Bridging formal and informal approaches to increase understanding and decrease anxiety in research methods courses [1]

Jennifer C. Gibbs
Department of Criminology and Criminal Justice
University of Maryland, College Park
and
Amanda J. McIntosh
Montgomery College

ABSTRACT

Experiential learning assists student understanding and creates socio-emotional benefits through peer-to-peer and student-to-instructor interaction. However, implementation can be challenging, especially when students are anxious about subject matter, as they often are in research methods or statistics courses. In such cases, student anxiety may impede learning and counteract any benefits from experiential learning.

In this study, we examine one technique (food) as a means of bridging informal and formal learning methods to reduce anxiety and increase student understanding. Here, a chicken wing "cook-off" was used to teach graduate students operationalization and measurement, survey development, data collection and entry, and descriptive statistics. Quantitative analyses (based on pre- and post-assessments) of this activity measure modest but significant improvement in student learning throughout the course; qualitative analyses indicate student satisfaction with teaching methods and that students believed the instructor was invested in their learning. Implications of these findings and applicability to other classes are discussed.

Keywords: teaching research methods, teaching statistics, food exercise, active learning, action learning

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Introduction

Students, even graduate students, often find research methods and statistics courses very stressful, which impedes learning (Auster, 2000; Briggs, Brown, Gardner & Davidson, 2009; Davis 2003; Green, Bretzin, Leininger and Stauffer, 2001). Teachers have long recognized this (e.g., Briggs et al., 2009; Leming, 1979; Macheski, Lowney, Buhrmann & Bush, 2008) and have recommended several techniques to encourage students to take an active approach to their own learning (e.g., Bordt, 1999; Lanier 2002; Longmore Dunn and Jarboe, 1996; Macheski et al., 2008). One such approach has been relatively absent from the literature: using food to actively engage students. Here, we explore the use of food throughout a program evaluation course with topics including research methods and descriptive statistics. Specifically, this project explores three research questions: (1) Do students believe the instructor is invested in their learning by using this method? (2) Does food increase student engagement? and (3) Does using food to introduce concepts improve learning?

After a brief review of the literature on student perception of instructor investment, student anxiety in research methods and statistics courses, the benefits of experiential learning, and incorporating food into the classroom and learning, the activity – using food to teach research methods – will be described. Assessments of the activity, addressing the three research questions outlined above, are presented and discussed.

Review of Literature

Anxiety in the classroom: Research Methods and Statistics

Many students experience anxiety when taking research methods and statistics courses (Auster, 2000; Bridges, Gillmore, Pershing and Bates, 1998; Briggs et al., 2009; Hubbell, 1994).

Students find the subject matter "uninteresting", difficult and irrelevant; and courses that emphasize quantitative techniques amplify student anxiety (Auster, 2000; Blalock, 1987; Briggs et al., 1998; Briggs et al., 2009; Hubbell, 1994). This is particularly problematic when anxiety leads to a decrease in learning, performance, and academic achievement, as research suggests it does (Robotham & Julian, 2006; Rosenfeld, 1978). Math anxiety in particular, which is associated with research methods and statistics courses, is shown to contribute to lower test scores and negatively influences mental processing during problem-solving (Ashcraft, 2002; Betz, 1978).

The literature proposes several ways for instructors to combat such anxiety to increase student learning. Two ways to increase student learning are increasing student perception of instructor investment in students and incorporating active learning techniques into the classroom. A brief review of the literature on each technique is discussed in the sections to follow.

Faculty Investment in Students through Increased Interaction

One purpose of this paper is to examine whether incorporating food into the classroom led students to believe the instructor is invested in their learning and, if so, whether that perception positively impacted their experience in a research methods course. When students believe that faculty are supportive, approachable and encouraging, they are more likely to increase the amount of effort they put forth in their academic work (Kuh, Schuh, Whitt, Andreas, Lyons, Strange, Krehbiel & MacKay, 1991). Further, research indicates that when student satisfaction with faculty interaction increases, there is also an increase in scientific reasoning, career development, intellectual development, and problem-solving (Eimers, 2001).

Experiential Learning

Experiential learning, or the process of constructing knowledge through direct experience, is often incorporated in classrooms to help students connect with material using hands-on and active learning experiences. Research indicates that experiential and activity-based learning increases student motivation and engagement, interest in the subject matter and leads students to deeper understanding and knowledge (e.g., Ahlfeldt, Mehta & Sellnow, 2005; Benson & Blackman, 2003; Reid & Barrington, 1999; Seeler, Turnwald & Bull, 1994). Additionally, increased classroom interaction, not only with peers but with faculty as well, creates a social-emotional benefit (Hickcox, 2002).

Experiential learning is particularly advantageous for adults, especially college students (Reed, 1993; see also Withrow, 2002, recommending a practical research assignment to students who are police officers). Bluestone (2007) examined the role of hands-on learning in teaching research methods, and found that students' confidence in their ability to apply the material increased significantly after participating in experiential learning activities, which included hands-on investigative research techniques. This is critical, as Bluestone found that students who felt more confident about their *ability* to learn the material tended to score higher on the comprehensive quiz and also reported that they learned more from these activities. Pre- and post-survey results also indicated that the activities helped students gain understanding of the material and those students found the knowledge acquired to be transferrable and applicable to other aspects of their lives.

While it is well-established that experiential learning is beneficial in research methods classes (Bluestone, 2007; Benson & Blackman, 2003; Longmore, et al., 1996), *how* to incorporate hands-on learning in a way that overcomes student anxiety is debatable. Researchers have examined the impact of group projects, simulations, workshops, practical experience and

other methods to enhance student understanding, finding success in many of these. Similarly, we propose that incorporating food into the formal classroom is one way to maximize the benefits of experiential learning while reducing student anxiety.

