A Research-Based Pilot Course for Statistics As A Component of a 4-year

Undergraduate Research Experience

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Outline of Topics

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Motivation

- ✓ Students require guidance using statistical methods to investigate a research question
- ✓ A need to develop the students' ability to read and interpret technical statistical and mathematics literature
- ✓ Students must
  - ✓ Develop data collection techniques
  - ✓ Conduct proper hypothesis tests
  - ✓ Use technology to report results (including creating visually stimulating graphs)
  - ✓ Write papers of interest
- ✓ A need to "raise morale" as there is a high level of mathematical and statistical anxiety in students

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Project Description

- ✓ MATH 2000 – Elementary Statistics
  - ✓ A Healthy diet and exercise theme to the course
- ✓ Two Instructors
- ✓ Two Undergraduate Teacher Assistants (1 per instructor)
- ✓ 4 sections of the course taught:
- ✓ 2 Research-based Courses
- ✓ 2 Control Courses

Course Objectives

Students will:

- Form a well-designed research question based on exercise and healthy diet;
- Engage in a literature review of the topic by investigating similar previous studies;
- Learn statistical and data analysis techniques needed to pursue the objective;
- Become acquainted with necessary and/or useful technology for their project;
- Conduct in-class group interviews with experts in the field; and
- Complete a report at the end of the semester

Proposal Goals

Construct a project-based learning approach that covers the "Essential Features of Undergraduate Research" including:

- ➢ Review of scientific literature
- ➢ Group work
- ➢ Ownership of the project
- ➢ Mastering of techniques
- ➢ Designing a focused research question
- ➢ Reporting significant findings
- ➢ Attendance at professional meetings

Pilot Description

10 Week Embedded Research Module	
Week 1	Design a Research Question
Week 2	Collection of Quantitative Data 1
Week 3	Review of Literature
Week 4	Collection of Qualitative Data
Week 5	Collection of Quantitative Data 2
Week 6	Survey Design
Week 7 – 8	Data Analysis: Perform T-tests, construct regression models, and observe trends
Week 9 – 10	Write a report as a final product/peer review process

The Guest Speakers

Katie Scharf, Fitness professional and cohost of the "Dr. Fitness and the Fat Guy radio show".

Jennifer Moon, MS, NCC, LPC, Director of Outpatient Services at Peachford Behavioral Health Systems and owner of the Resolutions Counseling and Consulting Group.

Project Descriptions

MATH 2000-01 Project (Brewley's Course)

Class Research Question:

Does Drinking Caffeine Before Walking Burn More Calories Than Drinking Water?

- Hypothesis test concluding that there is no difference in caloric burn when drinking caffeinated beverages versus drinking water

Project Descriptions

MATH 2000-02 Project (Sinclair's Course)

Class Research Question:

What Can We Do to Improve Our Physical Fitness as College Students?

- Regression model involving calories consumed and steps taken per day
- Hypothesis test concluding our students walk less than the recommended 10,000 steps per day.

@GGC Students &Technology in Academia Research & Service (STARS)

@GGC STARS

Preliminary Assessment Results

Comparing Dr. Brewley's Research based (RB) and Control Group (CG) classes.

Course Goals	Brewley – RB (%)	Brewley –CG (%)
See Statistical Analysis as a practical and useful tool in today's society.	53.33	73.68
Understand that variability is natural, predictable and quantifiable.	50	68.95
Know the parts of the process through which Statistics works to answer questions	82.22	98.95
Choose the appropriate graph and analysis techniques to address research questions	65.56	73.68
Communicate the results of a statistical study in the context of the given scenario, including scope of inference and causality.	52.22	89.47
Use Statistical language appropriately.	55.56	84.21
Use appropriate technology in the evolution, analysis and synthesis of information in problem solving situations.	72.22	81.58

Preliminary Assessment Results

Comparing Dr. Sinclair's Research based (RB) and Control Group (CG) classes.

Course Goals	Sinclair – RB (%)	Sinclair –CG (%)
See Statistical Analysis as a practical and useful tool in today's society.	75.8	88.3
Understand that variability is natural, predictable and quantifiable.	62.5	65
Know the parts of the process through which Statistics works to answer questions	87.5	98.3
Choose the appropriate graph and analysis techniques to address research questions	87.5	92.5
Communicate the results of a statistical study in the context of the given scenario, including scope of inference and causality.	77.5	75.8
Use Statistical language appropriately.	85.8	88.3
Use appropriate technology in the evolution, analysis and synthesis of information in problem solving situations.	97.5	91.7

Preliminary Assessment Results

IEE3 – Demonstrate effective use of technology

IEE8 – Demonstrate effective quantitative reasoning

IEE	Course Goals	RB (%)	CG (%)
8	See Statistical Analysis as a practical and useful tool in today's society.	75.8	88.3
	Understand that variability is natural, predictable and quantifiable.	62.5	65
	Know the parts of the process through which Statistics works to answer questions	87.5	98.3
	Choose the appropriate graph and analysis techniques to address research questions	87.5	92.5
	Communicate the results of a statistical study in the context of the given scenario, including scope of inference and causality.	77.5	75.8
	Use Statistical language appropriately.	85.8	88.3
3	Use appropriate technology in the evolution, analysis and synthesis of information in problem solving situations.	97.5	91.7

Student Evaluations - Highlights

"I really liked it (the overall design of the course), liked the way our project was integrated into the entire course, and I enjoyed the 'fitness' theme."

"It (the research-based course) made such projects and research less intimidating and I feel much more comfortable doing more (research) in the future."

"To see what I've learned being used in real life problems, supports my high opinion of the research-based course design."

"Applying what you learn in class to a research project is very rewarding."

"(This course) has prepared me to conduct statistical analysis in psychological studies, which I will be doing in my field."

"(The course) related (statistics applications) to biology, which I have used already."

"Most classes don't have a goal to achieve so I liked that this class did."

"The project, working with a team, (and) going through the process or research steps (contributed most to my learning)."

Student Evaluations - Lowlights

"Guidelines were not clear."

"(Would want to) be able to pick up a study from a medical journal and decipher what the technical jargon means."

"The course design took away time I could have dedicated to learning the important concepts to pass the class."

"I would make group projects rather than a whole class project."
"I feel the project takes away from the course."

"(The instructor should) give more time to work on the project."

T. A . Course Reflection

"This opportunity has given me such a great experience with other college students. I am able to go around and help each student individually in anything they have a question on. It has given me such great confidence to be able to help other students who are my age or even older. I believe it has also given me an opportunity as a future teacher what it feels like to be a teacher in the college.......Having a (supervisor) that leaves good instructions helped me very (much). I learned to be patient and open-minded."

## What's Next Future Plans for Research

- Currently running five pilot courses and collecting additional data in the 2012-2013 school year
- Refining how statistics content is aligned with research-based project components

Future Plans for Work

- Refine student engagement activities and the research project components
- Work on improvements and develop teaching materials and possibilities for collaborations with other disciplines Summer 2013
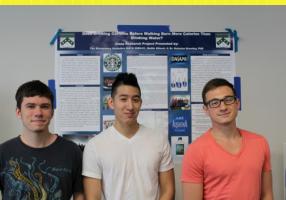
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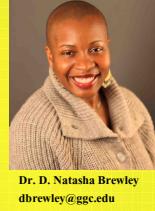
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