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# Psychometric Characteristics of the Attitude Towards Statistics Scale

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## ABSTRACT

Most graduate students consider statistics courses as the major obstacle towards the attainment of the desired degree. The researchers noticed that graduate students become anxious when they attend the first statistics course and attempt when possible particularly at Umm Al Qura University (UQU) to delay taking the required statistics courses until just before the end of their program.

While research in most of the higher education institutions in Saudi Arabia has focused on examining the effect of the cognitive factors on the variation of the students' academic achievement, little regard has been given to non-cognitive factors, such as students' feelings, attitudes, beliefs, interests, expectations and motivations. Therefore, it is the intent of this paper to provide the educators in Saudi Arabia with a new measurement scale that can be used to examine students' attitudes towards statistics.

Steven Wise designed this instrument in 1985. In order to make this instrument available to educators, twenty-nine items were translated into the Arabic language. The translation was reviewed by a number of specialists in English and Arabic. Additionally, specialists in measurement and statistics were asked to review the instrument. The final form of the instrument in Arabic contained, in addition to Wise's twenty-nine items, nine new items. For the purpose of examining the instrument's concurrent validity another Semantic Differential statistical attitude scale was developed.

In order to examine the instrument's psychometric properties, it was administered to one hundred and seventy-eight (178) graduate students enrolled in an introductory course in Statistics at two large universities in Saudi Arabia.

The analysis of the data revealed the following findings:

1. The reliability analysis as computed by split-half and Cronbach Alpha produced identical values for both the Wise 29-item scale and the complete Arabic form (38 items). (Split-half .94 and Alpha .96)
2. The concurrent validity of the instrument with the semantics differential attitude scale was found to be .75 for the Wise 29-item and .77 for the complete Arabic form.
3. The factor analysis result confirmed the presence of two factors approximately similar to what has been confirmed in the previous research.
4. The item total correlation analysis indicated that the majority of the items showed correlation values, which range between .46 and .79 with a median of .61

## الخصائص السيكومترية لمقياس الاتجاهات نحو الإحصاء

### الملخص

**معظم** طلاب الدراسات العليا يعتقدون أن مادة الإحصاء تمثل العائق الأساسي الذي يعترض مشوارهم العلمي لإكمال الدرجة العلمية المرغوبة. فمن خلال تدريس هذه المادة لوحظ أن طلاب الدراسات العليا في كلية التربية في كل من جامعة الملك سعود وجامعة أم القرى يشعرون بالقلق بمجرد التسجيل في مادة الإحصاء، كما لوحظ أن بعض الطلاب عندما تتاح لهم الفرصة، وخاصة طلاب جامعة أم القرى؛ يحاولون تأخير تسجيل مادة الإحصاء إلى فترة وجيزة قبل إنهاء المواد المقررة في الحطة الدراسية.

وبالرغم من اهتمام الباحثين في مؤسسات التعليم العالي بدراسة العوامل التي تؤثر في تباين التحصيل الطلابي فإن جل اهتمامهم تركز حول أثر العوامل المعرفية، دون اعتبار يذكر لأثر العوامل غير المعرفية المتعلقة بمشاعر الطلاب، واتجاهاتهم، ومعتقداتهم، وميولهم، ودوافعهم. وعلى هذا الأساس كان الهدف الرئيسي من هذا البحث توفير أداة قياس موضوعية يمكن أن يستفيد منها التربويون والباحثون في المملكة العربية السعودية في دراسة اتجاهات الطلاب نحو الإحصاء، والعمل على إثراء أدبيات البحث في هذا المجال، ووضع الاقتراحات التي من شأنها تحسين أداء القائمين على تدريس مواد الإحصاء، وخلق المناخ الأكاديمي الكفيل بتعزيز اتجاهات الطلاب الإيجابية نحو الإحصاء.

