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The purpose of the current study was to collect data from self-report measures (happiness, extraversion, depression, self-image, and self-esteem) created by laboratory students in conjunction with validated measures of state self-esteem, sensation seeking, and demographic variables that would allow for the reasonable application of a variety of descriptive and inferential statistical techniques to learn data analysis. An undergraduate under faculty supervision performed reliability analysis, correlational analysis, independent samples t tests, analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA), and created a multiple regression model to better understand the application and conceptual logic underlying many of the statistical tests used in contemporary psychology. It was predicted this model would further develop critical thinking and provide additional practice conducting research.

Psychology is becoming an increasingly popular field of study among undergraduates as the number of students majoring in psychology has drastically risen over recent years. Nationally, it is estimated that over 65, 000 students per year will graduate with degrees in psychology, a growth of more than 50% over the past few decades (Morgan & Korschgen, 2001). With such an increase, students can expect career options, such as graduate school, to be highly competitive and should strive to develop skills and abilities that distinguish them from other psychology majors (Landrum & Nelsen, 2002). It is imperative that undergraduates who wish to pursue advance degrees in psychology (e.g. Masters, Ph.D.) have skills such as critical thinking and research experience to set them apart from other competing students.

What is critical thinking? As Pellegrino (1995) suggests, there is no simple definition of critical thinking, but a good starting place is to focus on problem solving because it can be argued that if there is no problem to be solved, there is no need for critical thinking. More broadly defined, Kurfiss (as cited by Angelo, 1995) states critical thinking as, "an investigation whose purpose is to explore a situation, phenomenon, question, or problem to arrive at a hypothesis or conclusion about it that integrates all available information and that can therefore be convincingly justified. In critical thinking, all assumptions are open to question, divergent views are aggressively sought, and the inquiry is not biased in favor of particular outcomes." Keeping with those premises, the ability to engage in critical thinking should be an important difference between undergraduates majoring in psychol-

ogy and undergraduates majoring in other disciplines, especially those disciplines that do not emphasis statistics and psychological methodology.

According to Landrum, Davis, & Landrum (2000), there are many opportunities for students to enhance their undergraduate education in psychology, and to obtain the most from their education, they should become much more involved in activities outside of traditional coursework to enhance their reasoning abilities and research experience. One of the most beneficial ways of learning and improving reasoning and critical thinking skills while also gaining valuable research experience is to become involved with a faculty members research by means of an assistantship or independent study. In an analysis of the benefits of an undergraduate assistantship, Landrum and Nelsen (2002) found that undergraduate psychology educators' rated critical-thinking skills, preparation for graduate school, and enthusiasm for the research process the most important elements in an assistantship. The advantages of such experiences however extend far past these three.

Undergraduates who become involved in a one-on-one relationship with a mentoring professor are put in a position of direct first-hand experience. Unlike traditional courses, undergraduates, in the ideal, are exposed to the real world of scientific psychological research. They are put in the position of a researcher who must employ critical thinking skills in order to conduct literature searches, examine research questions, develop hypotheses, consider research methodologies, collect data, and perform data analysis with the appropriate statistical tests. Through the course of the mentoring process, undergraduates also develop communication skills, leadership ability, increase familiarity with modern data analysis techniques, and gain experience in reporting and presenting scientific research by writing APA format manuscripts and participating in conference presentations (e.g., poster presentations). This experience ultimately begins to teach the undergraduate the skills necessary to conduct independent research, a necessity for graduate school.

The purpose of the current study was to propose a model that would serve as an in-struction tool for the teaching of undergraduate statistics. This model was used to show how an undergraduate under faculty instruction could gain additional practice and more elaborate conceptual understanding of contemporary statistical tests and procedures by systematically performing analyses on a data set. Data produced from student self-report measures (happiness, extraversion, depression, self-image, and self-esteem) and validated measures of state self-esteem (SSES), sensation seeking, and demographic variables (sex, class year, relationship status, and preference for dogs or cats) were subjected to a variety of descriptive and inferential statistical techniques to learn data analysis comprehensively, thus increasing critical thinking skills and research competency. Student-generated measures and validated measures were subjected to reliability analysis, correlational analysis, then procedures to test mean differences using independent samples t tests, analysis-of-variance (ANOVA) and multivariate analysis of variance (MANOVA) techniques were employed. Student-generated measures, validated measures, and demographic variables were then used in a multiple regression model to analyze the joint and separate influences of two or more predictor variables on a dependent variable.

METHOD

Participants

Participants consisted of 117 University of Kentucky undergraduates (41 men, 76 women) who received extra credit points towards their next exam for completing the measure. Of the 117 participants, 26 volunteered from an application of statistics in psychology course and 91 volunteered from a general social psychology course. Only 108 of the 117 participants reported their age for this study. Age ranged from 19 to 38 years old with a mean of 21.63 (SD = 2.98).

