DOCUMENT RESUME

ED 360 324 TM 020 121

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TITLE Statistics Achievement: A Function of Attitudes and Related Experiences.
PUB DATE Apr 93
NOTE 19p.; Paper presented at the Annual Meeting of the American Educational Research Association (Atlanta, GA, April 12-16, 1993).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Ability; Attitude Measures; *College Students; Computer Centers; Computer Science; Computer Science Education; *Educational Background; Higher Education; *Mathematics Achievement; Mathematics Anxiety; Measurement Techniques; Statistical Significance; *Statistics; *Student Attitudes; Test Reliability

ABSTRACT

The effects of previous mathematics, statistics, and computer science coursework; attitudes toward statistics and computers; and mathematics ability on statistics achievement were studied for 289 college students over 4 semesters. A secondary purpose of the study was to determine the effect of the computer laboratory component of an inferential statistics class on students' end of course attitudes. Instruments were administered to determine attitudes toward statistics and computers, anxiety about statistics, algebra and mathematics skills, and biographical data. The proportion of variance in statistics achievement accounted for by the following parameters was not statistically significant: (1) attitudes toward computers; (2) attitudes toward statistics; (3) mathematics background; (4) computer science background; (5) mathematics ability; (6) statistical anxiety; and (7) Graduate Record Examination scores (available for only 83 students). Coefficient alpha reliabilities are reported for each of the scales used to measure attitudes and abilities. No statistically significant differences were found between students taught with a computer laboratory and those taught without the computer component for attitudes toward statistics, but those taught by computer exhibited more positive attitudes toward the computer and less statistical anxiety at the end of the course. Five tables present study findings. Contains 18 references. (SLD)

Statistics Achievement: A Function of Attitudes and Related Experiences

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Paper Presented at the Annual Meeting of the American Educational Research Association

Atlanta

April, 1993

Statistics Achievement: A Function of Attitudes and Related Experiences

The primary purpose of this study was to determine the effect of previous mathematics, statistics and computer science coursework; attitudes toward statistics and computers; and mathematics ability on statistics achievement. This study extends previous research by Elmore and Lewis (1991) by incorporating scores on the Verbal, Quantitative, and Analytical subtests of the Graduate Record Examination as additional predictors of achievement in applied statistics.

A secondary purpose of this study was to determine the effect of the computer laboratory component of an inferential statistics class on the end of course attitudes toward statistics and computers controlling for precourse attitudes. In our previous research only two sections of the course taught by two instructors were studied to determine the effect of the computer laboratory. This study extends our earlier work by using multiple sections of the applied statistics course taught by six instructors over four semesters.

A number of studies have examined the predictors of success in statistics achievement. Some of the important predictors include mathematics ability (Elmore & Vasu, 1980a; Presley & Huberty, 1988; Woehlke and Leitner, 1980); mathematical background (Elmore & Vasu, 1980b, 1986; Feinberg & Halperin, 1978); and attitudes toward statistics (Wise, 1985). Additional computer-related variables that may contribute to the prediction of success in statistics include computer attitudes (Loyd & Gressard, 1984; Munger & Loyd, 1989), computer experience (Wise, Barnes, Harvey, & Plake, 1989), and the use of computer simulation software (Sterling & Gray, 1991).

In a study conducted to determine the effect of computer simulation software, Sterling and Gray (1991) found that students who used the software received significantly better scores on course examinations. A majority of the students who used the software believed that the use of the software increased their ability in statistics and in the use of computers; however, only a minority reported that their interest in statistics or computers was increased.

In this study attitudes toward statistics will be measured using both the *Attitudes Toward Statistics Scale* (Wise, 1985) and the *Statistical Anxiety Rating Scale* (Cruise, Cash, & Bolton, 1985). In 1988 Tomazic and Katz found that academic major, academic status, perception of prior success in mathematics, and time since last mathematics course best discriminated the level of statistical anxiety using the *Statistical Anxiety Rating Scale (STARS)* developed by Cruise and Wilkins (1980).

Method

Subjects

The subjects were 289 student volunteers who completed applied statistics classes at a large midwestern university during the summer semester of 1990, the fall semester of 1991, and the spring and summer semesters of 1992. The students represented numerous disciplines including education, psychology, political science, journalism, geography, history, physiology, business, botany, forestry, zoology, speech, music, and administration of justice.