ونتيجة لصعوبة الحصول على مقياس باللغة العربية فقد تم اختيار المقياس الذي طوره ستيفن وايز (Steven Wise) في عام ١٩٨٥ م؛ وذلك لما يتميز به من خصائص سيكومترية جيدة. ولكي يتم توطيئ المقياس وفق معطيات البيئة المحلية؛ تم ترجمة فقراته المكونة من ٢٩ سؤالاً إلى اللغة العربية، كما تم مراجعة الترجمة من قبل مجموعة من المتخصصين في اللغة العربية والإنجليزية، ومجموعة أخرى من المتخصصين في مجال القياس والإحصاء. بوجه عام النسخة النهائية للمقياس اشتملت إلى جانب فقرات مقياس (وايز) التسعة والعشرون على تسع فقرات جديدة، بالإضافة إلى بناء أداة جديدة لقياس الاتجاهات نحو الإحصاء وفق أسلوب التمايز اللفظي؛ وذلك للتحقق من الصدق التلازمي للمقياس الجديد باللغة العربية.

ولكي يتم التحقق من خصائص الأداة السيكومترية؛ تم تطبيقها على (١٧٨) من طلاب الدراسات العليا الذين سجلوا مادة الإحصاء في جامعتين من أكبر الجامعات السعودية؛ وذلك في الفصلين: الأول والثاني من عام ٢٠٠٠ م. وبناء على مجمل التحليل النهائي للبيانات تم التوصل إلى النتائج التالية:

(١) معامل ثبات فقرات أداة (وايز) التسعة والعشرون، والأداة الكاملة (٣٨) فقرة، كما تم حسابها بأسلوب التجزئة النصفية وكرباخ ألفا كانت متماثلة (٠,٩٤ و ٠,٩٦). (٢) بلغ معامل الصدق التلازمي للأداتين كليهما (٠,٧٥ و ٠,٧٧) على التوالي. (٣) التحليل العاملي لفقرات الأداة أكد ظهور العوامل نفسها التي تم التوصل لها في الدراسات السابقة. (٤) معامل ارتباط فقرات الأداة مع الدرجة الكلية تراوحت بين (٠,٤٦ و ٠,٧٩). ويوجه عام هذه النتائج تؤكد صلاحية الأداة لقياس الاتجاهات نحو الإحصاء، وإمكانية الاستفادة منها في معرفة طبيعة هذه الاتجاهات، واتخاذ الإجراءات اللازمة للحد من أثرها في دافعية الطلاب، ومدى تعلمهم لمفاهيم مواد الإحصاء.

## 1-Introduction

Most graduate students consider statistics courses as the major obstacle toward the attainment of the desired degree. It was noticed that graduate students in general hold unconstructive beliefs and attitudes toward statistics and attend the first course with anxiety and stress.

Despite the long presence of such practices in most of the academic institutions that offer statistics courses, the available research literature in Arabic showed little concern with studies designed to explain the factors that caused students' anxiety toward statistics.

In contrast, the research literature in English language contained at least six instruments and twelve studies which were concerned directly with student's attitude toward statistics. Gal and Ginsburg (1994) in their review of the research concerned with student troubles with statistics stated:

"While many teachers of statistics are likely to focus on transmitting knowledge, many students are likely to have trouble with statistics due to non-cognitive factors, such as negative attitudes or beliefs toward statistics" They went on to say "such factors can impede learning of statistics, or hinder the extent to which students will develop useful statistics intuitions and apply what they have learned outside the classroom." p1

According to research findings regarding student trouble with statistics, it seems evident that statistics instructors must pay more attention to students' position on noncognitive factors such as students' feelings, attitudes, beliefs, interests, expectations, and motivations. To insure they have done their job well, statistics instructors should learn how to assess students' affective outcome, and use the result of such assessment to improve the quality of their teaching and instruction.

Based on the former argument, the present study was designed to provide statistics instructors and researchers interested in students' attitude toward statistics with an objective measurement scale which can be used to assess students' attitudes toward statistics. Because of the difficulty involved in obtaining a measurement scale in the Arabic language, the Wise scale (Wise 1985) attitude toward statistics was translated into the Arabic, and was used to collect the necessary data to examine its psychometric properties.