Uniqueness of Model

This model was developed because a review of pedagogical literature suggests that the teaching of critical thinking skills and participation in extracurricular projects helps enhance undergraduate education and better prepares students for graduate school. This model continues by advocating such findings, but is unique because (to the best of our

TABLE 1

Book	Reliability	r	t	One-way ANOVA	Factorial ANOVA	MANOVA	Multiple Regression
Abrami, Cholmsky, & Gordon (2001)	x	x	x	x	x		x
Gravetter & Wallnau (2002)	x	x	x	x	x		
Heiman (2003)		x	x	x	x		
Hinkle, Wiersma, & Jurs (2003)		x	x	x	x		x
Howell (1999)		x	x	x	x		x
Kranzler (2003)		x	x	x			
Rowntree (2004)		x	x	x	x		
Sprinthall (2003)	x	x	x	x	x		x
Thorne & Giesen (2000)		x	x	x	x		x
Vernoy & Kyle (2002)		x	x	x	x		

Note. r = Correlation; t = Independent Samples t test; x = Indicates Statistical Procedure Covered in the Text.

knowledge) no other models exist which emphasize a student-faculty member mentorship for learning data analysis comprehensively. A review of statistical textbooks used at the undergraduate level indicated that not all of the statistical procedures this model demonstrates are taught at the undergraduate level (see Table 1). For this model an undergraduate under faculty instruction implemented the statistical procedures commonly used in psychological research but often not taught at the undergraduate level to help strengthen critical thinking, increase conceptual understanding of statistics, and gain additional research experience.

Measures

Undergraduate psychology majors in an application of statistics course were instructed in groups as part of a laboratory assignment to generate a psychological construct of interest, to provide an operational definition, and then to create a 10 to 20 item scale for measurement of the construct. As a result students created measures for happiness, extraversion, depression, self-image, and self-esteem. Students defined happiness as high satisfaction with one's life; extraversion as the extent to which someone prefers to interact with large groups of people; depression as feeling unhappy most of the day as evidenced by change in sleep patterns, change in eating patterns, and loss of interest in pleasurable activities;

self-image as the image we possess of ourselves based on confidence and comfort levels in ourselves; and self-esteem as positive or negative beliefs about one's self. The student-generated questions were evaluated by a faculty member for appropriateness of content and a reverse coding scheme for relevant items was created for later data analysis.

Questions from each respective measure were then combined into a questionnaire along with the items from validated measures of state self-esteem (SSES; Heatherton & Polivy, 1991) and sensation seeking (Zuckerman, 1984). The state self-esteem (SSES) scale consists of 20 items divided into 3 factors: performance, social, and appearance self-esteem. This scale measures state levels of self-esteem. The sensation seeking measure consists of 36 items designed to measure a generalized preference for high or low levels of sensory stimulation. Individuals who are higher in sensation seeking prefer, and perhaps even need, higher levels of stimulation. The resulting questionnaire consisted of 118 items designed to measure the constructs of happiness, extraversion, depression, self-image, self-esteem, state self-esteem (SSES), and sensation seeking (see Table 2). Demographic information such as sex, class year (freshman, sophomore, junior, senior, other), relationship status (whether currently in a relationship or

not), and preference of whether participants favored dogs or cats was also collected.

Procedure

The questionnaire consisting of 118 items was administered to undergraduates in an application of statistics course and a general social psychology course. Students who volunteered received extra credit toward their next exam for participation. Participants were instructed to rate their level of agreement with each item using a 5 point Likert-type scale from 1 (never) to 5 (always).

Data collected from undergraduates were then entered into the statistical program SPSS (Statistical Product and Service Solutions), a frequently used statistical program among the social sciences, so that the application of various descriptive and inferential statistics could be performed. An undergraduate psychology major under faculty supervision and instruction conducted statistical analyses taught at the undergraduate level to better demonstrate the practical application and conceptual logic behind many of the statistical tests used in contemporary psychology.

RESULTS

Data Reduction

Relevant items were reverse scored and reliability analyses were conducted on each of the student-generated measures (happiness, extraversion, depression, self-image, self-esteem, and sensation seeking). Special attention was placed upon inspecting the corrected item-total correlations produced by SPSS and values for Cronbach's alpha. The item-total correlation (provided for each item of the questionnaire) is the correlation between each item and the total score, excluding the item of interest from the total score. Ideally these correlations should be positive. A negatively correlated item suggests the question does not agree with other items of the same measure. Negatively correlated items can also suggest confusion and/or misinterpretation of the question being asked. Cronbach's alpha is a reliability coefficient which indicates the degree of internal consistency of items within a test (the internal consistency refers to the degree to which the items of a test measure the same construct or attribute). Mathematically, Cronbach's alpha is the equivalent of the average of all possible split-half reliability coefficients of the test. By examing the results of the corrected item-total correlations and Cronbach's alpha, researchers are better able to assess each item's reliability and apply their own knowledge about how items rationally and theoretically relate to constructs of interest in constructing scales.

