

## **2005-2007 LITRE Grant Proposal**

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### **1. Project Title:**

Online Computing for Introductory Statistics Courses

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### **2. Project Coordinator:**

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### **3. Other Participants:**

Dr. Roger Woodard

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### **4. College or Unit:**

PAMS

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### **5. Department:**

Statistics

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### **6. Project Description:**

This proposal seeks to make statistical software available for use in lower division statistics courses by purchasing a site license for StatCrunch, a server on which it can run and by providing salary support for faculty to develop instructional materials which make use of StatCrunch. StatCrunch is a full-featured, pedagogically sound statistical package that runs via Java window through a web browser. It is exceptionally easy to use and does not require installation or support on the end user's machine.

The NCSU Department of Statistics teaches several introductory statistics courses. The largest of these is ST 311 (Introduction to Statistics). ST 311 is a multi-section course taught primarily by senior graduate teaching assistants under the close mentoring of faculty coordinators. Annually, approximately 1400 students take this course from dozens of majors. The course currently makes very little use of technology. Some instructors use technology for presenting material and making demonstrations. If funded, this project would introduce hands on analysis of real data into ST311 and capitalize on equipment available in Class Tech rooms for in-class demonstrations.

The American Statistical Association (ASA) funded the Guidelines for Assessment and Instruction in Statistics Education Project (GAISE) in 2003. One part of the project focused on college-level introductory statistics courses. The GAISE report (<http://it.stlawu.edu/~rlock/gaise/>) gave six

recommendations for teaching introductory statistics courses. One of those recommendations was “Use technology for developing concepts and analyzing data”.

In choosing technology for a course, the GAISE report recommended the following criteria

- Ease of data entry, ability to import data in multiple formats
- Interactive capabilities
- Dynamic linking between data, graphical, and numerical analyses
- Ease of use for particular audiences
- Availability to students, portability

StatCrunch is a software package that meets all of these criteria. Based on information from the website [www.StatCrunch.com](http://www.StatCrunch.com):

“StatCrunch was created and programmed by a team of programmers and statisticians led by Webster West. Dr. West is in the Department of Statistics at the University of South Carolina. The package was created as an initial attempt to solve many of the problems that exist with the delivery and use of modern statistical software. Many times statisticians develop procedures in languages such as Splus, SAS, Minitab, etc., which are very specific to statisticians. Students and other potential users may not have access to these languages, and therefore may not be able to use the procedures. By using Java and the World Wide Web, StatCrunch should reach the broadest possible audience of any statistical software of its kind.”

In addition to the GAISE criteria, a common platform for computing that is low cost and low maintenance is needed. A site license for StatCrunch is \$400 for unlimited users.

StatCrunch is currently being used in some sections of ST101 and ST370 and students have found it easy to use. Since the computing software is not a stumbling block, the students can concentrate understanding the statistical concepts. The software also can be used to help students learn concepts and let them explore data more easily than with other software packages. If funded, this project would introduce computing into ST311, the largest of the introductory service courses, and expand its use in ST 370, the largest introductory statistics course for engineers. Currently, students are using StatCrunch through the commercial server at StatCrunch.com. However, this server currently has 40,000 registered users. To improve the potential speed of access and reliability, students would access StatCrunch through a server based here at NCSU and supported by IT staff in the Department of Statistics.

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## **7. Project Objectives:**

We will incorporate hands-on analysis of real data for all students in ST 311. This is an essential part of a modern-day statistics course. Currently, students are only able to analyze “toy” data sets or to work with pre-analyzed data.

StatCrunch will allow students to get their hands dirty with the data. The GAISE report lists several suggestions for teachers to use technology in introductory statistics courses. Among those suggestions are

- Access large, real data sets
- Automate calculations
- Generate and modify appropriate statistical graphics
- Explore “what happens if ...”-type questions
- Create reports

We will also develop tools for instructors (mostly senior graduate teaching assistants) in these classes. This will provide instructors with in-class demonstrations that can be used to illustrate statistical concepts for the students and allow the instructor to capitalize on the Class Tech equipment. To reinforce both the computing and the statistical concepts, we will develop homework assignments for ST 311 and modify the current on-line labs for ST 370.

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#### **8. Estimated number of students affected:**

In ST 311, approximately 1400 students per academic year.

In ST 370, approximately 900 students per academic year.

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#### **9. Outcomes of the Project:**

1. Students will be able to calculate statistical summaries of data sets, including mean, standard deviation, median and quartiles.
2. Students will be able to generate and modify statistical graphics, including histograms, boxplots and scatterplots.
3. Students will be able to create and interpret statistical analyses for relatively large data sets.
4. Students will be able to write a report that describes the statistical analysis of a data set, including appropriate numeric and graphical summaries.
5. Students will be able to write a report using methods of statistical inference, interpreting the inference in context.