Instruments

The following instruments were administered:

1. *Attitudes Toward Statistics Scale* (*ATS*; Wise, 1985). The *ATS* is a five-category, 29-item rating scale that includes a 20-item **Attitude Toward Field of Statistics (Field)**

subscale and a 9-item **Attitude Toward Course (Course)** subscale. The *ATS* items were constructed to measure two separate domains: Student attitudes toward the course in which they were enrolled and student attitudes toward the use of statistics in their field of study. Both positively and negatively worded statements are included on both subscales. A high score indicates a negative attitude toward statistics and a low score indicates a positive attitude toward statistics.

2. *Computer Attitude Scale* (*CAS*; Loyd & Gressard, 1984). The *CAS* is a 40-item, four-category rating scale that includes four 10-item subscales measuring **Computer Anxiety, Computer Confidence, Computer Liking,** and **Computer Usefulness.** Positively and negatively worded statements are included in all four subscales. Item responses were coded so that a higher score indicated a higher degree of confidence, liking, and usefulness and a lower degree of anxiety.

3. *Statistical Anxiety Rating Scale* (*STARS*; Cruise, Cash, & Bolton, 1985). The *STARS* is a 51-item five-category rating scale. The six subscales include **Worth of Statistics,** 16 items; **Interpretation Anxiety,** 11 items; **Test and Class Anxiety,** 8 items; **Computation Self-Concept,** 7 items; **Fear of Asking for Help,** 4 items; and **Fear of Statistics Teacher,** 5 items. All items are worded in the same direction. A high score indicates a negative attitude toward statistics and high anxiety toward statistics; a low score indicates a positive attitude toward statistics and little anxiety toward statistics.

4. *Student Diagnostic Survey* (*SDS*; Woehlke and Leitner, 1980). The two subscales include a 21-item **Algebra** test and a 16-item **Cloze** test of statistical terminology.

5. *Biographic data sheet.* This includes age, sex, previous mathematics and statistics coursework (number of mathematics and statistics courses taken in high school and college),

previous computer science coursework (number of computer science courses taken in high school and college), and undergraduate and graduate majors.

Procedure

Students in the study were enrolled in multiple sections of a course on inferential statistics taught by six different instructors over four different semesters. Some sections of the course were taught with a computer laboratory and other sections were taught without computer applications. Students had no information as to which sections would use the computer prior to registration.

The students were administered the *Student Diagnostic Survey* during the first class session of each section. In addition, the students were asked to complete, outside class, the *Attitudes Toward Statistics Scale*, the *Computer Attitude Scale*, the *Statistical Anxiety Rating Scale*, and the biographic data sheet. The instruments were to be returned to the statistics instructor within one week. During the last week of class, the students were asked to again complete, outside class, the three attitude scales and to return them prior to the final examination. With the students' permission, scores on the **Verbal**, **Quantitative**, and **Analytical** subtests of the *Graduate Record Examination (GRE)* were obtained from University permanent records. The total number of points achieved in the course (the measure of statistics achievement) for each student were obtained from the statistics instructors.

Research Questions

1. What proportion of the variance in statistics achievement can be accounted for by (a) attitudes toward computers, (b) attitudes toward statistics, (c) mathematics background, (d) computer science background, (e) mathematics ability, (f) statistics anxiety, and (g) GRE verbal, quantitative, and analytical subtest scores?

2. What is the contribution of each variable set over and above the contribution of the other six variable sets in combination?
3. What is the effect of the computer laboratory component of an inferential statistics class on the end of course attitude toward statistics and computers controlling for precourse attitude?

Data Analysis

Each research question was answered using the general linear model. The first research question was answered using regression analysis. A full model containing all variable sets specified in the question was compared to a fully restricted model ($\mathbf{R}^2 = 0$) to determine if the loss in $\mathbf{R}^2$ was statistically significant. The second research question was answered using the same full model used for research question one and seven restricted models. Each restricted model was formed by dropping out one variable set from the full model. The $\mathbf{R}^2$ for the full model was compared to the $\mathbf{R}^2$ of each restricted model to determine whether the contribution of each variable set over and above the other six variable sets in combination was statistically significant. The analysis of covariance was used to answer the third research question. The level of significance chosen for the study was .05.

