

# Survey of Attitudes Toward Statistics: An Exploratory Look

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## Abstract

This paper presents some examples of simple analyses that instructors can perform on their own SATS © data.

**Key Words:** Attitudes, SATS, Statistics Education

## 1. Introduction

The Survey of Attitudes Toward Statistics (SATS ©) is a copyrighted instrument which measures six attitudinal components: Affect, Cognitive Competency, Value, Difficulty, Interest, and Effort. Descriptions of the attitudinal components were given elsewhere in the panel presentation. The purpose of this article is to show some simple analyses that instructors can perform on the SATS © data from their classes. Due to the restrictive length of this paper in these proceedings, this document gives a few examples and not a complete list of possible analyses.

The data was collected at a four-year residential, private, liberal arts college in the Midwest. The data was collected over four semesters (Fall 2004, Spring 2005, Fall 2005, and Spring 2006) with two sections per semester. The title of the course is “Elementary Statistics.” The course has no pre-requisite and is a required course for the following majors: Business Administration, Accounting, Psychology, and Sociology. Every course was taught by the same instructor.

The SATS © was administered using the paper and pencil form. The Pre-test was given the first day of class while the Post-test was given the last day of class. The number of students who took the Pre-test but not the Post-test is 46, the number of students who took the Post-test but not the Pre-test is 14, and 194 students took both the Pre- and Post-test. The remaining analyses are only for the students who took both the Pre-and Post-test. Also, the analyses combine all sections across the four semesters.

For all of the attitudinal components, a score of four (4) indicates Neutral (neither agrees or disagrees). For all of the attitudinal components, a score below 4 indicates that the student exhibits a more negative attitude, and a score above 4 indicates a more positive attitude. One needs to be careful with Difficulty. Difficulty scores below 4 indicates that the student feels that the course is difficult while scores above 4 indicates that the student feels the course is not as difficult.

## 2. Demographics

All of the students are below 30 years old with 2.5% (5 out of 194) being between 23 to 29 years old. The rest of the students are 22 years old or below. Concerning race, 85% of the students classify themselves as “White Americans” while only 4% of the students classify themselves a “Foreign Students.” The students report that their current GPA is 2.87 with a standard deviation of 0.69 points. Most of the students (86%) are underclassmen (FR or SO).

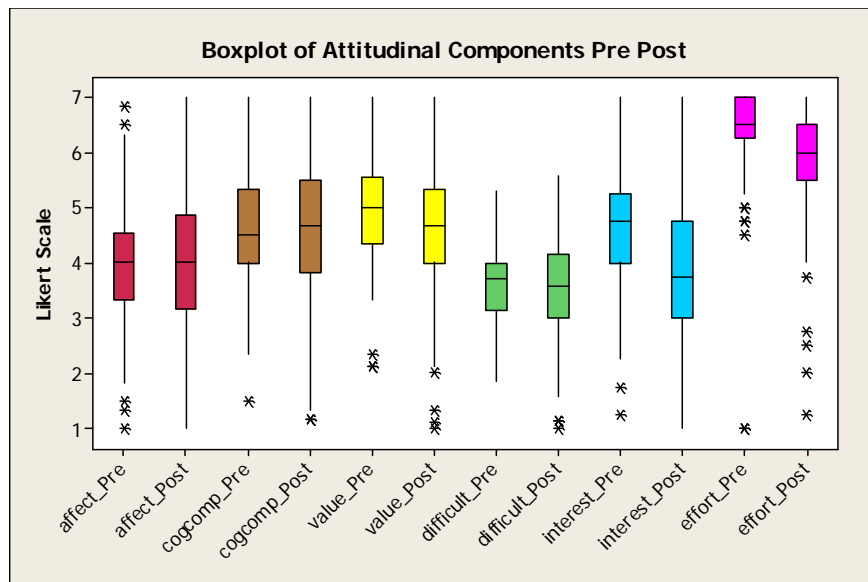
## 3. Comparison of Average Attitudinal Components Pre-test to Post-test

Side-by-side boxplots of each attitudinal component (Figure 1) and a table of the actual differences (Table 1) are created. From both Table 1 and Figure 1, one observes that there is a small or no difference (on average) between Pre- and Post-test for Difficulty, Affect, and Cognitive Competency. In general, Affect is around 4 (neutral) while Difficulty is around 0.5 points below neutral and Cognitive Competency is 0.5 points above neutral. So, these students feel that Statistics is slightly difficult, but they feel that they have an ability to do Statistics (slightly above neutral). These attitudes did not change **on average** as a result of the course. We will see later that attitudes did change from

Pre- to Post-test for individual students, so it is important to remember that for these results, we are looking at “in general.”

**Table 1:** Mean Differences and Cohen’s d for (Post – Pre) of the Attitudinal Components

Component	Mean Difference	Cohen’s d	Interpretation
Interest	-0.82	-0.68	Large
Effort	-0.56	-0.65	Large
Value	-0.37	-0.39	Medium
Difficulty	-0.06	-0.08	Small
Affect	0.01	0.01	Small
Cognitive Competency	0.00	0.00	Small



**Figure 1:** Side-by-Side Boxplot of Attitudinal Components Pre-test to Post-Test (Affect, Cognitive Competency, Value, Difficulty, Interest, and Effort)

For Interest, Effort, and Value, there is a decrease in attitudes from Pre- to Post-test, so for these attitudes, students had a worse attitude after the course. Interest and Effort experience a large drop in general while Value had a medium drop. Could this be the general result of students being less interested or have less value in a course when it is over, or starting a course expecting to put in a lot of effort but in the end, expending less effort? Although one could question whether these drops are a natural drop from Pre- to Post-test, most instructors would be concerned with a drop in Interest and Value after the course because if students do not value a subject, they probably won’t use the subject matter. This is probably an area in which researchers should further investigate.