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#### **10. Project impact on NCSU:**

Statistical tools are used in many disciplines. Students from almost every discipline have a need to conduct analysis of data collected from their research or class projects. We anticipate that students will have a better understanding of how statistical analyses can be applied to real data. This better appreciation will help students put their statistical knowledge to use in their future classes. Currently, ST370 students conduct experiments and conduct analysis of the data collected in those experiments. We anticipate the expanded access to statistical software via StatCrunch will encourage students to use this software

in the analysis of their future experiments.

A related possible outcome of this project will be the expanded availability of statistical analysis to ST311 students after the completion of the course. The web based nature of StatCrunch will allow students to use it for any subsequent course at NCSU. For instance, students in a biological sciences class could make use of StatCrunch in conducting the analysis of an experiment they have conducted in a biology lab.

Another possible outcome of this project will be expanded use of StatCrunch in other statistics courses. Potential courses that might use StatCrunch would be ST350 which serves over 800 students per year. Service graduate courses such as ST507 and ST508 which serve graduate students in the social sciences might also make use of this software.

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### **11. Project Assessment Plan:**

Learning outcomes #1-3 will be assessed using out of class homework assignments. Students will be given data sets to analyze. They will be assessed on their ability to construct numeric and graphical summaries.

Learning outcomes #3-5 will be assessed using written report assignments. An example assignment will have a student collect data from sources available via the internet, e.g., a study of home prices in Wake County by collecting data from the Wake county government website, data from the Center for Disease Control's national surveys of health, or data from Amazon.com to compare book prices with the bookstore. Students will be assessed on their ability to choose appropriate numeric and graphical summaries, conduct appropriate statistical inference and present the results of the analysis in context.

During Fall 2005, ST 311 students completed the Attitudes toward Statistics Survey at the beginning of the semester. Data will also be collected at the end of the semester. This will be repeated in Spring 2006. These data will serve as a baseline. The attitude survey will be administered in Fall 2006 and Spring 2007, providing evidence of whether students' attitudes towards statistics as a discipline, statistics in their every day lives and statistics in their disciplines are affected by use of software.

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### **12. Staffing and Support:**

Roger Woodard and Pam Arroyaw will receive salary support to develop instructional materials and assessment tools related to StatCrunch.

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### **13. Financial Support Requested:**

**EPA salary total:** \$10,000

**SPA salary total:**

**Other salary:**

**Equipment:**

**Cost associated with assessment:**

**Other financial support requested:**

**Total Funds requested:** \$10,000

**Additional Explanation of how funds will be used:**

The requested funds will cover approximately 1/2 month of summer salary support for each of the faculty members (Arroway and Woodard), including 23% fringe. If this grant is funded, the Department of Statistics has agreed to contribute approximately \$6050 to this project for IT staff salary support and equipment. These expenses are detailed below.

IT staff within the Department of Statistics will receive salary support to provide technical support for the hardware and software. The Department of Statistics will cover these expenses. We estimate this will take 20 hours of set up time and 2 hours / week maintenance while classes are in session. Total hours of about 110 hours, or approximately \$1650.

Equipment funds: This proposal requires \$400 for site license / year for 2 years and \$3,600 for a server. , for a total of \$4400. These expenses will also be covered by the Department of Statistics.

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**14. Funding Breakdown:**

**Total funding requested for fiscal year 2005-2006:** \$10,000

**Total funding requested for fiscal year 2006-2007:**

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**15. Staff Support and/or Technical Support Requested:**

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**16. Timetable for Implementation:**

Spring 2006, Pilot StatCrunch in ST 370 (one section) using on-line free version

Summer 2006, Convert existing ST 370 lab tutorials to StatCrunch; Purchase site license, install and test software

Fall 2006, Implement StatCrunch for all sections of ST 370; Develop tutorials and assignments for ST 311

Spring 2007, Implement StatCrunch as the computing tool of choice for ST 311 students.

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**17. Human Subjects Protection:**

If your proposal project involves research using human subjects, you will need approval from the Institutional Review Board for the Protection of Human Subjects in Research (IRB) prior to final approval. IRB information is available at <http://www.ncsu.edu/sparcs/irb>



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**18. Proposal Release:**

By submitting this proposal the applicant grants the LITRE Advisory Board

permission to make this proposal available as an example for future grant applicants. All personal information will be removed if this proposal is used as an example.

