

# **Interactive Learning Tools and Demonstrations for Behavioral Statistics Courses**

## **An Application for ACS Summer Technology Fellowship**

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### Background:

In the behavior sciences, the abstract nature of methodological and statistical issues make course material in these areas particularly challenging for many students. To the extent this material can be made more concrete, many students benefit as these abstract concepts are demonstrated via interactive visual displays. In addition, research has shown that learning improves to the extent students can interact with and manipulate relevant information. This is perhaps particularly true in methodological and statistical courses, in which students frequently benefit from context-based interactive exercises. For example, an understanding of effect size calculations can benefit from students observing the change in calculations as groups of scores are manipulated.

The goal of the proposed project is to develop interactive demonstration and learning activity modules for behavioral statistics and methods courses. These modules will include a) demonstration tools for instructors to use in class as well as b) student versions of these demonstrations that provide context-relevant explanations for individual study. By providing interactive demonstrations for instructors to use in class and related activities providing students interactive learning tools, students' comprehension of the material should improve.

Though similar activities and exercises are available through some publishing companies and websites, these modules are usually a) associated with a particular textbook, so they aren't freely available; b) non-manipulable by instructors desiring a classroom demonstration tool; and c) present the material at a level of complexity appropriate for either classroom use or personal instruction (usually the latter), but not transferable for ideal learning in both environments.

### Description:

After a review of behavioral statistics and methodology course materials, modules containing interactive demonstrations and activities will be developed and posted to a website for instructors and students to access. Instructor-oriented demonstration versions of the activities will have an interactive component, but little explanation for the concepts involved, allowing these demonstrations to be used by instructors in conjunction with their own explanations. Student-oriented versions of the activities will contain accompanying explanation of the concepts involved, allowing students to use them on their own (e.g., to review concepts after seeing the instructor use the demonstration.) . The modules will be made available for download or display over the web from a website.

Scaled-down versions of 2 sample activities were developed to test the authoring tool and premise of the project. The first sample displays calculation of correlation coefficients and the corresponding display of scores. In this concept version, users place 5 data points on the XY graph and the computer then calculates the coefficient. Over several attempts, it serves as a visual display of the strength of relationships between data points and the corresponding correlation coefficient. The second sample displays the calculation of effect size estimates as users manipulate the relationship between sets of scores. Specifically, it displays 2 distributions of scores along a continuum and allows a user to slide one of the distributions, altering its

relative position to the other distribution. Over repeated manipulations and effect size calculations, users can get a sense of the relationship between sample comparisons and estimates of effect size.

Modules will Include (but are not limited to):

**A. Descriptive Statistics**

Central Tendency and Skewness  
Charts and Graphs

**B. Correlation and Regression**

Correlation/Scatterplot Examples  
Calculating Correlation Coefficients  
Regression Line and Least Squares  
Multiple Regression and Variance

**C. The logic of Inferential Statistics**

t-test Comparisons  
Power and Alpha Levels  
Constructing Confidence Intervals  
Calculating Effect Size  
Constructing Sampling Distributions

**D. Factorial ANOVA**

Demonstrating Interaction Effects

Timeline:

Modules will be developed in May and June of 2006 for use in Centenary College's summer statistics course. Feedback will be provided by the students in the course and these evaluations will be used in July to improve the modules.

Technology:

The modules will be developed using Macromedia's Authorware program, a powerful authoring tool popular for creating interactive webpages and learning exercises. Executable files created with Authorware are playable in any web browser with the free Shockwave plugin (which can be made available from the website) and can even be executed in a stand alone format.

The psychology department at Centenary College already has Authorware and the files will be housed on Centenary's server, so no special technology is necessary.

Other Support:

Other than space on the server, no other institutional support is needed.

Learning Outcomes:

The different versions of the modules have different objectives, with the instructor version designed to aid classroom instruction and the student version to assist with independent learning. Through the use of the interactive demonstrations, instructors can engage their students with dynamic visual displays. This allows students to see how results of calculations change as the elements of the calculations are manipulated. Pedagogical research suggests this should aid in students *construction of understanding* rather than simply memorization of information.

The student version will have explanation of the concepts and calculations available that are not available in the instructor version. These will allow students the opportunity to manipulate the activities for their own learning objectives. The interactivity should allow students better opportunities to visualize the course material and make it concrete rather than abstract.

Curriculum:

The instructor modules can be incorporated into class lecture, supplementing the instructor's presentation of class material. The Authorware files used in creating the modules

will be available for download, completely alterable for anyone with Authorware. Course instructors can inform students of the student versions, made available through the website housing the modules. This way, students can access the modules any time they want to.

Assessment:

An email address will be provided on the website to allow instructors using the materials to offer suggestions and corrections to the modules. In addition, there will be an opportunity for instructors developing their own materials to supply those for adding to the course website. The summer statistics course at Centenary College will be used in the development of the modules. The behavioral statistics and research methods courses at Centenary College in the 2006-2007 academic year will see the implementation of the modules, with subsequent evaluation of the modules by the students each semester. Specifically, at the end of the fall 2006 and spring 2007 semesters, students will complete a brief evaluation form regarding the modules, assessing their a) Usefulness, b) Ease of Use, and c) Clarity.

Collaboration and Dissemination:

In addition to the project author (Matthew Weeks), additional faculty at Centenary College who teach statistics (Dr. Betsy Rankin, Economics; Dr. Bobbi Carothers, Psychology) will assist in reviewing the modules as they are developed. The website making the modules available will be listed with the ACS On-Line Course Materials Database.