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ABSTRACT

The purpose of this study was to investigate some variables that relate to students' anxiety in learning statistics. The variables included sex, class level, students' achievement, school, mathematical background, previous statistics courses, and race. The instrument used was the 24-item Students' Attitudes Toward Statistics (STATS), which was administered to the statistics classes at the College of Education and at the College of Commerce and Business Administration at the University of Alabama (Tuscaloosa). The STATS required students to describe themselves based on a 0 to 9 scale, with 0 being "does not describe me" and 9 being "describes me." The sample included 79 male and 97 female students in undergraduate and graduate statistics classes. The data were analyzed in contingency tables using chi square statistics to compute significance of relationships. All data analyses were performed on an IBM miniframe computer. The association analysis showed that there was a significant relationship between students' anxiety in learning statistics and the variables of students' achievement, statistical preknowledge, school, and current class level. However, the results do not provide enough evidence to suggest that there was a relationship between students' anxiety in learning statistics and the other variables (such as college mathematics background, gender, and ethnicity). (RLC)

SOME VARIABLES IN RELATION TO STUDENTS' ANXIETY IN LEARNING STATISTICS

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Discussion

"SOME VARIABLES IN RELATION TO STUDENTS' ANXIETY IN LEARNING STATISTICS"

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The purpose of the study was to investigate some variables that relate to students' anxiety in learning statistics. The variables included sex, class level, students' achievement, school, mathematical background, previous statistics courses, and race.

The instrument used was the Students' Attitude Toward Statistics (STATS) instrument which administered to the statistics classes at the College of Education, and at the College of Commerce and Business Administration, the University of Alabama. The sample consisted of 79 male students, and 97 female students.

The data were analyzed in contingency tables using the Chi Square statistics to compute significance of relationships. All data analyses were performed on the IBM 3081-400E (version 4.1).

The association analysis showed that there was a significant relationship between students' anxiety in learning statistics and the variables students' achievement, statistical preknowledge, school, and current class level. However, an interesting phenomena, the data showed that there was not enough evidence to say that there was a relationship between students anxiety in learning statistics and the other variables.

SOME VARIABLES IN RELATION TO STUDENTS' ANXIETY IN LEARNING STATISTICS

Introduction

Statistics is considered one of the scientific tools, not only for describing data but also as an inductive method in research methodology. This distinguishes it as a very important subject, especially in higher education. Statistics is offered at every college. It is common, in some colleges, for statistics to be given in series of courses, from the very basic up to the advanced level.

Statistics is also considered a complicated field. Statistics is related to mathematics, probability, calculators, and computers. Previous studies showed that there was a statistics anxiety among college students (Roberts & Bilderback. 1980; Roberts & Saxe. 1982; Frank & Rickard. 1988; Katz & Tomazik. 1988; and Benson. 1989). Moreover, Dillon (1982) reported that there is a statisticophobia in college level statistics classes.

Considering the two aspects above, investigating variables which might relate to Students' Attitudes Toward Statistics (STATS) is very important. The main

purpose of this study is to investigate some variables that relate to students' anxiety in learning statistics.

Literature Review

Dillon (1982) reported that there was a statisticophobia in college level statistics classes. Statistics anxiety, even less than statisticophobia, is 'dangerous' not only for the student but also for statistics itself, and for other sciences in general. Students who are anxious about a class will feel the course is more difficult than it should be. The instructional goals will be difficult to achieve. For statistics itself, this situation will lead to an attitude of not liking statistics. Many students may try to avoid this class. On the contrary, statistics courses are needed as a research tool. Consequently, since statistics is a scientific tool in the research method, the bad attitudes toward statistics may lead to a bad impact on sciences in general, especially the sciences that are closely related to it such as psychometry, sociometry, biometry, and econometrics.

Research tends to show that there is a positive relationship between STATS and student achievement.

Research done by Robert and Saxe (1982), by using the Student Attitude Survey (SAS), indicated that the more positive the STATS the higher the statistics achievement. This finding was supported by Roberts and Reese (1987) who found that regardless of gender grouping, more positive STATS tended to show a higher course grade. Moreover, even though the instruments used were different, the data analysis still revealed the same finding. This statement was verified by Water, Martelli, Zakrajsek & Popovich (1988) when they used both SAS and the Attitudes Toward Statistics (ATS) instrument of Wise (1985).

Benson (1989) used the Statistical Test Anxiety (STA) which he developed to measure a student anxiety in learning statistics. In the issue of the relationship between the STA score and the course grade, he came up with the conclusion that the higher the STA score the lower the course grade. In other words the more anxious the student was in learning statistics the lower the course grade. In addition, a similar finding was also mentioned by Ware and Chastain (1989), the more positive the STATS, the lower their anxiety, and the higher the score achieved. In conclusion, the research showed that

there was a positive relationship between STATS and course grade; and that there was a negative relationship between anxiety and both STATS and course grade.

Some variables were found related to the STATS. However, others variables were found insignificant or there were inconsistent findings among the previous studies.