Happiness The student-generated measure of happiness originally consisted of a 10 item questionnaire (items 31, 39, 41, 43, 89, 102, 104, 107, 112, and 117). Examination of the corrected item-total correlations obtained from SPSS showed no negatively correlated items ($rs > .22$). However, upon inspection of the 10 items it was thought best to delete item 31 (*I have enough free time*). Item 31, based on a subjective decision, was believed to not properly measure the construct of happiness and that the other items were sufficient for measurement. Item 31 ($r = .24$) did not possess the lowest correlation compared to the other items. Item 43 (*I hate my job*) possessed the lowest correlation ($r = .22$). The inspection of predicted alpha indicated that the deletion of the lowest correlated item, item 43, would result in an alpha $= .67$. Likewise, the deletion of item 31 would result in no greater increase, alpha $= .67$. Thus, only item 31 was deleted resulting in a 9 item measure.

Extraversion The student-generated measure of extraversion originally consisted of 10 items (items 61, 67, 69, 72, 74, 75, 76, 77, 78, and 82). Correlations based on the corrected item-total correlations produced by SPSS revealed no negatively correlated items ($rs > .13$). Inspection of the predicted alpha levels indicated that the deletion of item 67 (*I will try anything once*) would result in a higher alpha level. The actual item was assessed and deleted primarily because it was believed that this question pertained more to the sensation seeking measure than to extraversion. The deletion of item 67 increased the alpha level from .68 to .70, improving the internal consistency ($rs > .21$). The resulting measure consisted of 9 items.

Depression Reliability analysis of the original 12 item measure of depression (items 27, 35, 51, 63, 99, 100, 105, 106, 108, 109, 110, and 111) yielded an alpha level of .65. No negatively correlated items were produced as

a result of the reliability analysis (rs > .07). Inspection of the predicted alpha levels showed that the deletion of item 109 (*I have lost or gained weight over the past month*), the lowest correlated item (r = .07), would result in an alpha level of .69. Next the predicted alpha if item deleted revealed that the deletion of item 100 (My appetite has not changed), the second lowest correlated item (r = .15), would result in an even greater increase in alpha, to .70. Final inspection revealed that the deletion of item 108 (*I sleep more than normal*), the third lowest correlated item (r = .21), would result in an alpha of .71. These items, though characteristic symptoms associated with depression, were thought to perhaps be too specific and confusing for the participants since short-term fluctuations in health (e.g., illness, stressful event) could account for these findings. Deletion of these three items increased the correlations within the scale (rs > .22). The resulting measure consisted of 9 items, alpha = .71.

Self-Image Reliability analysis performed on the 17 item self-image measure (items 1, 7, 19, 57, 79, 80, 86, 87, 88, 92, 95, 98, 113, 114, 115, 116, and 118) resulted in no negatively correlated items (rs > .17). Inspection of the predicted alpha levels contingent on item deletion indicated that the alpha level would increase from .84 to .85 if item 1 (*I prefer tasks which involve a lot of concentration rather than ones that are routine*) was removed (r = .17). Upon investigation of this item it was thought best to remove it primarily because this item did not appear to reflect a measure of self-image. Item 1 could potentially be tapping into another construct such as need for cognition. Examination of the corrected item-total correlations also revealed that the correlations would increase among the items (rs > .27). The resulting measure after deletion of item number 1 consisted of 16 items, alpha = .85.

Self-Esteem Finally, the student-generated measure of self-esteem consisted of 16 items (items 5, 11, 17, 23, 25, 37, 45, 47, 55, 71, 81, 83, 84, 85, 91, and 96). These items when subjected to reliability analysis resulted in no negatively correlated items (rs > .26) and produced adequate internal consistency. Inspection of the predicted alpha levels re-

vealed that alpha would only increase from .86 to .87 with the deletion of item 96 (*I feel concerned about making a good first impression*), the lowest correlated item (r = .26). It was thought best to include this item in the measure since the concern about others impressions could influence an evaluation of worth. The resulting measure consisted of 16 total items.

Correlational Analyses

After reliability analyses were conducted on all student-generated measures (happiness, extraversion, depression, self-image, and self-esteem) correlations among these measures and the validated measures of state-self-esteem (SSES) and sensation seeking were performed. Correlational analyses were performed to test the convergent and discriminant validity of the student-generated scales by examing the relationships with each other and the validated measures. Convergent validity shows that different measures of the same or related hypothetical constructs correlate significantly with one another while discriminant validity assumes that measures of unrelated hypothetical constructs should not correlate with one another.

Three primary predictions were made regarding correlations among the student-generated measures and validated measures. These predictions were not designed to test new hypotheses about hypothetical and theoretical constructs. The goal was merely to replicate results which already have empirical support, a necessary component of the scientific method. First, it was predicted that the student-generated measures of happiness, self-esteem, and self-image would correlate positively with each other and with the validated measure of state self-esteem (SSES). This is because the student-generated measures of happiness, self-esteem, and self-image and validated measure of state self-esteem (SSES) share similar features of the same hypothetical constructs (e.g., attitudes and opinions of the self, evaluation of worth). The second prediction was that the student-generated measure of depression would be negatively correlated with self-esteem, self-image, state self-esteem (SSES), and happiness since some characteristics of depression include states of sadness, pessimistic ideation, loss of interest in enjoy-

able activities, and feelings of worthlessness or guilt. Third, the validated measure of sensation seeking and the student-generated measure of extraversion would not be highly correlated with the other student-generated measures of happiness, self-esteem, and self-image and the validated measure of state self-esteem (SSES). Currently there is no research which would suggest any strong associations between measures of sensation seeking and extraversion with measures of happiness, self-esteem, self-image, and state self-esteem (SSES).