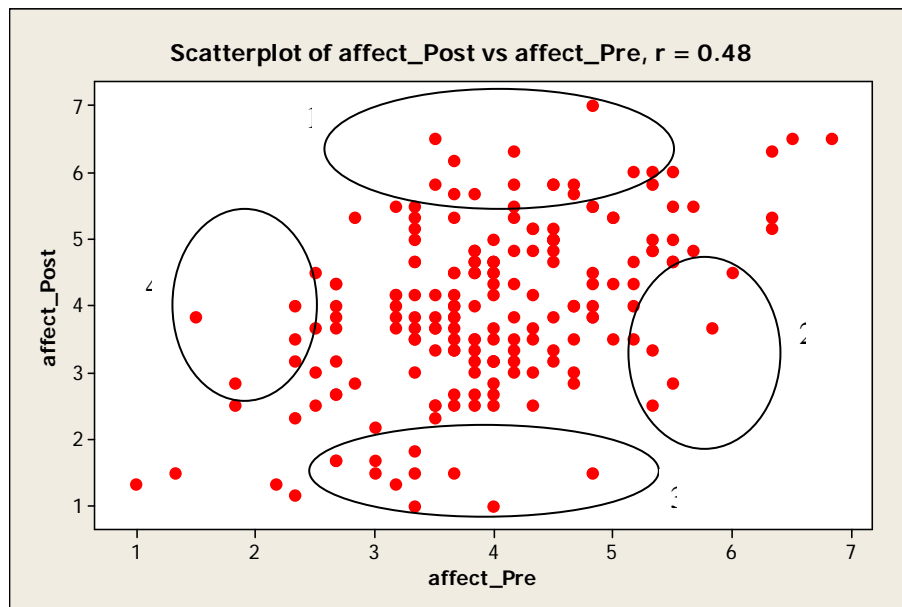
By looking at the Figure 1 (and by looking at simple descriptive statistics which are not included in this paper, but could easily be calculated by instructors), one can make several simple observations. For all of the attitudinal components except for Effort, the distribution of scores appears to be symmetric. Effort is skewed to the left. Most of the scores do contain outliers, and these outliers tend to be toward the negative attitudes. It is important to remember that for each of the attitudinal component scores that the score is an average of the responses of several questions. In order for a student to have a score of 1 or 7, the student would have had to answer 1 on every question or a 7 on every question in that attitudinal components grouping of questions which ranges from 4 questions (Interest & Effort), to 6 questions (Affect, Cognitive Competency) to 7 questions (Difficulty) to 9 questions (Value), so these outliers may merit further investigation. Also, one observes that the Post-test scores are more variable than the Pre-test scores. Many of these trends (skewedness of Effort, more variability in Post-test, and drop in Value & Interest from Pre- to Post-test) are not just seen in this data set but have been seen repeatedly in many other data sets.

#### 4. Analyses of Change of Position

Consider what it means “to keep the same position.” To explain this, we will assume that there is a small or no difference on average between Pre- and Post-test; however, the explanation can be extended easily to a situation in which there is a larger difference on average between Pre- and Post-test. To keep the same position means that a student would maintain a similar score on the Post-test as he/she did on the Pre-test. A student who had a low attitude on the Pre-test would have a low attitude on the Post-test, likewise for higher and neutral scores. If students kept the same position, we would expect that the Pearson correlation coefficient would be relatively strong. However, if the correlation is not strong, then we should investigate “change of position.”

For Affect, the correlation coefficient is 0.48. Figure 2 contains the scatterplot of Affect, Pre-test versus Post-test with four circles drawn which are labeled 1, 2, 3, and 4. Circle 1 indicates those students who started the course around neutral concerning their feelings toward Statistics, but by the end of the course, their feelings are substantially more positive. However, Circle 3 contains those students in which the opposite is true. They started the course around neutral, but ended the course with strongly negative feelings toward Statistics. Circles 2 and 4 contain students who began the course with positive or negative attitudes (respectively) yet ended the course with neutral attitudes. Lastly, consider the multiple points above the value 4 (neutral) for the Pre-test. There is a wide range of values for the Post-test scores, from 1 to 6.

Recall that Affect had a small average difference between Post-test and Pre-test, so looking at the sections as a whole, the course had little influence on how students feel toward Statistics; however, by looking at individual students, we observe change of positions. At this point of the analysis, instructors could use the additional questions which are asked on the SATS © such as previous mathematics background, how much they expect to use Statistics in the future, expected grade, actual grade in course, etc.



**Figure 2: Scatterplot of Affect Pre-test versus Affect Post-test, n = 194.**

Presented here is just a small example of easy analyses that instructors can perform on the SATS © data set, and we have not begun to investigate the additional questions contained in the data sets. Instructors can learn a lot about their students’ attitudes which will, hopefully, help the instructor understand and teach their students better.