FACTORS INFLUENCING THE PSYCHOLOGY STUDENT IN DEALING WITH STATISTICS COURSES

Feisal A. Yunis
Cairo University, Egypt
fyunis@mailer.enu.eg

Psychology students usually rate Statistics courses among the most difficult. The objective of the present study is to explore some aspects of the difficulties encountered by Psychology students in studying statistics and how these difficulties relate to statistics anxiety. A questionnaire measuring Psychology students' evaluation of the level of difficulty of the statistics courses studied; together with their opinions concerning the reasons for these difficulties was administered to a sample of 152 female undergraduate Psychology students at Cairo University. In addition, a measure of statistics anxiety was also used. Difficulties reported by students were in five categories in the following order: course content, teaching, examinations, relevance of statistics, and student characteristics. The perceived level of difficulty and abstraction were related to attitudes and opinions towards statistics and to the grades of the previous year.

INTRODUCTION

The objectives of the present study are twofold:

1- To describe the difficulties encountered by the students of Psychology in an Egyptian University and how they perceive the statistics courses in the context of other academic subjects.

2- To explore the value of using a standardized procedure to assess the anxiety felt by the students in relation to the study of statistics.

Statistics is a core course required from all undergraduate psychology students in Egypt. However, many of the students report varying levels of difficulties in dealing with the course. One of the possible reasons might be the fact that most of the students opted, while in secondary school, to study humanities subjects, and kept away from science and mathematics, which are considered very difficult. Hence, to many, dealing with numbers and formulae appear to be a negative experience. . Another reason might be attributed to the difficulty of the language of instruction used by Statistics teachers. Scientists of different disciplines use different vocabularies. Sometimes the vocabulary used in relation to one discipline might not be suitable for the students studying another (Murtonen and Lehtinen, 2003). This is yet another reason that might relate to statistics anxiety. There is a large body of literature suggesting that many students report high levels of anxiety while enrolled in statistics courses (Onwuegbuzie and Wilson, 2003). Statistics Anxiety is defined as "a performance characterized by extensive worry, intrusive thoughts, mental disorganization, tension, and physiological arousal … when exposed to statistics content, problems, instructional situations, or evaluative contexts, and is commonly claimed to debilitate performance in a wide variety of academic situations by interfering with the manipulation of statistics data and solution of statistics problems" (Zeidner, 1990, p. 319).

Onwuegbuzie and Wilson (2003) classified the literature dealing with the antecedents of statistics anxiety into three categories: situational, environmental, and dispositional. . As for the situational antecedents, statistics anxiety was found to be related to factors such as the performance parameters of statistics and mathematics prior knowledge, instructors' evaluation, course grades, whether the course is required or elective, and whether statistics is a major or a minor subject. As for environmental antecedents, gender (female reporting higher anxiety), age (older students reporting higher anxiety), race, and learning styles were some of the important variable related to statistics anxiety. As for dispositional antecedents, the most frequently studied variables were related to self esteem, perceived scholastic competence, perceived intellectual ability, perfectionism, procrastination, hope and coping strategies.

In their extensive review of the literature, Onwuegbuzie and Wilson (2003) report that there are five scales that directly measure statistics anxiety. These were the Statistics Anxiety Scale of Pretorius and Norman in1992, the Multifactorial Scale of Attitudes Toward Statistics, developed by Auzmendi in 1991, the Statistics Anxiety Inventory developed by Zeidner in 1991,

an unnamed instrument measure of statistics anxiety and attitudes developed by Zanakis and Valenza in 1997, and the Statistics Anxiety Rating Scale designed by Cruise and his colleagues developed in1985. The STARS is made up of two types of items. Items tapping anxiety felt during engagement in different activities relating to statistics, such as taking classes or exams. The other type of items relates to ideas and opinions concerning statistics learning and teaching Those include remarks denoting that "Statistics takes more time than it's worth," or "I don't know why someone in my field needs statistics." The authors divide it into six Factors, according to the results of a factorial analysis. They are: worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of statistics teachers.

The Worth of Statistics subscale is assumed to measure perception of the relevance of statistics. The Interpretation Anxiety subscale is designed to measure anxiety experienced when trying to interpret statistical results. The Test and Class Anxiety subscale is assumed to assess anxiety experienced while taking statistics courses and/or examinations, with higher scores referring to higher anxiety. The Computation Self-concept subscale is related to a person's anxiety when solving mathematical problems and his ability to calculate statistics. The Fear of Asking for Help subscale is assumed to assess anxiety experienced when a person attempts to ask for help in statistics-related problems. Finally, the Fear of Statistics Teachers subscale is supposed to measure students' perceptions of statistics teachers (Cruise *et al*., 1985).