## 2- Theoretical background and literature review

The subject of attitude has been of a great interest to researchers in various fields. Most of them have focused on examining the component of attitude and how it affects people's daily behavior. In the education field, Bloom is considered

among the pioneers who devoted a great effort to describe student's attitude and how it affects learning outcome in school. According to his teaching model, a student who enters any new learning task with something of a history which he perceives as related to the learning task leaves the learning task with a new perception which in turn becomes the initial affective characteristic for the next learning task. (Bloom 1976)

Generally, all students at the beginning of a new learning task differ with respect to their previous education experience, and the way in which they perceive such experience. Consequently, the student who has a successful perception of his previous educational experience will approach the task with evident interest and consider it as a relevant thing to learn. In contrast, students who believe they have been unsuccessful with the related prior tasks, will approach the new task as a duty or with evident discomfort (Bloom 1976)

Basically, a student's Affective Entry Characteristic is composed of several non-cognitive factors such as interest, attitude and self-view which students acquire during their school experiences. As they progress in school, they encounter various negative and positive experiences, which in turn become at later stages one single system named by Bloom as the Affective Entry Characteristic. Bloom (1976) described the relation of this

system to school learning in his book "Human characteristic and school learning" as follows:

"Success or lack of success in a school subject eventually is a major force in determining how the student feels about the subject, and his desire to learn more about that subject." P160

As students attend to a new learning task, they will differ with respect to their interest, enthusiasm, and desire to learn, depending on their prior experiences. Students who believe they were successful in prior similar task will learn the new task more rapidly than students who had an unsuccessful experience with related tasks. However, good instructors who attempt to assess students' attitude, and continuously improve the quality of their instruction, and reward the student for accomplishment will on the long run bring the student with negative attitudes to attain some sense of accomplishment and satisfaction, and therefore enhance the students' positive attitude toward subsequent related learning tasks. (Gal and Gins-burg 1994).

Therefore, in order to help those students who carry unconstructive beliefs about themselves with respect to a particular learning task; instructors need to be sensitive to the students' emotional and attitudinal status, and should have access to assessment instruments that enable them to quantify their students' attitudes

and beliefs. Furthermore, they must learn how to make the learning of new tasks less frustrating, less fearful, and more effective.

The need for an objective measure to assess attitude toward school subject matter, was first recognized by educators and researchers in the field of science education (Gal and Ginsburg 1994). In response to such need many efforts have been made to examine the various non cognitive factors that affect the students' academic achievement. Much of the research in the Arab world and elsewhere contains large numbers of published papers which involve attitude survey design, and the use of these surveys to examine the status of students' attitude toward science subjects and its affect on their academic achievement.

Overall, the availability of rich research findings and objective scales to assess attitude have impacted education instructors' teaching strategies, and enhanced their understanding of the student's attitude. Specifically, it enabled them to identify the areas of the student's frustration, and provide the relevant intervention.

When statistics courses became part of the undergraduate and graduate program, statistics instructors began to encounter much the same problems faced by mathematics teachers (Giesbrecht 1996). As a result of students' negative

views about their mathematical skills and their ability to handle quantitative problems, they approached statistics courses with great fear and stress. (Gal and Ginsburg 1994 and Cashin and Elmore, 1997).

Most of those who teach statistics or have taken statistics courses are familiar with the high level of anxiety exhibited by many students on the first day of the term. With the advent of graduate and undergraduate programs, statistics courses became a major requirement for the completion of various degrees in many disciplines. Consequently, the intensity of the students' trouble with statistics became a known fact in almost all academic institutions. Students' attitudes toward statistics have been reported as negative in many institutions and it has become common to see students delaying taking statistics courses until just before graduation. (Waters et al 1988). The immense increase in the number of students who come to statistics courses with unconstructive beliefs and attitudes toward statistics has led many educators to call on statistics instructors and concerned researchers to explore the nature of the beliefs, attitude and expectation which students bring into the statistics classroom. In response to these calls Roberts and Bilderbeck (1980) reported the development of the first assessment scale entitled "Statistics Attitude Survey" to meet the need of statistics

instructor to assess their students attitude toward statistics.