Research showed that there was a relationship between STATS and statistics preknowledge. The correlation analysis tended to indicate that between the two variables there was a significantly positive correlation (Roberts & Saxe, 1982; Roberts & Reese, 1987; and Collis, Oberg, & Shera, 1989). Their research findings consistently showed the positive relationship between STATS and statistics preknowledge, or negative relationship between students' anxiety and statistics preknowledge.

However, regarding the relationship between STATS and a number of previous college mathematics completed, there was an inconsistency among research findings. Some researchers found that there was a positive relationship between the number of previous college mathematics courses completed and the STATS. The more previous

college mathematics courses completed the more positive the STATS (Robert & Saxe, 1982; Roberts & Reese, 1987). However, the research done by Benson (1989) showed a tendency but an insignificant correlation between number of college mathematics courses completed and statistics anxiety. His findings were supported by other researchers who mentioned that there was not enough evidence to say that there was a relationship between number of college mathematics completed and STATS (Collis, Oberg, & Shera, 1989; Ware & Chastain, 1989).

Sex differences also revealed an inconsistency among the research findings. Roberts and Saxe (1982) concluded that there was a significant association between students' sex and their attitude toward statistics. Male students tended to have more a positive attitude then their female counterparts. Consequently, the male students tended to have a better statistics achievement than their female counterparts. This finding was supported by other researchers. It was found that female students were more anxious than male students (Benson, 1989; and Zeidner & Safir, 1989). In some studies, male students tended to have higher scores in statistics then their female counterparts (Frank & Rickard, 1988; Waters,

Martelli, Zakrajsek, & Popovich, 1988; Benson, 1989; and Ware & Chastain, 1989). However, Elmore & Vasu (1986) found the contrary. They showed that feminist issues were the significant predictor of statistics achievement. Female students showed better attitudes than male students did. Consequently, female students tended to have higher achievement compared with their male counterparts. This finding was supported by Raiszadeh & Ahmadi (1987). Their data analysis showed that female students had higher statistical achievement than male students had.

Other variables which related to the STATS were also found by some researchers. They were material and instructor qualification (Johnson, 1980; Robert & Saxe, 1982; and Reisner, 1985), teaching methods (Reisner, 1985; Katz & Tomazik, 1988), computer use (Ware & Chastain, 1989; and Collis, Oberg, & Shera, 1989), the status of a course whether required or elective, and calculator attitudes (Roberts & Saxe, 1982). However, research showed that ethnicity was not an indicator of significant difference of anxiety (Zeidner & Safir, 1989).

Method of the Study

The instrument used in this study was the STATS instrument (Sutarso, 1991). The instrument was a set of statements (24 items) which allowed students to describe themselves based on 0 to 9 scale with **0 = does not describe me** and **9 = describe me**. Each statement related to attitudes toward statistics. In addition, it had variables which may relate to their attitude in learning statistics such as current class level, major, number of previous college mathematics and statistics had, race/ethnic background, and gender. It was piloted with 20 students who took a statistics class. The purpose of this pilot study, especially, was to try out the instrument made. Based on the pilot study, the instrument was revised. Finally, it was administered to the statistics classes at the College of Education, and the College of Commerce & Business Administration, the University of Alabama. The classes consisted of undergraduate statistics classes (BER 345, ST 250, and ST 251), and the graduate statistics classes were (BER 540, BER 546, and ST 553).

The sample consisted of 79 male and 97 female students. There were 8.5% Afro-American, 78.4% White, and

23% other ethnic groups in the sample. Demographic variables included were: class level, sex, ethnic background, score, college/school, statistics preknowledge, and mathematics background.

The data were analyzed in contingency tables using the Chi Square statistics to compute significance of relationships. All data analyses were performed on the IBM 3081-400E mainframe computer using the SPSS-X (version 4.1).

Result and Discussion

The first statistical comparison was between the Students' Anxiety in Learning Statistics (SALS) score and variable course score. The data tended to say that there was a significant relationship between the SALS and the course score ($p < .002$). The relationship between these two variables was negative which means the lower the SALS score the higher the students' achievement.

This finding was consistent with the literature review which stated that there was a positive relationship between Students' Attitudes Toward Statistics (STATS) and their achievement (Robert, & Saxe, 1982; Robert, & Reese, 1987; Water, Martelli, Zakrajsek,

& Popovich, 1988; Benson, 1989; and Were, & Chastain, 1989).

The second statistical analysis was between SALS score and statistics preknowledge. Statistical preknowledge was measured by the number of statistics courses taken before the student entering the class surveyed. The Chi Square test showed that there was a negative relationship between the SALS score and the statistics preknowledge ($p < .01$). This significant relationship showed that the more a student had a statistics preknowledge, the less their anxiety; or the more confident a student is in learning statistics, the more possibility that the student will take other statistics courses.

The third investigation was testing the association between SALS score and college mathematical background. The data tended to say that more mathematics background succesfully reduced students' anxiety from the worst level to the medium level. However, the mathematics backgound was not a significant predictor for the SALS ($p < .45$). This association indicated that mathematics background was not as important as statistics preknowledge in relation to the STATS.