Consistent with the first prediction, the student-generated measures of happiness, self-esteem, self-image, and the validated measure of state self-esteem (SSES) were all positively and significantly intercorrelated (see Table 3). Correlational analyses revealed that the student-generated measure of happiness correlated positively with self-esteem, r = .68, p < .01, self-image, r = .73, p < .01, and state self-esteem (SSES), r = .57, p < .01. The student-generated measure of self-esteem demonstrated good convergent validity due to its correlation with the validated measure of state self-esteem (SSES), r = .77, p < .01. The student-generated measures of self-esteem and self-image also possessed a strong correlation, r = .75, p < .01.

Consistent with the second prediction, the measures of depression, self-esteem, self-image, state self-esteem (SSES), and happiness were all negatively and significantly intercorrelated. The student-generated measure of depression had strong negative correlations with self-esteem, r = -.77, p < .01, self-image, r = -.75, p < .01, state self-esteem (SSES), r = -. 72, p < .01, and happiness, r = -.76, p < .01, demonstrating good convergent

validity. These findings were not surprising since individuals who exhibit characteristics of depression would also have low levels of self-esteem, self-image, state self-esteem (SSES), and happiness.

Finally, consistent with the third prediction, the validated measure of sensation seeking was not highly correlated with the student-generated measures of happiness, r = .13, p > .05, self-esteem, r = .20, p < .05, self-image, r = .24, p < .05, or the validated measure of state self-esteem (SSES), r = .18, p < .05. The student-generated measure of extraversion also was not highly correlated with the student-generated measures of happiness, r = .38, p < .05, self-esteem, r = .41, p < .05, self-image, r = .32, p < .05, and the validated measure of state self-esteem (SSES), r = .19, p < .05 attesting to their discriminant validity.

Comparison of Means

After assessing correlations among the student-generated and validated measures, several statistical tests designed to assess mean differences were conducted. Independent samples t tests were first performed followed by analysis of variance (ANOVA) procedures. These statistical tests allow researchers to test hypotheses by investigating the differences between means.

An independent samples t test evaluates the difference between the means of two independent groups (groups for which there is no expected relationship). In SPSS each case must have scores on two variables, a grouping variable and a test variable. The grouping variable (independent variable) divides the cases into two mutually exclusive groups or categories, such as sex (male or female). The

TABLE 3
Correlations among Student-Generated and Validated Measures

Measure	1	2	3	4	5	6	7
1. Happiness	—						
2. Self-Esteem	.68**	—					
3. Self-Image	.73**	.75**	—				
4. SSES	.57**	.77**	.79**	—			
5. Depression	-.76**	-.77**	-.75**	-.72**	—		
6. Extraversion	.38**	.41**	.32**	.19*	-.36**	—	
7. Sensation Seeking	.13	.20*	.24**	.18*	-.14	.35**	--

Note. SSES = State Self-Esteem Scale. * *p* < .05. ** *p* < .01.

test variable (dependent variable) describes each case on some quantitative dimension, such as sensation seeking. The t test evaluates whether the mean value of the test variable for one group significantly differs from the mean value of the test variable for the second group. There are three assumptions underlying the independent samples t test (Howell, 1999). First, the test variable is normally distributed in the two populations. Second, there is homogeneity of variance between the two groups (variances are equal between the groups). A guideline suggested by Howell (1999) is that heterogeneity of variance exists if a variance is greater than 4 times the smallest number, then the test is said to have heterogeneity of variance. Empirically, Levene's Test for Equality of Variances can be employed to evaluate the assumption that the population variances for the two groups are equal. Third, the scores are independent of one another. The statistic calculated in an independent samples t test is the t statistic, a measure of the magnitude of difference between two groups' means.

Univariate (ANOVA) and multivariate analysis-of-variance (MANOVA) tests assess the relationship of one or more factors (independent variable(s)) with a dependent variable (univariate ANOVA) or with multiple dependent variables (MANOVA). This allows for the control of familywise error (the rate of occurrence of any (one or more) Type I errors (rejecting the null hypothesis when it is true) when a series of individual tests are conducted) by testing for the existence of at least one significant difference between means before assessing specific differences between means. The factors can be either between-subjects or within-subjects factors. A between-subjects factor divides participants into different groups such as sex while a within-subjects factor has multiple levels, and each participant is observed on a dependent variable across those levels (e.g., trials repeated at different times). As with independent samples t tests, analysis-of-variance procedures on independent groups (which are more complex versions of t tests) operate under the same assumptions. The first is that scores from the population are normally distributed on the dependent variable. Second, there is homogeneity of variance (variances between the groups are equal, and not 4

times larger than the smallest variance), and third, there is independence of observations. The analysis-of-variance (ANOVA) procedures allow for the calculation of the statistic F, a ratio that in the case of independent groups compares the variance between the groups (effect) and the variances within the groups (error).

