helps in developing my scientific thinking abilities	0.27	0.55	0.42	0.48
21	I can do a perfect job in online testing	0.46	0.64	0.51	0.63
22	Online testing makes the student more dependable on his/her own efforts	0.17	0.41	0.29	0.34
23	I can access the online testing items very easily	0.24	0.47	0.32	0.40
24	I can use my computer skills efficiently during online testing	0.37	0.41	0.68	0.53
25	I can understand the online testing instructions very easily	0.35	0.42	0.65	0.52
26	I have a great confidence in using my computer skills successfully during online testing	0.37	0.32	0.63	0.48
27	I can do online testing very efficiently	0.57	0.58	0.77	0.71
28	I like the careers that require using computer skills	0.28	0.30	0.62	0.43
29	Online testing saves the student's time and effort	0.33	0.42	0.61	0.50
30	My scores in online testing are high	0.54	0.54	0.67	0.66
31	The computer correction of the test is more accurate and objective than the instructor's	0.19	0.26	0.46	0.33

It was found that the correlations among the items of the affective dimension, and then between its items and the whole scale range between 0.50 and 0.84, and between 0.36 and 0.76, respectively. Second, the correlations among the items of cognitive dimension, and then between its items and the whole scale range between 0.41 and 0.71, and between 0.34 and 0.67, respectively. Finally, the correlations among the items of the behavioral dimension, and then between its items

and the whole scale range between 0.46 and 0.77, and between 0.33 and 0.71, respectively.

Internal Validity

Pearson Interclass Correlation was used to measure the correlations between the dimensions on the one hand, and between these dimensions and the whole scale on the other as shown in Table 4.

Table 4: Pearson's Interclass Correlations

	Affective	Cognitive	Behavioral
Cognitive	0.65*		
Behavioral	0.60*	0.64*	
Scale	0.87*	0.90*	0.82*

*P < 0.05

From this table, we can notice that the correlation between the affective and the cognitive dimensions is 0.65, between the affective and the behavioral is 0.60, and between the behavioral and the cognitive is 0.64. The correlations between the affective, cognitive, and behavioral, on the one hand, and the whole scale, on the other, are 0.87, 0.90, and 0.82, respectively. This means that the correlation between the scores on the three dimensions and the scale show that the

dimensions and the scale significantly correlate with each other. Based on this analysis, the scale was approved and administered to 638 subjects.

Discrimination Power

The ability of items, belonging to their dimensions or to their scale, to discriminate between the higher 33% and lower 33% of the respondents' scores is an indication which confirms the scale validity. In order to figure this out, the differences between the scores of the two groups on the thirty-one items of the scale were tested. As a result, it was found that the items had high discriminating power at the level of their dimensions on the one hand, and at the scale level as a whole on the other as illustrated in Tables 5 and 6.