This finding was supported by the conclusion of the some previous studies (Benson, 1989; Collis, Oberg, & Shera, 1989; and Ware, & Chastain, 1989). However, it was inconsistent with the result of two other studies which said there was a significant relationship between the STATS and previous mathematics completed (Robert & Saxe, 1982; and Robert & Reese, 1987).

The fourth statistical comparison was about the gender differences in SALS score. The Chi Square test revealed insufficient evidence to say that there was a relationship between gender and the SALS score ($p < .64$). Also, there was insufficient evidence to say that male students had more confident in learning statistics compared with their female counterparts nor female students had better attitude toward statistics. This finding contradicted the inconsistent conclusions of both sides in the literature review.

The fifth statistical comparison was the relationship between the SALS score and ethnicity. The data revealed insufficient evidence to say that there was a relationship between an anxiety in learning statistics and ethnic background ($p < .42$). This statement was consistent with the conclusion of Zeidner & Safir (1989)

who reported that ethnicity was not an indicator of significant difference of anxiety.

The sixth investigation was testing the association between the SALS score and the students' school. Because of the data distribution consideration, the variable school just divided into three categories: Commerce and Business Administration (C&BA), Education, and others. The Chi Square test indicated there was a significant relationship between the SALS score and the students' school ($p < .004$). The data tended to show that students from School of Education had more confidence in learning statistics compared with both their C&BA and other counterparts.

The final comparison was the relationship between the SALS score and the students' class level. The data tended to show that senior and graduate students had more confidence in learning statistics compared with their junior, sophomore and freshman counterparts. This finding was logical since the probability of statistics preknowledge is higher for seniors and graduate students than for juniors, sophomores, and freshmen.

Conclusions

The study showed that there was a significant relationship between students' anxiety in learning statistics and some variables, such as students' achievement, statistics preknowledge, school, and current class level. However, interesting phenomena, the data showed that there was not enough evidence to say that there was a relationship between students' anxiety in learning statistics and the other variables, such as college mathematics background, gender, and ethnicity.

The study might be useful for statistics instructors to know their students' attitude toward statistics, and realize some variables that relate significantly to their anxiety in learning the subject. Knowing this, they could provide better teaching strategies to overcome the problems in teaching statistics course. It also would be useful for educational researchers to know variables as an indicator in investigating their relationship.

However, this study still needs improvement. There is no research without error. Also, the finding here might be restricted to the sample statistics classes in the College of Commerce & Business Administration, and the College of Education, the University of Alabama.

REFERENCES

Benson, Jeri. (1989). Structural components of statistical test anxiety in adults: An exploratory model. Journal of Experimental Education, 57, (3), 247-261

Collis, B., Oberg, A., & Shera, W. (1989). An evaluation of computer-based instruction in statistical techniques for education and social work students. Journal of Educational Technology System, 17, (1), 59-71.

Elmore, P. B., & Vasu, E. S. (1986). A model of statistics achievement using spatial ability, feminist attitude and mathematics-related variables as predictors. Educational & Psychological Measurement, 46, (1), 215-221.

Frank, M. L., & Rickard, K. (1988). Psychology of the scientist: LVIII: Anxiety about research: An initial examination of a multidimensional concept. Psychological Reports, 62, 455-463.

Katz, B. M., & Tomazic, T. Z. (1988). Changing students' attitudes toward statistics through a nonquantitative approach. Psychological Reports, (62), 658.

Kim, J. O., & Mueller, C. W. (1991). Factor Analysis. Sage University Papers on Quantitative Application in the Social Sciences. Newsbury Park and London: Sage Pub.

Raiszadeh, F. M. D., & Ahmadi, M. (1987). Students' race and gender in introductory business statistics. Journal of Education for Business Statistics, 63, (1), 21-23.

Roberts, D. M., & Bilderback, E. W. (1980). Reliability and validity of a statistics attitude survey. Educational and Psychological Measurement, 40, (1), 235-238.

Roberts, D. M., & Reese, C. M. (1987). A comparison of two scales measuring attitudes toward statistics. Educational and Psychological Measurement, 47, (3), 759-764.

Roberts, D. M., & Saxe, J. E. (1982). Validity of a statistics attitudes survey: A follow-up study. Educational and Psychological Measurement, 42, (3), 907-912.

Ware, M. E., & Chastain, J. D. (1989). Computer-assisted statistical analysis: A teaching innovation? Teaching of Psychology, 16, (4), 222-227.

Waters, L. K., Martelli, T., Zakrajsek, T., Popovich, P. M. (1988). Attitudes toward statistics: An evaluation of multiple measure. Educational and Psychological Measurement, 48, 513-516

Wise, Steven L. (1985). The development and validation of a scale measuring attitudes toward statistics. Educational and Psychological Measurement, 45, (2), 401-405.

Zeidner, M., & Safir, M. P. (1989). Sex, ethnic, and social differences in test anxiety among Israeli adolescents. Journal of Genetic Psychology, 150, (2), 175-185.