t tests Three primary predictions were made concerning mean differences between student-generated measures, validated measures, and demographic variables. First, we predicted that males would score higher than females would on levels of sensation seeking since males generally are more prone to seek out high sensation activities (e.g., rock climbing, bungee jumping). Second, we predicted that there would be a greater mean for participants who favored dogs rather than cats on the validated measure of sensation seeking since dogs are generally more active and stimulus provoking than cats. Third, we predicted that participants currently in a relationship would have a higher mean than those participants not currently in a relationship would on the student-generated measure of happiness since individuals actively involved in relationship tend to report higher levels of happiness.

First, an independent samples t test was performed on the sensation seeking measure to assess differences between the means for male and female participants. Levene's Test for homogeneity of variance revealed no significant differences between variances for male and female participants on the sensation seeking measure. If Levene's Test had revealed a significant difference, then the homogeneity of variance assumption would have been violated, thus resulting in heterogeneity of variance among male and female participants. In that case, the calculation of the pooled standard deviation (the mean of the standard deviations weighted by sample size) would not be appropriate. That procedure is necessary for the t test because it is an important assumption for the efficiency of the test. However, it should be noted that the t test is fairly robust to violations of this assumption, and the results will generally still be valid when the assumption is violated. A t test for Equality of Means revealed a significant difference between male and female participants on

the measure of sensation seeking, t(111) = 2.01, p < .05. Inspection of the group statistics revealed that, consistent with predictions, males had a greater mean (M = 106.66, SD = 10.64) than females (M = 102.24, SD = 11.96).

An independent samples t test was then conducted to assess mean differences between participants' who preferred dogs and cats on the sensation seeking measure. Levene's Test of homogeneity of variance revealed no significant difference between the variances of the participants who favored dogs and cats. A t test for Equality of Means revealed a significant difference between participants who preferred dogs and cats on the measure of sensation seeking, t(111) = 2.13, p < .05. Inspection of the group statistics showed that, consistent with predictions, participants who preferred dogs had a greater mean (M = 105.17, SD = 10.96) than participants who preferred cats (M = 99.29, SD = 12.89).

A final independent samples t test was performed to assess differences between the variances of the demographic variable relationship status and the student-generated measure of happiness. Using Levene's Test of homogeneity of variance, no significant difference in variances between participants in and not in relationships for the measure of happiness were found. A t test for Equality of Means revealed no significant difference between relationship status and the measure of happiness, t(111) = 1.21, p > .05. Examination of the group statistics revealed that those participants currently in a relationship reported a higher mean (M = 33.28, SD = 3.83) than those not currently in a relationship (M = 32.32, SD = 4.53) on the measure of happiness, but this difference was not large enough to be significant.

ANOVA Model The General Linear Model function of SPSS was used to conduct a multivariate analysis of variance (MANOVA) using sex and relationship status (independent variables) and the student-generated and validated measures (dependent variables) to assess mean differences among the groups. Wilks's lambda, a frequently reported multivariate analysis of variance (MANOVA) procedure, was used to evaluate whether the means on the multiple dependent variables were equal across groups. A test for main effect of sex on the dependent variables revealed no significant effects, F (1,111) = .80, p > .05. This suggested that there was no significant difference between men and women on any of the dependent measures. A test for main effect of relationship status also revealed no significant effects, F (1,111) = 1.54, p > .05. It appeared that participants in or out of a relationship did not differ on any of the dependent measures. There was also no significant interaction between sex and relationship status, F (1,111) = 1.81, p > .05. The effect of the independent variable sex on the dependent measures did not change as a result of the levels of the other independent variable relationship status. Had a significant effect been found, follow up analyses using univariate tests, and simple effects (the comparison of all levels of one independent variable at only one level of another independent variable) would have been conducted.

Since the MANOVA prevents this actual analysis, for illustrative purposes only we assessed the univariate results by conducting tests of between-subjects effects using sex and relationship status as independent variables and student-generated and validated measures as individual dependent variables. No main effect of sex was found on any of the student-generated measures or validated measures. A main effect of relationship status was found on the student-generated measure of depression, F (1,111) = 6.70, p < .05. It appeared that whether participants were in a relationship or not had an effect on the student-generated measure of depression. Women not in a relationship reported a slightly higher mean (M = 22.37, SD = 4.60) than men in a relationship (M = 21.54, SD = 5.03) on the measure of depression (see Figure 1). A significant interaction between sex and relationship status on the validated measure of sensation seeking was also discovered, F (1,111) = 10.80, p < .05. This finding suggests that the effect of sex on sensation seeking changed depending on whether participants' were in a relationship or not. It should be noted that these findings could potentially be the result of Type I errors.