The initial pool of items consisted of 50 Likert-type items with a five choice scale ranging from "strongly agree" to "strongly disagree". After examining the fifty items the final form of the survey was reduced to 34 items formulated by both writers to assess students' perceived competence in dealing with statistics problems and how they think about the usefulness of statistics with respect to their future career. Then the final form of the scale was used to collect data for examining the scale psychometric properties. Overall, the findings confirmed that the SAS items were highly consistent, and measured approximately the same construct. Specifically, data analysis showed that the SAS is highly reliable (.94), and seem to possess a moderate predictive validity regarding students total score in basic statistics courses. Further studies on SAS reliability by Robbers and Sax 1983, and Robbers and Reese 1987 reported coefficient Alpha of (.92) and (.93).

In 1982, Roberts and Sax designed the first study to examine the SAS criterion validity as it was related to various cognitive and noncognitive variables. The overall analysis of the collected data suggested that SAS scores were found to be correlated with cognitive factors such as: basic mathematic skills, preknowledge in statistics, and course grade. Also, the

SAS score was found to be correlated with a number of non-cognitive factors such as sex, number of previous mathematic courses completed, calculator attitude, etc. Further findings show that SAS scores exhibited a significant positive change between the students mean at the beginning and the end of the semester.

The significant change in the SAS score between the beginning and the end of the semester was perceived by Wise (1985) as a sign of serious limitation in the scale. Therefore, he exposed the content of the SAS items to complete inspection. Wise concluded that approximately one third of SAS items deal with students' success in solving or understanding statistics problems and concepts. In more details, Wise reported that:

"There are two difficulties with these types of items. First, these items appear to be measuring student's achievement rather than student attitude. Second, these items are inappropriate for students who are just beginning their statistics courses. Beginning students cannot meaningfully answer these types of items, as they typically have had little or no experience with statistical problems or concept. Hence, although SAS addresses an important measurement needs many of its items are inappropriate"p402.

To overcome the aforementioned limitation of SAS as a scale for measuring students' attitude toward statistics and

meet the statistics educators need for an objective scale, Wise developed 29 items to measure students' attitude in two domains: (a) students' attitude toward the course and (b) students' attitude toward the usefulness of statistics in their field of study. He argued that his scale "Attitude toward statistics" measures attitude rather than student success in statistics, and could be answered by the students at any time during the semester. Wise completed the final form of ATS according to the following stages:

1. Wise first developed 40 items using response scale ranging from "strongly agree" to "strongly disagree", with at least half of the items using reversed key.

2. After inspection of content validity by two statistics instructors five items were deleted.

3. The remaining 35 items were tried out on a sample of 92 students, and five items were dropped as a result of their low item total correlation.

4. Finally one more item was dropped when it was rated by more than one rater as an item that can not be validly answered by the students on the first day of the class.

In order to examine the ATS psychometric properties, Wise administered the 29 items on two samples. The result of the data analysis was that ATS

exhibited coefficient Alpha of .92 and .90, and test retest reliability of .82 and .91 for both field and course subscale. Also the factor analysis indicated the presence of two common factors which explained .49 of the total variance.

In addition to SAS and ATS several other instruments were designed to assess students' attitude toward statistics: Survey of Attitude Toward Statistics (Schau et al 1993), Multi-factor Attitude Toward Statistics (Auzmendi 1991), Statistics Attitude Scale (McCall, Belli, and Madjidi, 1990). Also, a few other instruments were designed to characterize how anxiety influences student performance in statistics courses: The Coping Strategies Inventory for Statistics (Jarrell and Burry 1989), Statistical Anxiety Rating Scale (Cruise, Cash and Bolton 1985), and Statistics Anxiety Inventory (Zeidner 1991).

Although some of the aforementioned instruments have been used by researchers to examine students' trouble with statistical courses, SAS and ATS remained the most widely used instruments among statistics instructors, educators, and researchers concerned with the assessment of students' attitude toward statistics.