Results

Table 1 shows the subscale and total score means, standard deviations, and Cronbach α reliability coefficients for the precourse administration of the *Computer Attitude Scale*, *Statistical Anxiety Rating Scale*, and the *Attitudes Toward Statistics Scale*. **Table 2** shows equivalent information for the postcourse administration of the three scales. Cronbach α reliability coefficients for the *Computer Attitude Scale* subscales ranged from .78 to .91 for the precourse administration and from .80 to .93 for the postcourse administration. Total *CAS* Cronbach α coefficients were .96 for both precourse and postcourse administrations. Cronbach α reliability coefficients for the *Statistical Anxiety Rating Scale* subscales ranged from .79 to .93 and from .78 to .94 for the precourse and postcourse administrations, respectively. Total *STARS* Cronbach α coefficients were .95 for both the precourse and postcourse administrations. Cronbach α reliability coefficients for the *Attitudes Toward Statistics Scale* subscales were both .90 for precourse administration and .93 and .90 for postcourse administration. Total *ATS* Cronbach α coefficients were .92 and .94 for the precourse and postcourse administrations, respectively.

The proportion of variance in statistics achievement accounted for by (a) attitudes toward computers, (b) attitudes toward statistics, (c) mathematics background, (d) computer science background, (e) mathematics ability, (f) statistical anxiety, and (g) GRE verbal, quantitative and analytical subtest scores was not statistically significant $R^2 = .29$, $F(21,61) = 1.20$, $p = .2825$ (see Table 3). Since only 83 students had GRE scores on file in their permanent records at the university, the regression analyses reported in Table 3 included less that 30% of the students participating in the study. A second set of regression analyses reported in Table 4 included 255 students and all previously referenced variable sets except GRE scores. The proportion of variance accounted for by the six variable sets (a) through (f) specified above was .27, $F(18,236) = 4.87$, $p = .0001$ (See Table 4). Attitudes toward computers [$F(4,236) = 2.95$, $p = .0210$] and mathematical ability [$F(2,236) = 7.81$, $p = .0005$] each made a statistically significant contribution over and above the other five variable sets in combination. Of the four subscales of the *Computer Attitude Scale* only the **Computer Usefulness** subscale made a significant contribution over and above the other variables in the regression equation, F(1,236) = 8.23, p = .0045. Of the two mathematics ability measures, only the score on the *Student Diagnostic Survey* **Algebra** test made a significant contribution over and above the other variables in the regression equation, F(1,236) = 12.86, p = .0004. The proportion of variance accounted for by the regression model containing the five variable sets (a) through (e) specified above was .24 F(12,242) = 6.35, p = .0001]. This theoretical model appears to be the most parsimonious since it accounts for only 3 to 5 percent less variance with 6 to 9 fewer variables, respectively. The results for this regression model are presented in **Table 5**. Attitudes toward computers [F(4,242) = 2.67, p = .0001], attitudes toward statistics [F(2,242) = 4.98, p = .0076], and mathematics ability [F(2,242) = 7.96, p = .0004] each made a significant contribution over and above the other four variable sets in combination. Only the **Computer Usefulness** subscale of the *Computer Attitude Scale* [F(1,242) = 8.09, p = .0048], the **Course** subscale of the *Attitudes Toward Statistics Scale* [F(1,242) = 4.26, p = .0400], and the **Algebra** test of the *Student Diagnostic Survey* [F(1,242) = 14.04, p = .0002] made a significant contribution over and above the other variables in the regression equation.

In order to determine the effect of the computer laboratory component of an inferential statistics class on the end of course attitudes toward statistics and computers controlling for precourse attitudes, twelve one-way analyses of covariance were run. In all twelve analyses, the first step was to determine if precourse administration of each of the four *CAS* subscales, the six *STARS* subscales, and the two *ATS* subscales was related to postcourse administration of the same scale. It was found that the precourse administrations (the covariates) were related to the postcourse administrations (the dependent variables). The assumption of homogeneity of regression was met for all twelve analyses. For none of the twelve subscales was the class taught with a computer component significantly different from the class taught without a computer laboratory.

Discussion

The coefficient α reliabilities found in this study are consistent with the reliabilities reported for the *CAS*, *STARS*, and *ATS* scales. Loyd and Gressard (1984) reported coefficient α reliabilities of .86, .91, .91, and .95 for the *CAS* **Computer Anxiety, Computer Confidence, Computer Liking,** and **Total**, respectively. The coefficient α reliabilities found in this study were .91, .90, .88, and .96 for the precourse administration of the **Computer Anxiety, Computer Confidence, Computer Liking,** and **Total**, respectively. The coefficient α reliabilities reported by Cruise, Cash, and Bolton (1985) for the *STARS* subscales were .94, .89, .91, .88, .85, and .80 for **Worth, Interpretation, Test/Class, Computation Self-Concept, Asking for Help,** and **Statistics Teacher**, respectively. The coefficient α reliabilities found in this study were .93, .87, .90, .88, .87, .79 for the precourse administration of the same six *STARS* subscales, respectively. Coefficient α was reported by Wise (1985) to be .92 for the *ATS* **Field** subscale and .90 for the *ATS* **Course** subscale. In this study the coefficient α reliabilities for precourse administration were .90 for both *ATS* **Field** and **Course** subscales.