Onwuegbuzie and Wilson (2003) claim that the Statistics Anxiety Rating Scale (STARS) is by far the most used measure of statistics anxiety. It has also, unlike the other scales, been subjected to extensive reliability and validity studies. One question, however, comes to mind concerning the structure of the scale. Looking at the content of the item, one can see that there are two types of items. The first type is made up of those that portray feelings of anxiety related to different aspects of the statistics courses, like exam situations and facing the task of interpreting data. The other group of items are made up of opinions about the usefulness of learning statistics, whether the student likes/dislikes statistics, and how she/he perceives statistics teachers. It seems that only the first type of items are considered measures of anxiety, while the second type measures attitudes and beliefs. Further evidence on the validity of this speculation can be obtained by inspecting the factors reported by Cruise and his colleagues (1985). Each factor is made up of one type or the other of the items mentioned and there is no overlap. It was felt desirable to explore the differential performance of each group of items in the present study.

METHODS AND PROCEDURES:

Participants

One hundred and sixty four students from the Department of Psychology, Cairo University volunteered to take part in the study. Only 12 male students participated and the rest were females. Due to the very small number of male students, it was decided to restrict our analyses to the female sample. The mean age of the group was 19.03 ± 0.959.

Three courses in statistics are compulsory at the Psychology Department during the second and third year of study. The students had varied exposure to statistics instruction. Some of them only enrolled in their first course ($n=55$), others have passed one course and are enrolled in the second ($n=56$), and the remainder ($n=41$) have finished the three courses. Their latest grades in statistics were rather high. Only two failed their last examination, 38 obtained a D, 61 a C, 34 a B, and 17 obtained an A.

Instruments

A number of tools were employed in the present study. They are as follows:

1- An open- ended question asking about the difficulties that encountered students in their study of statistics was presented to them Answers to the questions were counted and analyzed along a number of dimensions.

2- The Arabic version of the Statistics Anxiety Rating Scale (STARS): The questionnaire was translated into Arabic by the author and a colleague and the translation was further presented to 6 members of the faculty at the Department of Psychology. They were asked to evaluate the clarity of the items and its suitability for measuring the concept within the Egyptian culture. It was also presented to a small ($n=10$) sample of students of

psychology and were asked to judge the clarity of the language. Only 4 items were rejected on these criteria, and were excluded from further analyses. Item-total correlations for the scale ranged from 0.193 to 0.694, all very highly significant. Chronbach's Alpha coefficient was 0.931. Scores of each part of the scale making one type of items were computed separately into two subscales, one for "statistics anxiety feelings," and the other for "attitudes and opinions toward statistics." For the Statistics Anxiety Feelings Scale, inter-item correlations ranged from 0.321 to 0.577, with a Chronbach's Alpha of 0.860. For the Attitudes and Opinions toward Statistics Scale the inter-item correlations ranged from 0.109 to 0.762 with a Chronbach's Alpha of 0.927. The Pearson correlation between the two scales was 0.505, which seems high but allowing a separate consideration for each. The two scales will be used in our analyses.

3- Following Murtonen and Lehtinen (2003), the students were asked to place 10 academic subjects within a dimensional field, i.e., a coordinate system with two dimensions: easy/difficult and concrete/abstract. The 10 academic subjects were: Statistics, Developmental Psychology, Social Psychology, Introduction to Biology, Physiological Psychology, English Language, General Psychology, Sociology, Arabic Language, and Psychological Text in English. These are subjects taught within the Psychology Program at the University. The idea was to look into statistics within the context of the rest of the curricula and see how the difficulties of statistics compare with the rest of the subjects. The distance from the most concrete was measured to give a score along the dimension: concrete-abstract, and the distance from the easiest was measured to give a score of the level of difficulty of the subject.

RESULTS

1- *Analysis of the difficulties encountered by the students*: The answers to the questions were recorded in a separate sheet. There were 494 statements. Five categories were developed by first reading the answers a couple of times, and then re-reading them, while classifying the themes in the answers. Then, the themes were gathered and final categories were constructed. Categories were named after the most common themes in each group. There were 5 categories: The course content, the lecturer and the teaching assistant, the examinations, the student her/himself, and the remoteness of the material taught from reality. Reliability of the classification was established by having another researcher classify 20 answers. Agreement between the two was 95%.

In the first category, the course content, 241 statements making up 49% of the total were reported. Examples of the difficulties reported are: large number of difficult and similar rules and laws, lack of examples, the content is too long for the time available, the use of too many incomprehensible symbols. The second category relates to the teaching with 116 complaints making up 24% of the total. These covered aspects such as the fast pace of teaching, lack of clarity in communication, not allowing time for questions, and negative attitudes towards humanities students (lecturers come from the department of statistics, whereas the department of Psychology is part of the Faculty of Arts). The third category concentrated on the examinations. Fifty eight complaints were made here accounting for 12% of the total. Examples are: the examination is always difficult, too many questions, and very long examinations. The fourth category complained about the lack of relationship between what was taught and their practical life. Forty four complaints were made here making around 9% of the total. Finally, the student her/himself was the subject of the final category with 35 complaints making up 7% of the total. Most of the statements dealt with issues like, lack of attention in class, not studying hard, lack of familiarity with numbers, and a general negative attitude towards statistics.