Roberts and Reese (1987) designed a study to compare SAS and ATS with respect to their psychometric properties. First, they combined the two scales and

administered them to 280 students enrolled in introductory statistics courses. Data analysis showed that both scales proved to be highly reliable and exhibited high criterion validity. They concluded that both scales are similar and could be used as alternatives.

In 1988 Waters et al conducted the principle components analysis on combined items of SAS and ATS.n A separate and combined analysis of the collected data suggested that items from both scales reflected two stable and related factors: (a) attitude toward the field of statistics, and (b) attitude toward specific statistics courses. Further evidence on SAS reliability and validity was reported by Shultz and Koshino 1998. They collected data on 36 undergraduate and 38 graduate psychology students and the data analysis results supported the previous evidence of the high internal consistency for both subscales at the beginning of the course and at the end.

Overall, the body of research on the assessment of students' attitude toward statistics is very small (Gal and Ginsburg 1994), and has not yet met the statistics educator's needs. Most of the known studies have been based on data collected from paper and pencil Likert-type scales. Although the available surveys and instruments have encouraged statistics instructors to pay serious attention to the affective factors that caused students' difficulties in learning

statistics concepts, they were criticized by Gal and Ginsburg (1994) and described as having a very serious limitation. In their critical review paper of the previous effort concerned with the designing of instruments to quantify students' attitude toward statistics, they stated that such effort was ill-suited for assessing the students' attitude toward statistics as a result of the following:

- 1."Exclusive use of Likert-type scales.

2. The inclusion of items that are not appropriate for students who have not had extended experience with statistics, or who are not at a very advanced stage of their career development.

3. The tendency not to seek explanation from subject for their answer etc "... They went on to say that "These problems severely limit interpretability of obtained score at both the personal and group level." p11

Generally both writers have recommended the development of instruments which include both Likert-type items and open-ended questions so that students can explain the effects underlying their responses to Likert scale items, and therefore provide interpretable information that may enhance better understanding of their trouble with statistics.

Despite the sound argument of Gal and Ginsburg regarding the use of

Likert-type instruments to measure students' attitude toward statistics, they have continued to be a major source for the understanding of students' attitudes toward a particular subject matter. The available research published in Western journals and elsewhere have influenced statistics instructors teaching strategies and directed their attention so as to focus on beliefs and attitudes that students bring into classrooms. Furthermore the use of the attitude surveys by researchers and statistics instructors has promoted positive attention towards students' attitudes toward statistics, and many of them have began to engender in the students a positive view of statistics and an appreciation for its potential uses in the outside world. (Mills 2001)

In order to help instructors who teach statistics in Saudi Arabia to assess students' attitude toward statistics and identify areas of problems for individual learners, the present study was undertaken to describe the redevelopment and validation of Wise scale Attitude Toward Statistics (ATS) in Arabic, and determine the extent to which it can be used by statistics instructors. Specifically the study was designed to examine the reliability and the validity of the Arabic version of the scale and determine the extent to which the total translated form will represent the two factors reported in the original form by Wise (1985) and Waters et al (1988).

### **3- The purpose of adopting the Wise ATS scale**

The current scale is an adaptation of the Attitude Toward Statistics Scale constructed by Wise (1985). Wise developed the Attitude Toward Statistics (ATS) scale as an alternative to a well known scale "Statistics Attitude Survey" or (SAS) developed by Roberts and Bilderback (1980). Although both scales are popular, previous research suggested that the ATS scale has a number of advantages over the SAS. First, it measures attitudes rather than achievement or success in statistics courses. Second, it can be administered at the beginning, at the middle, and at the end of the statistics course. Third, it has two dimensions; attitudes toward course, and attitudes toward field (Wise 1985). Fourth, it is the most widely used instrument in research (Shau et al 1993). Fifth, it has been used with graduate as well as undergraduate students (Wise, 1985) (Waters et al, 1988) (Percy & Ruth 1990). Last, but not least, the scale possesses appropriate psychometric characteristics (Wise, 1985) (Waters et al, 1988) (Gal & Ginsburg, 1994) (Shultz & Kishino 1998). Because of the aforementioned advantages, and because of the simplicity of the scale, the ATS scale was selected by the researchers to provide educators in Saudia Arabia with an objective instrument to measure graduate students' attitudes toward statistics.