Multiple Regression

Multiple regression is a statistical test which analyzes the joint and separate influences of two or more predictor variables on a

FIGURE 1
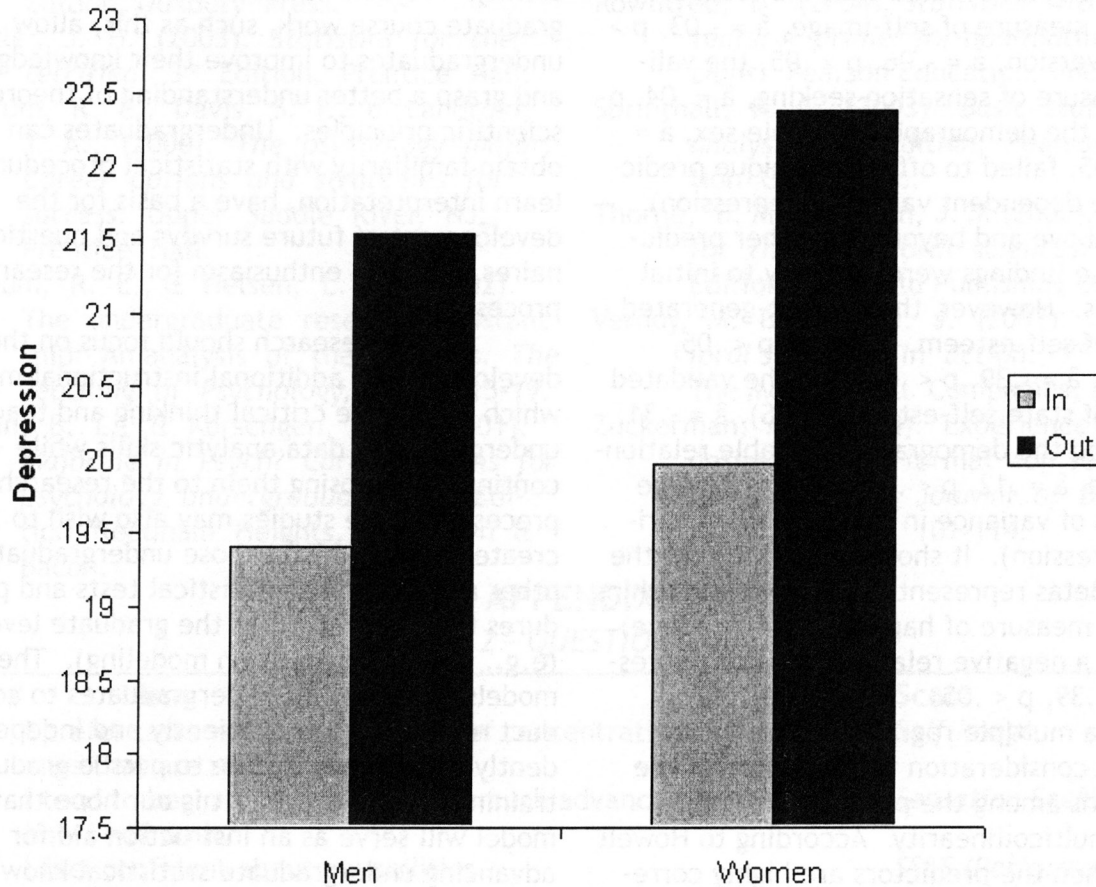
Means of men and women in and out of a relationship on the student-generated measure of depression.

dependent variable. This procedure is used to calculate a strength-of-relationship index that indicates the degree that the predicted scores are correlated with the dependent scores for a sample. By squaring the multiple correlation coefficient the statistic R^2 is calculated, giving a measure of the variance in the dependent variable accounted for by the predictor variables as a whole. Examining the standardized regression coefficients (which assess the predictive ability of each variable on a standardized scale so that relative strengths could be compared) allows for the assessment of each individual predictor's unique relationship with the dependent variable above and beyond that of the other predictors. It was predicted that the student-generated measures of self-image, self-esteem, happiness, extraversion, and the validated measures of sensation seeking and state self-esteem (SSES) and the demo-

graphic variables sex and relationship status would predict substantial amounts of the variance in the student-generated measure of depression both in combination and uniquely.

A regression model was created using the multiple variables of student-generated measures of self-image, self-esteem, happiness, and extraversion in conjunction with validated measures of state self-esteem (SSES) and sensation seeking and demographic variables of sex (coded male = 1, female = 2) and relationship status (coded currently in a relationship = 1, not currently in a relationship = 2). Data analyses revealed that the model predicted over three-quarters (R^2 = .76) of the variance in the dependent variable (depression) as accounted for by the predictor variables of student-generated measures, demographic variables, and validated measures.

This was a significant proportion of the variance, $F(1,111) = 41.71$, $p < .05$.