The students participating in this study were similar to students enrolled in part-time off-campus programs described by Belli and Seaver (1989) in terms of age and mathematical background. They described their typical graduate students as older with a wide variance in mathematical preparation, where some students had little or no knowledge of simple algebraic manipulations and others had backgrounds in advanced calculus. In this study the average age of participants was 30 years with a range of 20 to 62 years. The average score on the *Student Diagnostic Survey* **Algebra** test was 14 with a range of 3 to 21, a perfect score. The average number of college mathematics courses taken was 3 with a range of no course to 36 courses. A few students had completed a baccalaureate degree in mathematics.

In this study we found the proportion of variance in statistics achievement accounted for by (a) attitudes toward computers, (b) attitudes toward statistics, (c) mathematics background, (d) computer science background, (e) mathematics ability, (f) statistical anxiety, and (g) GRE verbal, quantitative, and analytical scores was **.29**, with an ***adjusted*** $\mathbf{R}^2 = \hat{\mathbf{R}}^2 =$ **.05**. The proportion of variance accounted for by the model containing variable sets (a) through (f) specified above was **.27**, with $\hat{\mathbf{R}}^2 =$ **.22**. The model containing variable sets (a) through (e) appears to be the most parsimonious model since the five variable sets account for **24%** of the variance in statistics achievement as compared with **29%** found for variable sets (a) through (g). The proportion of variance accounted for by the independent variables in this study is less than the $\mathbf{R}^2$ values reported by Elmore and Vasu ($\mathbf{R}^2 =$ **.46**, 1980a; $\mathbf{R}^2 =$ **.44**, 1980b; $\mathbf{R}^2 =$ **.34**, 1986) and Presley and Huberty ($\hat{\mathbf{R}}^2 =$ **.31**, 1988) for comparable studies. In 1986 Elmore and Vasu found *GRE* **Verbal** and **Quantitative** scores to be particularly salient predictors of statistics achievement, producing a **26%** increase in variance accounted for when added to the regression model containing spatial visualization ability, attitudes toward mathematics, mathematics background, masculinity-femininity of interest pattern, and attitudes toward feminist issues. In this study the increase in variance accounted for when GRE scores were added to the regression model was only **2%**.

The ANCOVA results indicated no statistically significant differences between the students taught with a computer laboratory and the students taught without a computer component to the applied statistics course on the postcourse computer attitudes, statistics attitudes, and statistical anxiety controlling for the precourse attitudes on the same subscale for all of the twelve subscales. However, the students taught with a computer laboratory exhibited more positive attitudes toward the computer and less statistical anxiety at the end of the course than did students taught without a computer laboratory.

Previous studies by Elmore and Vasu (1980a, 1980b, 1986) found spatial visualization ability to be an important predictor of statistics achievement. Hudak and Anderson (1990) report formal operational ability and learning style as significant predictors of achievement. Future studies should incorporate these variables in the theoretical model predicting statistics achievement.

References

Belli, G. M., & Seaver, W. L. (1989). Graduate statistics service courses in part-time off-campus programs. *The American Statistician,* 43(2), 86-90.

Cruise, R. J., & Wilkins, E. M. (1980, August). *Managing student stress in statistics courses*. Paper presented at the annual meeting of the American Statistical Association, Houston, TX.

Cruise, R. J., Cash, R. W., & Bolton, D. L. (1985, August). *The development and validation of an instrument to measure statistical anxiety*. Paper presented at the annual meeting of the American Statistical Association, Las Vegas, NV.

Elmore, P. B., & Lewis, E. L. (1991, April). *Statistics and computer attitudes and achievement of students enrolled in applied statistics: Effect of a computer laboratory.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Elmore, P. B., & Vasu, E. S. (1980a). Effect of affective and cognitive mathematics-related variables on statistics achievement. *Proceedings of the 1980 Annual Convention of the American Statistical Association Section on Statistical Education*, 1-2.

Elmore P. B., & Vasu, E. S. (1980b). Relationship between selected variables and statistical achievement: Building a theoretical model. *Journal of Educational Psychology*, **72**, 457-467.