## **4-Methodology**

### **4.1-The development of the Arabic version.**

The original ATS scale is composed of 29 items with a 5-point Likert- scale ranging from "strongly agree" to "strongly disagree", with a middle point for an undecided response. To introduce ATS to the educators in Saudi Arabia, it was translated into Arabic and administered to a number of graduate students in two large universities in Saudi Arabia.

The complete development of the ATS was accomplished through the following stages: First, both researchers translated the Wise ATS independently. Second, the translation was reviewed to reduce discrepancies in translation and reach an agreement on the final format of the scale. Third, the translated form along with the English version of the scale was given to two experts in English and Arabic to review the accuracy of the translation. Fourth, an open ended questionnaire was given to 20 graduate students to express their attitudes toward statistics. They were asked to write an essay about the way they feel about statistics in general, and how important is a statistics course is to their program of study and to their future profession. After examining the students answers 15 items were developed to cover some cultural aspects of Saudi students regarding statistics subject matter. Fifth, in

order to examine the whole scale content validity, the 15 items together with the original 29 ATS scale items were given to a number of specialists in measurement and statistics. They were asked to examine the appropriateness of the items in terms of their clarity, relevance and representation of the construct. The overall judgment of the specialists suggested the deletion of 6 items of the newly developed items. This deletion left a final ATS pool in Arabic language consisting of Wise 29 items plus 9 of the new 15 items.

### **4.2- Research participants**

The current study took place in two of the largest universities in Saudi Arabia; King Saud University in the city of Riyadh and Umm Al Qura University in the city of Mecca. The total sample consisted of 178 graduate students enrolled at elementary statistic course during the first and second semester (2000), 44 of whom were from KSU and 134 from UQU, 42 females and 136 males.

Most of the participants were working in schools as teachers, supervisors, administrators, or student counselors. The remainder were fulltime students. These students were enrolled in the academic year 2000 in the following Masters programs: Curriculum, Foundation of Education, Psychology, Physical Education, Educational Administration, Educational Technology, Art Education, Special Education.

All graduate students in the College of Education in both universities are required to take at least one three-credit course in statistics and another three-credit course in research methods. They are also required to prepare a Master thesis as part of their Master degree requirements.

The study was conducted at about the middle of the 2<sup>nd</sup> semester of the year 2000 when the students either had finished their statistics course or were enrolled in their research method course, or they had finished their research method course, and were enrolled in their statistics course. This suggests that most of the participants were somewhat familiar with most of the statistical concepts used in the scale items.

### 4.3 - Reliability and validity

The reliability of the present scale in its original as well as in its complete form was examined by two methods, Split-half and Coefficient alpha

As shown in table1, the split-half reliabilities for both scales (the original ATS 29 items and the complete 38) items are .94 and .96, respectively. Furthermore, the Coefficient alpha reliabilities for both scales the original ATS 29 items and the complete 38 items, are also .94 and .96, respectively. Further reliability analysis of the different scales (the Wise 29 items, the Wise 20 item, the Wise 9 item, the complete 38 items, the new added 9 items and the SD 19 items) by University and sex presented an evidence of high stability and consistency with respect to all the four scales. (Table1)

**(Table1) Coefficient alpha and split-half value for the ATS Components**

	Coefficient alpha					Split-half				
	Total	Male	Female	KSU	UQU	Total	Male	Female	KSU	UQU
Wise 29	.94	.94	.92	.95	.94	.88	.84	.83	.89	.87
Wise 20	.90	.91	.88	.91	.90	.90	.90	.86	.90	.90
Wise 9	.92	.93	.89	.94	.92	.93	.93	.92	.93	.93
Complete 38	.96	.96	.94	.96	.95	.95	.96	.96	.96	.95
Added 9	.85	.86	.81	.85	.85	.85	.86	.77	.84	.85
SD 19	.97	.96	.95	.97	.96	.93	.93	.92	.93	.93