2- *Correlates of statistics anxiety*: Only two students reported failing the last year examination in statistics. After excluding those two, one way ANOVA was carried out to test the relationship between statistics anxiety variables and the statistics grades. Students were divided into four groups according to their last year grade in statistics: pass, good, very good, and excellent. *F* across the groups approached significance ($F=2.529$, sig. at 0.060) only in the case of Attitudes and Opinions toward Statistics Scale. For the Total score of SARS and the Statistics Anxiety Feelings Scale, the *F* values were not significant. Further analyses in the case of

Attitudes and Opinions toward Statistics Scale showed the significant differences to be only between those who scored "Excellent" and both those who scored "Pass" or "Good."

3- *Statistics within the context of academic subjects:* Figure (1) shows the level of difficulties reported by the students in dealing with statistics. It is clear that students put statistics as the second most difficult of subjects, superseded only by sociology.

Figure (1) difficulty and abstractedness of courses as perceived by students (n=152)
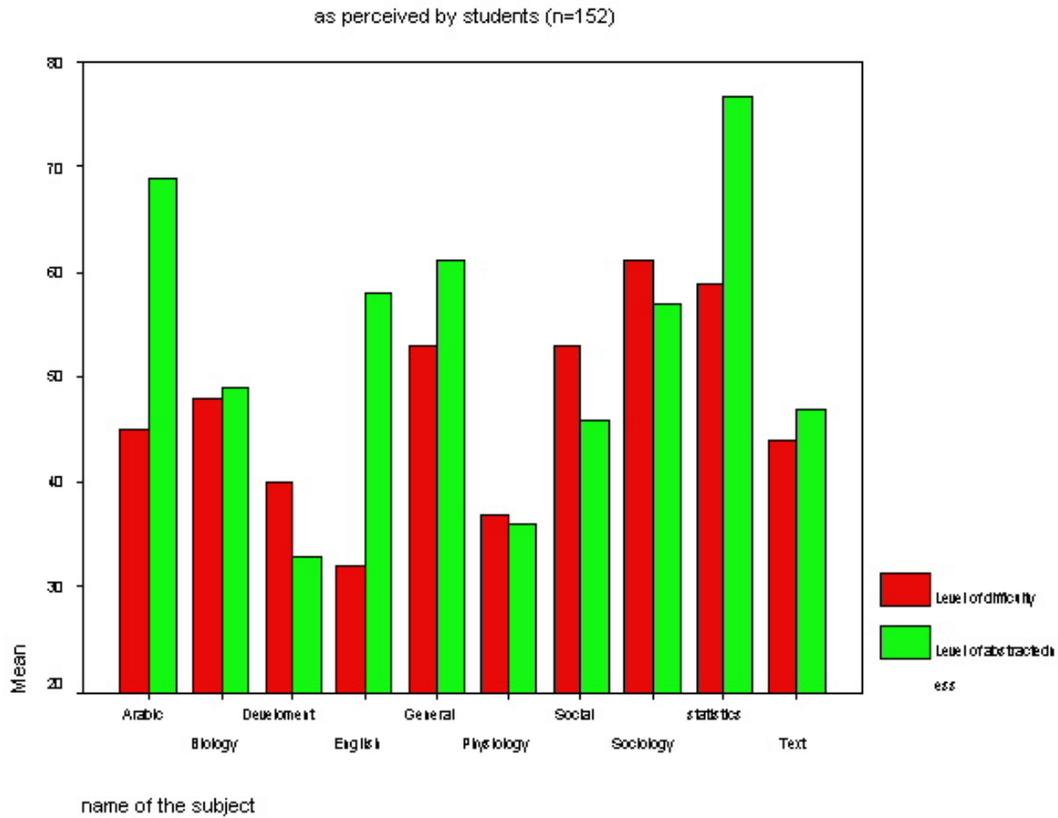
As for the level of abstractedness, it was, by far, the most abstract of all subjects studied. These results correspond with the results obtained by Murtonen and Lehtinen (2003). It explains the results of the rating of statistics. One way analyses of variance with the previous year grade in statistics as an independent variable and the level of difficulty and abstractedness as dependent variables were computed. There were no significant differences between the different grades of performance in statistics and the perceived level of difficulty or the abstractedness. Correlations between both the level of difficulty and abstractedness with the statistics anxiety measures are shown in Table 1.

Table 1: Pearson correlations between measures of statistics anxiety and levels of difficulty and abstractedness (*n*=152)

Scale	Level of difficulty	Level of abstractedness
STARS total score	0.610*	0.280*
Attitudes and Opinions toward Statistics Scale	0.559*	0.238*
Statistics Anxiety Feelings Scale	0.493*	0.253*

* Correlation is significant at .0009 or beyond

The results clearly indicate very significant correlations between variables of statistics anxiety and attitudes toward statistics and level of difficulty and abstractedness. These results shed light on the dynamics of both the perception of the subject and the likely influence of anxiety and the conceptions of statistics.

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