Table 5: Discrimination power of the items at the level of their dimensions

Dimension	Id	Item	Group	Dimensions					
				N	Mean	Std. Dev.	t	df	Sig.
Affective	1	I feel anxious about the mysterious conditions prevailing in the online testing atmosphere	Low	212	1.373	0.67	-21.717	355.178	0.000
			High	219	3.306	1.13			
	2	I feel tense and nervous upon entering the online testing room	Low	212	1.264	0.52	-35.754	352.060	0.000
			High	219	3.781	0.90			
	3	I am afraid that the time allotted for online testing would pass quickly before finishing the test	Low	212	1.132	0.35	-17.969	250.128	0.000
			High	219	2.790	1.32			
	4	I feel confused when having online testing	Low	212	1.382	0.65	-32.818	400.114	0.000
			High	219	3.845	0.89			
	5	I feel frightened during online testing	Low	212	1.764	1.06	-21.625	411.915	0.000
			High	219	3.804	0.89			
6	I think that the time allotted for online testing is insufficient	Low	212	1.519	0.88	-15.702	391.704	0.000	
		High	219	3.160	1.26				
7	I feel scared about the occurrence of any technical errors in the computer I would be taking my test on	Low	212	1.302	0.68	-12.326	329.884	0.000	
		High	219	2.530	1.30				
8	I feel comfortable when entering the online testing room	Low	212	1.708	0.91	-23.112	429.000	0.000	
		High	219	3.767	0.94				
9	The quickness of the computer in giving the result of the test upsets me	Low	212	1.675	1.10	-17.227	422.295	0.000	
		High	219	3.667	1.29				
10	I feel at ease while taking online testing	Low	212	1.868	0.94	-22.560	429.000	0.000	
		High	219	3.872	0.90				
Cognitive	11	Online testing weakens the spirit of creativity in students	Low	223	1.717	0.88	-19.692	399.360	0.000
			High	214	3.645	1.14			
	12	Online testing affects my intellectual abilities negatively	Low	223	2.067	1.05	-20.546	413.903	0.000
			High	214	3.902	0.80			
	13	Online testing results in losing much of the information I have	Low	223	1.659	0.89	-25.143	435.000	0.000
			High	214	3.860	0.94			
	14	My concentration becomes lower during online testing	Low	223	1.637	0.95	-22.377	435.000	0.000
			High	214	3.706	0.98			
	15	Online testing weakens the relations between the instructor and student	Low	223	1.570	0.79	-20.564	387.565	0.000
			High	214	3.449	1.09			
	16	Online testing tires the student's eyes	Low	223	1.578	0.81	-18.603	370.390	0.000
			High	214	3.421	1.21			
	17	Online testing creates competition among students	Low	223	2.049	0.99	-15.644	427.656	0.000
			High	214	3.607	1.09			
	18	Online testing does not take into consideration the individual differences among students	Low	223	1.668	0.93	-11.889	391.812	0.000
			High	214	2.935	1.26			
	19	I have difficulty in doing and revising the online testing questions	Low	223	1.332	0.76	-17.337	338.891	0.000
			High	214	3.112	1.31			
	20	Online testing helps in developing my scientific thinking abilities	Low	223	2.291	1.07	-15.593	431.563	0.000
			High	214	3.785	0.93			
21	I can do a perfect job in online testing	Low	223	2.112	0.90	-18.614	435.000	0.000	
		High	214	3.776	0.97				
22	Online testing makes the students more dependable on his/her efforts	Low	223	3.395	1.20	-9.568	380.297	0.000	
		High	214	4.313	0.77				
23	I can access the online testing items very easily	Low	223	2.798	1.52	-10.952	398.866	0.000	
		High	214	4.168	1.07				
Behavioral	24	I can use my computer skills efficiently during online testing	Low	203	2.887	1.17	-18.221	297.886	0.000
			High	231	4.563	0.62			
	25	I can understand the online testing instructions very easily	Low	203	3.044	1.21	-15.853	292.952	0.000
			High	231	4.541	0.62			
	26	I have a great confidence in using my computer skills successfully during online testing	Low	203	2.665	1.23	-16.574	337.944	0.000
			High	231	4.338	0.80			
	27	I can do online testing very efficiently	Low	203	2.079	0.86	-28.099	432.000	0.000
			High	231	4.273	0.76			
	28	I like the careers that require using computer skills	Low	203	2.793	1.28	-17.109	302.766	0.000
			High	231	4.519	0.70			
	29	Online testing saves the student's time and effort	Low	203	3.034	1.27	-15.911	294.878	0.000
			High	231	4.615	0.66			
	30	My scores in online testing are high	Low	203	1.759	0.88	-20.702	430.963	0.000
			High	231	3.684	1.05			
	31	The computer correction of the test is more accurate and objective than the instructor's	Low	203	3.069	1.43	-11.200	338.122	0.000
			High	231	4.381	0.92			