The validity of the Arabic version of the ATS scale was examined through qualitative as well as quantitative procedures. The qualitative procedure was established as indicated earlier by presenting the original 29 ATS items along with the additional suggested items to psychological measurement and statistics specialists and having them evaluate the item relevance and their representativeness of the scale construct.

Further evidence of the scale validity was provided through the item-total correlation analysis of both scales, the original and the added ones. The results of the item-total correlation of the ATS 29 item scale showed correlation coefficients ranging between (.23) to (.77) with a median of (.61). On the other hand, the results of the item-total correlation of the ATS 38 items scale showed correlation coefficients ranging between (.26) to (.80) with a median of (.61). More than 84% of the items on both scales has a correlation with the total score equals .51 or more.

A third evidence of validity for the ATS 29 item and ATS 38 items was obtained by correlating the ATS scale score with the score of the semantic differential scale. To conduct such validation, the researchers developed a semantic differential scale (Osgood, Suci and Tanenbaum 1957), using two sets of bipolar

adjectives; for the first set, the participants were asked to place an X in the space that best described their view about the course and the field of statistics.

For example:

**I consider statistics to be:**

EASY	DIFFIICULT
DESIRABLE	UNDESIRABLE
IMPORTANT	UNIMPORTANT

For the second set the participants were asked to place an X in the space that best described their perceived competency with respect to statistics. For example:

**I describe myself in the statistics course to be:**

CONFIDENT	UNCONFIDENT
HAPPY	UNHAPPY
ABLE	UNABLE
RELAXED	TENSE
ACTIVE	PASSIVE

The development of the semantic differential scale underwent qualitative as well as quantitative scrutiny. The items were judged by a number of measurement and statistics specialists. Also the quantitative analysis was preformed to examine the SD reliability and item-total correlation. All the 19 SD items exhibited a coefficient alpha of (.97) and item-total correlation ranging between (.56) and (.88).

From the standpoint of factorial validity, the SD 19 items seem to be grouped under two common factors explaining approximately (.70) of the total variance. The rotated factors were clearly identifiable as: (a.) the course subscale (6 items) and (b.) the field subscale (13 items). These findings suggested that SD scale represents a good criterion that can be used to examine the concurrent validity of Arabic scale component (ATS 29 items, ATS 38 items, and the new added items).

To evaluate the concurrent validity of the Arabic scale component, Pearson product moment correlation coefficients relating the scores of the ATS 29 items, ATS 38 items and the new added 9 items with the scores of the SD scale were calculated and evaluated. (Table2)

The concurrent validity values indicated that the Arabic scale component (ATS 29 items, ATS 38 items, and the new added 9 items) exhibited a correlation coefficient of (.75), (.77), and (.76), respectively with the students' score of the SD scale. Furthermore, the intercorrelations between the scale components represent another evidence regarding the scale validity.

The final evidence of validity for the ATS 29, and the ATS 38 items was confirmed by applying factor analysis technique to the items of both scales. Overall, the analysis results suggested the presence of two factors explaining .49 of the variance.

**(Table 2) Correlation coefficients between the SD scale and the ATS components**

	Sem. Diff. 19 Items	Orig. Wise 29 Items	Complete 38 Items	Added 9 items
Sem. Diff. 19 items	1.00	.75	.77	.76
Orig. Wise 29 items		1.00	.99	.88
Complete 38 items			1.00	.94
Added 9 items				1.00

The ATS 29 items loaded approximately in both factors suggested by Wise; The field and the course. However four items of the field factor (6, 11, 14 and 16) were loaded under the course factor.