Examination of the standardized regression coefficients revealed that the student-generated measure of self-image, $\hat{a} = -.03$, $p > .05$, extraversion, $\hat{a} = -.06$, $p > .05$, the validated measure of sensation seeking, $\hat{a} = .04$, $p > .05$, and the demographic variable sex, $\hat{a} = .01$, $p > .05$, failed to offer any unique prediction of the dependent variable (depression) variance above and beyond the other predictors. These findings were contrary to initial predictions. However, the student-generated measure of self-esteem, $\hat{a} = -.19$, $p < .05$, happiness, $\hat{a} = -.39$, $p < .05$, and the validated measure of state self-esteem (SSES), $\hat{a} = -.31$, $p < .05$, and the demographic variable relationship status, $\hat{a} = .12$, $p < .05$, were all unique predictors of variance in the dependent variable (depression). It should be noted that the negative Betas represent negative relationships (e.g., the measure of happiness (from above) possessed a negative relationship with depression, $\hat{a} = -.39$, $p < .05$).

In a multiple regression model, one important consideration is the degree of the correlations among the predictor variables know as multicollinearity. According to Howell (1999), when the predictors are highly correlated with each other the regression equation is very unstable from one sample to another. Two random samples from the same population might produce regression equations that appear to be completely different from one another. Two or more highly correlated predictors may predict the same variance in the dependent variablemaking it less likely that the predictors will uniquely predict the dependent variable. Often, using highly correlated predictors is not recommended.

DISCUSSION

Our goal for this study was to create a model which would facilitate better understanding of the theoretical and practical applications of statistical techniques typically used in psychological research but not taught at the undergraduate level for the purpose of learning data analysis and helping improve critical thinking ability. As the number of majors in psychology continues to increase, so will the demand for individuals who can contribute new theories and research. Current research emphasizes the need for stronger critical thinking skills and the ability to carryout research independently and efficiently. Projects outside of normal undergraduate course work, such as this, allow undergraduates to improve their knowledge, and grasp a better understanding of theoretical scientific principles. Undergraduates can obtain familiarity with statistical procedures, learn interpretation, have a basis for the development of future surveys and questionnaires, and gain enthusiasm for the research process.

Future research should focus on the development of additional instructional models which emphasize critical thinking and teach undergraduates data analytic skills while continually exposing them to the research process. Future studies may also wish to create models which expose undergraduates to other more complex statistical tests and procedures typically taught at the graduate level (e.g., structural equation modeling). These models could permit undergraduates to conduct research more efficiently and independently should they decide to pursue graduate training in psychology. It is our hope that this model will serve as an instruction aid for advancing undergraduate statistical knowledge and research competency.

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APPENDIX
TABLE 2 - QUESTIONNAIRE

Item #	Item	Scale
1	I prefer tasks which involve a lot of concentration rather than ones that are routine.	*Self-Image*
2	I tend to begin a new job without much advance planning on how I will do it.	*Sensation Seeking*
3	I feel confident about my abilities.	*SSES (Performance)*
4	I do not like to waste my time just sitting around and relaxing.	*Sensation Seeking*
5	I doubt the decisions I make.	*Self-Esteem*
6	I usually think about what I am going to do before I do it.	*Sensation Seeking*
7	I feel that I can overcome most difficulties.	*Self-Image*
8	I lead a busier life than most people.	*Sensation Seeking*
9	I feel that I have less scholastic ability right now than others.	*SSES (Performance)*
10	I often to things on impulse.	*Sensation Seeking*
11	Do you think that your thoughts and opinions are important?	*Self-Esteem*
12	I like complicated jobs that require a lot of effort and concentration.	*Sensation Seeking*
13	I feel frustrated or rattled about my performance.	*SSES (Performance)*
14	I very seldom spend much time on the details of planning ahead.	*Sensation Seeking*
15	I feel that I am having trouble understanding things that I read.	*SSES (Performance)*
16	I do not have a great deal of energy for life's more demanding tasks.	*Sensation Seeking*
17	I feel confident expressing my opinion(s) in public.	*Self-Esteem*
18	I like to have new and exciting experiences and sensations even if they are a little frightening.	*Sensation Seeking*
19	I feel intelligent.	*Self-Image*
20	I like a challenging task much more than a routine one.	*Sensation Seeking*
21	I feel like I'm not doing well.	*SSES (Performance)*
22	Before I begin a complicated job, I make careful plans.	*Sensation Seeking*