* $\alpha = 0.05$

Table 6: Discrimination power of the items at the level of the whole scale

Dimension	Id	Item	Group	Scale					
				N	Mean	Std. Dev.	t	df	Sig.
Affective	1	I feel anxious about the mysterious conditions prevailing in the online testing atmosphere	Low	208	1.471	0.75	-15.975	355.845	0.000
			High	216	3.065	1.25			
	2	I feel tense and nervous upon entering the online testing room	Low	208	1.351	0.66	-28.763	380.816	0.000
			High	216	3.671	0.97			
	3	I am afraid that the time allotted for online testing would pass quickly before finishing the test	Low	208	1.250	0.59	-14.264	300.706	0.000
			High	216	2.662	1.32			
	4	I feel confused when having online testing	Low	208	1.505	0.79	-24.609	402.438	0.000
			High	216	3.681	1.02			
	5	I feel frightened during online testing	Low	208	1.947	1.19	-16.486	422.000	0.000
			High	216	3.685	0.97			
6	I think that the time allotted for online testing is insufficient	Low	208	1.716	1.13	-10.805	416.861	0.000	
		High	216	3.005	1.32				
7	I feel scared about the occurrence of any technical errors in the computer I would be taking my test on	Low	208	1.481	0.92	-7.905	390.063	0.000	
		High	216	2.338	1.29				
8	I feel comfortable when entering the online testing room	Low	208	1.702	0.87	-23.352	422.000	0.000	
		High	216	3.755	0.94				
9	The quickness of the computer in giving the result of the test upsets me	Low	208	1.865	1.24	-13.474	421.463	0.000	
		High	216	3.556	1.34				
10	I feel at ease while taking online testing	Low	208	1.913	0.98	-21.218	422.000	0.000	
		High	216	3.856	0.91				
Cognitive	11	Online testing weakens the spirit of creativity in students	Low	208	1.740	0.88	-17.153	394.094	0.000
			High	216	3.500	1.21			
	12	Online testing affects my intellectual abilities negatively	Low	208	2.154	1.14	-16.932	382.181	0.000
			High	216	3.806	0.85			
	13	Online testing results in losing much of the information I have	Low	208	1.769	1.06	-21.421	411.617	0.000
			High	216	3.847	0.93			
	14	My concentration becomes lower during online testing	Low	208	1.716	1.05	-19.949	422.000	0.000
			High	216	3.699	1.00			
	15	Online testing weakens the relations between the instructor and student	Low	208	1.644	0.87	-17.048	398.196	0.000
			High	216	3.333	1.16			
	16	Online testing tires the student's eyes	Low	208	1.644	0.84	-16.848	379.079	0.000
			High	216	3.370	1.24			
	17	Online testing creates competition among students	Low	208	2.091	1.03	-13.940	421.671	0.000
			High	216	3.532	1.10			
	18	Online testing does not take into consideration the individual differences among students	Low	208	1.673	0.94	-10.492	398.583	0.000
			High	216	2.801	1.25			
	19	I have difficulty in doing and revising the online testing questions	Low	208	1.327	0.73	-16.359	335.743	0.000
			High	216	3.023	1.33			
	20	Online testing helps in developing my scientific thinking abilities	Low	208	2.380	1.10	-12.922	422.000	0.000
			High	216	3.694	0.99			
21	I can do a perfect job in online testing	Low	208	2.101	0.91	-18.868	422.000	0.000	
		High	216	3.787	0.93				
22	Online testing makes the students more dependable on his/her efforts	Low	208	3.481	1.20	-7.756	361.498	0.000	
		High	216	4.255	0.81				
23	I can access the online testing items very easily	Low	208	2.837	1.50	-8.933	395.930	0.000	
		High	216	4.019	1.20				
Behavioral	24	I can use my computer skills efficiently during online testing	Low	208	3.139	1.26	-13.685	289.714	0.000
			High	216	4.454	0.58			
	25	I can understand the online testing instructions very easily	Low	208	3.202	1.24	-12.946	304.788	0.000
			High	216	4.444	0.63			
	26	I have a great confidence in using my computer skills successfully during online testing	Low	208	2.913	1.32	-11.112	351.904	0.000
			High	216	4.120	0.85			
	27	I can do online testing very efficiently	Low	208	2.192	1.00	-23.729	380.890	0.000
			High	216	4.222	0.74			
	28	I like the careers that require using computer skills	Low	208	3.072	1.31	-10.757	370.321	0.000
			High	216	4.264	0.92			
	29	Online testing saves the student's time and effort	Low	208	3.183	1.32	-12.511	328.363	0.000
			High	216	4.495	0.76			
	30	My scores in online testing are high	Low	208	1.813	0.94	-19.090	420.574	0.000
			High	216	3.648	1.04			
31	The computer correction of the test is more accurate and objective than the instructor's	Low	208	3.264	1.40	-7.476	383.843	0.000	
		High	216	4.167	1.05				