Further principal factor solution followed by a varimax rotation was applied to the complete ATS 38 items. The first 29 items loaded in factors, field and course in a fashion similar to the aforementioned analyses. With regard to the new 9 added items, seven of them loaded logically under the course subscale and the remaining items were also loaded logically under the field subscale.

### **Discussion**

The present study was undertaken to describe the stages through which the Attitude Toward Statistics Scale was adopted, developed and examined to be ready for use by the statistics instructors, educators and researchers in Saudi Arabia. The Wise ATS 29 items were applied in their new Arabic form to a new group of students at two large universities in Saudi Arabia.

The analyses of the data showed that for the ATS is an effective measure for assessing Saudi students' attitude towards statistics. The ATS 29 items were highly reliable, measuring approximately

two distinct aspects of students' attitudes towards statistics; the student attitude toward statistics course and students' attitude toward the usefulness of statistics outside the classroom.

A minor difference between the Arabic ATS scale and the original ATS scale was related to the fact that four items of the Wise 20 items loaded under the field subscale items failed to correspond to the field. Instead they were loaded under the course subscale. The inspection of the four items content in light of the original items in English suggested further effort should be extent to conduct further factor analysis studies.

Despite the aforementioned limitation, statistics instructors in Saudi Arabia and elsewhere in the Arab world should find the Arabic ATS useful in measuring students attitudes toward statistics. Also, instructors should find the ATS scale to be a useful outcome measure in evaluating the effectiveness of changes in their teaching strategies as they try to engender in students a positive view of statistics during a particular statistics course. Furthermore, educators and researchers should find the ATS to be a very useful instrument in identifying the sources of student problems with statistics and motivating them to provide suggestions as to how statistics instructors can make the learning of statistics less frustrating, less fearful and more effective in enhancing

the student's attitude for further statistics learning.

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**Psychometric Characteristics of the Attitude Towards Statistics Scale**

**الخصائص السيكومترية لمقياس الإيحاءات نحو الإحصاء**

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## Psychometric Characteristics of the Attitude towards Statistics Scale

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Most graduate students consider statistics courses as the major obstacle towards the attainment of the desired degree. The researchers noticed that graduate become anxious when they attend the first statistical course and attempt when possible particularly at Umm Al Qura University (UQU) to delay taking the required statistics courses until just before the end of their program.

While research in most of the higher education institutions in Saudi Arabia has focused on examining the effect of the cognitive factors on the variation of the students' academic achievement, little regard has been given to non-cognitive factors, such as students' feelings, attitudes, beliefs, interests, expectations and motivations. Therefore, it is the intent of this paper to provide the educators in Saudi Arabia with a new measurement scale that can be used to examine students' attitudes towards statistics.

Steven Wise designed the origin of this instrument in 1985. In order to make this instrument available to educators, twenty-nine items were translated into the Arabic language. The translation was reviewed by a number of specialists in English and Arabic. Additionally, specialists in measurement and statistics were asked to review the instrument. The final form of the instrument in Arabic contained, in addition to Wise's twenty-nine items, nine new items. For the purpose of examining the instrument's concurrent validity another Semantic Differential statistical attitude scale was developed.\*

In order to examine the instrument's psychometric properties, it was administered to one hundred and seventy-eight (178) graduate students enrolled in an introductory course in Statistics at two large universities in Saudi Arabia.

The analysis of the data revealed the following findings:

1. The reliability analysis as computed by split-half and Cronbach Alpha produced identical values for both the Wise 29-item scale and the complete Arabic form (38 items). (Split-half .94 and Alpha .96)
2. The concurrent validity of the instrument with the semantics differential attitude scale was found to be .75 for the Wise 29-item and .77 for the complete Arabic form.
3. The factor analysis result confirmed the presence of two factors approximately similar to what has been confirmed in the previous research.
4. The item total correlation analysis indicated that the majority of the items showed correlation values, which range between .46 and .79 with a median of .61

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\*The instrument is available if you write to : [assrri@yahoo.com](mailto:assrri@yahoo.com) or [aadogan@kfu.edu.sa](mailto:aadogan@kfu.edu.sa)