Elmore, P. B., & Vasu, E. S. (1986). A model of statistics achievement using spatial ability, feminist attitudes and mathematics-related variables as predictors. *Educational and Psychological Measurement*, **46**, 215-222.

Feinberg, L. B., & Halperin, S. (1978). Affective and cognitive correlates of course performance in introductory statistics. *Journal of Experimental Education*, **46**, 11-18.

Hudak, M. A., & Anderson, D. E. (1990). Formal operations and learning style predict success in statistics and computer science courses. *Teaching of Psychology*, **17**(4), 231-234.

Katz, B. M., & Tomazic, T. J. (1988, August). *Reducing statistical anxiety through a nonquantitative approach to advanced statistical techniques*. Paper presented at the annual meeting of the American Statistical Association, New Orleans, LA.

Loyd, B. H., & Gressard, C. (1984). Reliability and factorial validity of computer attitude scales. *Educational and Psychological Measurement*, 44, 501-505.

Munger, G. F., & Loyd, B. H. (1989). Gender and attitudes toward computers and calculators: Their relationship to math performance. *Journal of Educational Computing*, 5(2), 167-177.

Presley, R. J., & Huberty, C. (1988). Predicting statistics achievement: A prototypical regression analysis. *Multiple Linear Regression Viewpoints*, 16(1), 36-77.

Sterling, J., & Gray, M. W. (1991). The effect of simulation software on students' attitudes and understanding in introductory statistics. *Journal of Computers in Mathematics and Science Teaching*, 10(4), 51-56.

Tomazic, T. J., & Katz, B. M. (1988, August). *Statistical anxiety in introductory applied statistics*. Paper presented at the annual meeting of the American Statistical Association, New Orleans, LA.

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

Wise, S. L., Barnes, L. B., Harvey, A. L., & Plake, B. S. (1989). Effects of computer anxiety and computer experience on the computer-based achievement test performance of college students. *Applied Measurement in Education*, 2(3), 235-241.

Woehlke, P. L., & Leitner, D. W. (1980). Gender differences in performance on variables related to achievement in graduate-level educational statistics. *Psychological Reports*, 47, 1119-1125.

Table 1

Precourse Subscale and Total Score Means, Standard Deviations, and Cronbach α Reliabilities for the CAS, STARS, and ATS Scales

Variables	Number of Items	Number of Cases	Mean	SD	Cronbach α
Computer Attitude Scale					
Computer Anxiety	10	288	30.00	6.83	.91
Computer Confidence	10	282	30.87	6.01	.90
Computer Liking	10	287	29.56	6.02	.88
Computer Usefulness	10	286	34.94	4.01	.78
Total	40	279	125.80	20.24	.96
Statistical Anxiety Rating Scale					
Worth of Statistics	16	282	30.97	10.46	.93
Interpretation Anxiety	11	282	26.29	7.48	.87
Test and Class Anxiety	8	288	23.70	7.07	.90
Computation Self-Concept	7	274	14.98	5.82	.88
Fear of Asking for Help	4	288	8.52	3.77	.87
Fear of Statistics Teacher	5	285	10.75	3.87	.79
Total	51	264	114.53	28.34	.95
Attitudes Toward Statistics					
Field	20	278	40.64	9.48	.90
Course	9	287	24.10	7.76	.90
Total	29	277	64.79	14.89	.92

Note: N=289

Table 2

Postcourse Subscale and Total Score Means, Standard Deviations, and Cronbach α Reliabilities for the CAS, STARS, and ATS Scales

Variables	Number of Items	Number of Cases	Mean	SD	Cronbach α
Computer Attitude Scale					
Computer Anxiety	10	286	30.63	6.78	.93
Computer Confidence	10	282	31.31	6.19	.91
Computer Liking	10	287	29.82	6.22	.90
Computer Usefulness	10	282	34.53	4.24	.80
Total	40	276	126.43	21.23	.96
Statistical Anxiety Rating Scale					
Worth of Statistics	16	282	30.38	11.25	.94
Interpretation Anxiety	11	285	24.00	6.63	.86
Test and Class Anxiety	8	288	22.19	6.58	.88
Computation Self-Concept	7	278	13.48	5.19	.87
Fear of Asking for Help	4	288	8.11	3.25	.81
Fear of Statistics Teacher	5	283	10.48	4.05	.78
Total	51	274	108.33	27.65	.95
Attitudes Toward Statistics					
Field	20	276	39.76	11.06	.93
Course	9	286	22.13	7.53	.90
Total	29	274	61.85	16.51	.94