* $\alpha = 0.05$

Factorial Validity

The OTAS was administered to 638 students, which constituted the study sample, and then the scale and its dimensions were subjected to a confirmatory factor analysis, which yielded a three-dimension scale

with thirty-four items (Valois et al. 2000, Rainer and Miller 1996, Joreskog and Sorbom 1988). The eigenvalues and percentage of variance are shown in Table 7.

Table 7: Eigenvalues & Percent of Variance Indices

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.920	32.0	32.0	5.037	16.2	16.2
2	1.990	6.4	38.4	4.454	14.4	30.6
3	1.563	5.0	43.5	3.982	12.8	43.5

Extraction Method: Principal Component Analysis.

As a result of factor analysis, it was found that these 31 items had factor loadings on the scale as shown in Table 8.

Table 8: Factor loadings of the Scale Dimensions Items

Dimension		Content of Item	Loading of Item
Affective	1	I feel anxious about the mysterious conditions prevailing in the online testing atmosphere	0.72
	2	I feel tense and nervous upon entering the online testing room	0.71
	3	I am afraid that the time allotted for online testing would pass quickly before finishing the test	0.69
	4	I feel confused when having online testing	0.69
	5	I feel frightened during online testing	0.60
	6	I think that the time allotted for online testing is insufficient	0.58
	7	I feel scared about the occurrence of any technical errors in the computer I would be taking my test on	0.57
	8	I feel comfortable upon entering the online testing room	0.56
	9	The quickness of the computer in giving the result of the test upsets me	0.51
	10	I feel at ease while taking online testing	0.50
Cognitive	11	Online testing weakens the spirit of creativity in students	0.68
	12	Online testing affects my intellectual abilities negatively	0.63
	13	Online testing results in losing much of the information I have	0.60
	14	My concentration becomes lower during online testing	0.59
	15	Online testing weakens the relations between the instructor and the student	0.56
	16	Online testing tires the student's eyes	0.56
	17	Online testing creates competition among students	0.51
	18	Online testing does not take into consideration the individual differences among students	0.51
	19	I have difficulty in doing and revising the online testing questions	0.50
	20	Online testing helps in developing my scientific thinking abilities	0.47
	21	I can do a perfect job in online testing	0.47
	22	Online testing makes the student more dependable on his/her own efforts	0.35
	23	I can access the online testing items very easily	0.31
Behavioral	24	I can use my computer skills efficiently during online testing	0.65
	25	I can understand the online testing instructions very easily	0.63
	26	I have a great confidence in using my computer skills successfully during online testing	0.63
	27	I can do online testing very efficiently	0.62
	28	I like the careers that require using computer skills	0.58
	29	Online testing saves the student's time and effort	0.57
	30	My scores in online testing are high	0.47
	31	The computer correction of the test is more accurate and objective than the instructor's	0.33

Table 8 shows that the items 1-10, 11-23, and 24-31 had factor loadings ranging between 0.50 and 0.72 on the affective dimension, between 0.31 and 0.68 on the cognitive dimension, and between 0.33 and 0.65 on the behavioral dimension, respectively.

Stage 3: Scale Reliability

In order to measure the degree to which the OTAS could reliably measure attitudes toward online testing overtime, the scale was administered again two weeks later to 35 students outside the study sample, using the stability method. The Pearson correlation was calculated for the scale scores on the two occasions, as shown in Table 9, and was found to have a coefficient of 0.78, indicating that the OTAS has an adequate test-retest reliability. Also, a Cronbach's Alpha was calculated for each of the dimensions and the whole scale. It was found that the affective, the cognitive, the behavioral dimensions, and the whole have coefficients of 0.87, 0.85, 0.79, and 0.92, respectively, as demonstrated in Table 9.