23	I am a confident person.	*Self-Esteem*
24	I like to be doing things all the time.	*Sensation Seeking*
25	I adapt well to change, especially in unpredictable situations.	*Self-Esteem*
26	I would like to take off on a trip with no planned or definite routes or timetable.	*Sensation Seeking*
27	I feel inadequate as a person.	*Depression*
28	I can enjoy myself just lying around and not doing anything active.	*Sensation Seeking*
29	I feel confident that I understand things.	*SSES (Performance)*
30	I can enjoy getting into new situations where you can't predict how things will turn out.	*Sensation Seeking*
31	I have enough free time.	*Happiness*
32	I do not feel the need to be doing things all of the time.	*Sensation Seeking*
33	I feel as smart as others.	*SSES (Performance)*
34	I like doing things just for the thrill of it.	*Sensation Seeking*
35	I consider myself a failure.	*Depression*
36	I would like a job that provided a maximum of leisure time.	*Sensation Seeking*
37	I feel that I am a leader.	*Self-Esteem*
38	I tend to change interests frequently.	*Sensation Seeking*
39	I regret many things in my life.	*Happiness*
40	I usually seem to be in a hurry.	*Sensation Seeking*
41	I always feel good about myself.	*Happiness*
42	I sometime like to do things that are a little frightening.	*Sensation Seeking*
43	I hate my job.	*Happiness*
44	When on vacation, I like to engage in active sports rather than just lie around.	*Sensation Seeking*
45	I believe others speak positively of me.	*Self-Esteem*
46	I like to wear myself out with hard work or exercise.	*Sensation Seeking*
47	I compare myself to others and feel inferior.	*Self-Esteem*
48	I would like the kind of life where one is on the move and traveling a lot, with lots of change and excitement.	*Sensation Seeking*
49	I am worried about whether I am regarded as a success or failure.	*SSES (Social)*
50	I sometimes do "crazy" things just for fun.	*Sensation Seeking*
51	Do you have close relationships with others?	*Depression*
52	I like to be active as soon as I wake up in the morning.	*Sensation Seeking*
53	I feel concerned about the impression I am making.	*SSES (Social)*
54	I like to explore a strange city or section of town by myself, even if it means getting lost.	*Sensation Seeking*
55	I feel competent around my peers.	*Self-Esteem*
56	I prefer friends who are excitingly unpredictable.	*Sensation Seeking*
57	I feel that people generally like me.	*Self-Image*
58	I like to keep busy all of the time.	*Sensation Seeking*
59	I feel self-conscious.	*SSES (Social)*
60	I often get so carried away by new and exciting things and ideas that I never think of possible complications.	*Sensation Seeking*
61	I am happiest when I am alone.	*Extraversion*
62	I can enjoy routine activities that do not require much concentration or effort.	*Sensation Seeking*
63	I never feel depressed.	*Depression*
64	I am an impulsive person.	*Sensation Seeking*
65	I am worried about looking foolish.	*SSES (Social)*
66	When I do things, I do them with lots of energy.	*Sensation Seeking*

67	I will try anything once.	*Extraversion*
68	I like "wild" uninhibited parties.	*Sensation Seeking*
69	I like to be where all the activity is.	*Extraversion*
70	Other people often urge me to "take it easy."	*Sensation Seeking*
71	I am worried about what other people think of me.	*Self-Esteem*
72	Large crowds often make me nervous.	*Extraversion*
73	I feel inferior to others at this moment.	*SSES (Social)*
74	I like to spend my time going out to parties with my friends.	*Extraversion*
75	I get bored easily unless I am with others.	*Extraversion*
76	I like to be the center of attention.	*Extraversion*
77	I like to spend my time quietly reading a book.	*Extraversion*
78	I am usually the person who plans activities.	*Extraversion*
79	I feel uncomfortable in unfamiliar situations.	*Self-Image*
80	I feel that I am not a worthy person.	*Self-Image*
81	I can achieve my life goals.	*Self-Esteem*
82	I am a shy person.	*Extraversion*
83	I often speak out first in social situations.	*Self-Esteem*
84	Do you have a positive outlook for the future?	*Self-Esteem*
85	Do you have trouble making friends?	*Self-Esteem*
86	I am comfortable with my appearance.	*Self-Image*
87	I look for personal flaws in myself.	*Self-Image*
88	I am satisfied with my weight.	*Self-Image*
89	I often feel relaxed.	*Happiness*
90	I feel good about myself.	*SSES (Appearance)*
91	I spend a lot of time worrying about my appearance.	*Self-Esteem*
92	I enjoy looking in the mirror.	*Self-Image*
93	I am pleased with my appearance right now.	*SSES (Appearance)*
94	I feel satisfied with the way my body looks right now.	*SSES (Appearance)*
95	I am well like by others.	*Self-Image*
96	I feel concerned about making a good first impression.	*Self-Esteem*
97	I feel that others respect and admire me.	*SSES (Appearance)*
98	I feel that I am an attractive person.	*Self-Image*
99	I have an easy time making new friends.	*Depression*
100	My appetite has not changed.	*Depression*
101	I feel unattractive.	*SSES (Appearance)*
102	I have a good relationship with my family.	*Happiness*
103	I am dissatisfied with my weight.	*SSES (Appearance)*
104	I have a lot of stress in my life.	*Happiness*
105	I cry frequently.	*Depression*
106	I have negative thoughts about myself.	*Depression*
107	I have many friends.	*Happiness*
108	I sleep more than normal.	*Depression*
109	I have lost or gained weight over the past month.	*Depression*
110	I am happy most of the day, everyday.	*Depression*
111	I have trouble staying awake or falling asleep more than is normal.	*Depression*
112	I enjoy life.	*Happiness*
113	I wish I were someone else.	*Self-Image*
114	I am happy.	*Self-Image*
115	I feel that I do not deserve happiness.	*Self-Image*
116	I feel that I am a lucky person.	*Self-Image*
117	I laugh a lot.	*Happiness*
118	I feel that I can make a difference.	*Self-Image*

Note. SSES = State Self-Esteem Scale