Note: N=289

Table 3

Summary of Regression Analysis Using Seven Variable Sets

Model	Variable Sets in Model	Variable Set Eliminated	R^2	Reduction in R^2	df	F	p
Full	1,2,3,4,5,6,7		.2926		21,61	1.20	.2825
RM1	2,3,4,5,6,7	1	.2707	.0219	4,61	.47	.7557
RM2	1,3,4,5,6,7	2	.2715	.0211	2,61	.91	.4082
RM3	1,2,4,5,6,7	3	.2843	.0083	2,61	.36	.7008
RM4	1,2,3,5,6,7	4	.2164	.0762	2,61	3.29*	.0441
RM5	1,2,3,4,6,7	5	.2906	.0020	2,61	.09	.9165
RM6	1,2,3,4,5,7	6	.2390	.0536	6,61	.77	.5964
RM7	1,2,3,4,5,6	7	.2307	.0619	3,61	1.78	.1605

Note: N = 83

*$p < .05$

The dependent variable is statistics achievement (total number of points achieved in the statistics course).

1 = Computer Attitude Scale (Anxiety, Confidence, Liking, and Usefulness).

2 = Attitude Toward Statistics Scale (Field and Course).

3 = Mathematics background (number of mathematics courses taken in high school and college).

4 = Computer science background (number of computer science courses taken in high school and college).

5 = Mathematics ability (scores on Student Diagnostic Survey Algebra and Cloze tests).

6 = Statistical Anxiety Rating Scale (Worth, Interpretation Anxiety, Test and Class Anxiety, Computation Self-Concept, Fear of Asking for Help, and Fear of Statistics Teacher).

7 = Graduate Record Examination Subtest Scores (Verbal, Quantitative, and Analytical).

Table 4

Summary of Regression Analysis Using Six Variable Sets

Model	Variable Sets in Model	Variable Set Eliminated	R^2	Reduction in R^2	df	F	p
Full	1,2,3,4,5,6		.2710		18,236	4.87*	.0001
RM1	2,3,4,5,6	1	.2346	.0364	4,236	2.95*	.0210
RM2	1,3,4,5,6	2	.2619	.0091	2,236	1.47	.2325
RM3	1,2,4,5,6	3	.2602	.0108	2,236	1.75	.1755
RM4	1,2,3,5,6	4	.2695	.0015	2,236	.25	.7797
RM5	1,2,3,4,6	5	.2228	.0482	2,236	7.81*	.0005
RM6	1,2,3,4,5	6	.2396	.0314	6,236	1.70	.1225

Note: N = 255

*$p < .05$

The dependent variable is statistics achievement (total number of points achieved in the statistics course).

1 = Computer Attitude Scale (Anxiety, Confidence, Liking, and Usefulness).

2 = Attitude Toward Statistics Scale (Field and Course).

3 = Mathematics background (number of mathematics courses taken in high school and college).

4 = Computer science background (number of computer science courses taken in high school and college).

5 = Mathematics ability (scores on Student Diagnostic Survey Algebra and Cloze tests).

6 = Statistical Anxiety Rating Scale (Worth, Interpretation Anxiety, Test and Class Anxiety, Computation Self-Concept, Fear of Asking for Help, and Fear of Statistics Teacher).

Table 5

Summary of Regression Analysis Using Five Variable Sets

Model	Variable Sets in Model	Variable Set Eliminated	R^2	Reduction in R^2	df	F	p
Full	1,2,3,4,5		.2396		12,242	6.35*	.0001
RM1	2,3,4,5	1	.2060	.0336	4,242	2.67*	.0329
RM2	1,3,4,5	2	.2082	.0314	2,242	4.98*	.0076
RM3	1,2,4,5	3	.2286	.0110	2,242	1.74	.1781
RM4	1,2,3,5	4	.2365	.0031	2,242	.49	.6154
RM5	1,2,3,4	5	.1895	.0501	2,242	7.96*	.0004

Note: N = 255

*$p < .05$

The dependent variable is statistics achievement (total number of points achieved in the statistics course).

1 = Computer Attitude Scale (Anxiety, Confidence, Liking, and Usefulness).

2 = Attitude Toward Statistics Scale (Field and Course).

3 = Mathematics background (number of mathematics courses taken in high school and college).

4 = Computer science background (number of computer science courses taken in high school and college).

5 = Mathematics ability (scores on Student Diagnostic Survey Algebra and Cloze tests).