Table 9: Test-Retest Reliability

Dimension	Stability Coefficient	Cronbach's Alpha	No of Items
Affective	0.81	0.87	10
Cognitive	0.79	0.85	13
Behavioral	0.83	0.79	8
Scale	0.78	0.92	31

These coefficients show a high level of internal consistency (Seal and Scott 1992) for each of the affective and cognitive dimensions and the whole scale. The items of the scale are strongly related to each other. Although the coefficient for the behavioral dimension is a little bit lower than 0.80 as suggested by Seal and Scott, it indicates that the internal consistency is still appropriate.

Instrument Evaluation Method

A statistical procedure called 'absolute scaling' was employed to classify the means of the scale, its dimensions, and its items. The classification is illustrated as follows:

Strongly agree corresponds with means ranging between 4.5 and 5.

Agree corresponds with means ranging between 4.49 and 3.5.

Not sure corresponds with means ranging between 3.49 and 2.5.

Disagree corresponds with means ranging between 2.49 and 1.5.

Strongly disagree corresponds with means ranging between 1.49 and 1.0.

Conclusion

The study aimed at developing a multiple dimension scale that could measure university students' attitudes toward online testing. Data for constructing the scale were collected from a variety of sources. The scale and its items were subjected to a confirmatory factor analysis, which yielded a three-dimension scale:

affective, cognitive, and behavioral, with thirty-four items. Three items of the scale were excluded because they met the item deletion criterion (below 0.25). The final scale consisted of 31 items and was administered to 638 students. 10 items had high factor loading on the affective dimension, 13 on the cognitive, and 8 on the behavioral.

The results revealed that the scale was valid. There were high correlations between the items and their dimensions, and between the dimensions and the whole scale. In other words, it had construct validity. The items also had discriminating power in terms of their dimensions and concerning the whole scale. Finally, the scale had internal validity in that high correlations were found between the dimensions, and between these dimensions and the whole scale.

The scale was reliable in that it showed an appropriate test-retest reliability. The coefficients provided by Cronbach's Alpha uncovered high level of internal consistency between the dimensions items and the whole scale.

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Appendix (1)
Online Testing Attitudes Scale

Id	Item	strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1	I feel anxious about the mysterious conditions prevailing in the online testing atmosphere					
2	I feel tense and nervous upon entering the online testing room					
3	I am afraid that the time allotted for online testing would pass quickly before finishing the test					
4	I feel confused when having online testing					
5	I feel frightened during online testing					
6	I think that the time allotted for online testing is insufficient					
7	I feel scared about the occurrence of any technical errors in the computer I would be taking my test on					
8	I feel comfortable upon entering the online testing room					
9	The quickness of the computer in giving the result of the test upsets me					
10	I feel at ease while taking online testing					
11	Online testing weakens the spirit of creativity in students					
12	Online testing affects my intellectual abilities negatively					
13	Online testing results in losing much of the information I have					
14	My concentration becomes lower during online testing					
15	Online testing weakens the relations between the instructor and the student					
16	Online testing tires the student's eyes					
17	Online testing creates competition among students					
18	Online testing does not take into consideration the individual differences among students					
19	I have difficulty in doing and revising the online testing questions					
20	Online testing helps in developing my scientific thinking abilities					
21	I can do a perfect job in online testing					
22	Online testing makes the student more dependable on his/her own efforts					
23	I can access the online testing items very easily					
24	I can use my computer skills efficiently during online testing					
25	I can understand the online testing instructions very easily					
26	I have a great confidence in using my computer skills successfully during online testing					
27	I can do online testing very efficiently					
28	I like the careers that require using computer skills					
29	Online testing saves the student's time and effort					
30	My scores in online testing are high					
31	The computer correction of the test is more accurate and objective than the instructor's					