Food can serve many purposes in the classroom (e.g., community building, hands-on learning, a source of energy to engage students), but examples of such uses mostly are published outside the social sciences (see, e.g., Chavez & Poirier, 2007). One excellent exception and perhaps most relevant to the present study, Auster (2000) used M&M's in a statistics course to teach the importance of sampling. Students were given M&M's candies and asked to find the proportion of yellow M&M's. Students pooled their candies into larger and larger groups, repeating their computations, thus demonstrating sampling theory. Auster reported that, in response to a questionnaire distributed to students, most agreed that the activity was at least somewhat useful and interesting, and informal conversations with students demonstrated their understanding of sampling theory.

In short, adult learners tend to work longer and harder when they are sufficiently motivated to learn (Helterban, 2007). When we incorporate food into the classrooms and involve students, we can blur the boundaries between informal and formal learning and create intrinsic motivation; students are often more interested and motivated to learn. Incorporating food into classrooms should increase student motivation and enhance active learning.

Course Activity Description

The food theme was applied to a *Program Effectiveness and Evaluation* course offered during the 2008-2009 academic year at a large university in eastern United States. While there were several learning objectives for the course, the most relevant to this activity are that students are able to (1) critically assess and apply research methods; and (2) analyze and interpret data

gathered from evaluation tools. To assess whether these learning outcomes have been met, preliminary and final assessments (pre-test/post-test) were administered, as described below.

The larger graduate program of which the course is a part follows a cohort structure; community building is a goal of the program. Students enrolled in this program are emergency responders, mostly police officers. In this particular course, 14 students were enrolled. The course was taught during a 5-day (meeting once every two weeks), 8-hour/day format, so engagement was a challenge – especially since many students would work night shifts, coming to class after work. For some, understandably, staying awake past the lunch break was difficult. This prompted the instructor to find a way to engage students while reducing anxiety about the course content and encouraging community building to fit with the graduate program objectives.

The activity proposed was assessing "good" chicken wings.[2] First, students were instructed on conceptualization and measurement. For example, students were presented with examples of uni-dimensional and multi-dimensional constructs and ways to measure each. Students were asked to operationalize "good" chicken wings, which they decided had many dimensions for assessment (e.g., crispness, method of cooking, type of sauce, size).

Next, students were instructed on various research methods and were asked how to best measure people's preferences of chicken wings. They chose a survey design and created a list of criteria for developing survey questions, drawing mainly from the textbook: Bachman and Shutt's (2007) *The Practice of Research in Criminology and Criminal Justice* (3rd ed.), published by Sage. With their criteria for developing survey questions and examples of effective surveys used in published studies, students designed a survey assessing "good" chicken wings, tapping into their many dimensions of "good" chicken wings. At this point, the instructor provided

[2] The first author originally is from the Buffalo, New York area, as were some of the students, staff and faculty of the aforementioned program. A discussion of Buffalo and Buffalo food (Buffalo is well-known for "Buffalo wings" or chicken wings) spilled into the classroom, hence the choice of food for this exercise.

minimal instruction, allowing the students to take an active role in developing the survey. The instructor asked leading questions, but ultimately the decisions to include/exclude a survey question, question placement, and wording of questions were left to the students. The draft survey was placed on the electronic course companion, Blackboard, for student review before the next class meeting, when time was devoted to finalizing the survey.

When the survey development was completed, students were tasked with survey administration and data collection. Specifically, students organized the "chicken wing cook off", bringing chicken wings and other food and beverages to class. Students and the instructor brought a variety of chicken wings to class (specified in advance). Students invited faculty and staff members to participate as "judges". [3] Students asked faculty/staff judges to taste each chicken wing type before completing the survey.

From this activity, students were able to learn first-hand the problems and pitfalls of collecting data. For example, some questions were confusing to the judges. Being present during data collection allowed the students to reflect on the importance of survey question wording. Also, faculty members other than the instructor reinforced the importance of research; some were able to casually make connections between research methods and their classes, emphasizing the value of understanding research methods for all coursework. Additionally, faculty commented on the survey, so students had multiple avenues of feedback. Several students noted that they did not consider the activity to be classwork, nor was it "research", since they enjoyed it.[4]

[3] The faculty and staff "judges" commented they enjoyed the activity, especially since they received a free lunch for completing a survey instrument. Students noticed this, too. One student commented: "I enjoyed the class and the chicken wing activity. It was obvious the faculty panel enjoyed the role they played." (Of course, faculty and staff judges appreciated assisting the students in learning, as well.)

[4] Of course, this highlights the need to debrief after the activity to assist students with integration of course concepts.

After lunch, the class brought the completed surveys to the computer lab for data entry and analysis. Each student was responsible for building an SPSS dataset from the anonymously completed surveys. Once the datasets were complete, students ran descriptive statistical analyses and discussed formulating a results section.

Methods

Participants

Participants for this study were students enrolled in the cohort program evaluation course mentioned above during the fall 2008 semester. A total of 14 students[5] comprised the study sample. Data collection of student-completed questionnaires was approved by the Institutional Review Board after an expedited review.

Data

Data were collected in two ways. First, a 30-item multiple choice and short-answer preliminary knowledge assessment was distributed at the beginning of the first day of class, immediately following the review of the syllabus.[6] The same assessment was administered again at the end of the last class, seven weeks later. Neither the pre- or post-activity assessment counted toward the grade; there was no final exam in this course. Also, participation was voluntary. All students completed both the preliminary knowledge assessment and the final knowledge assessment. Each item on each assessment was coded "1" for correct and "0" for incorrect. Only the assessment items relevant to the concepts addressed through the activity discussed above are included in analyses.

[5] Unfortunately, because of the small sample size, there is not enough statistical power to assess whether demographic factors (i.e., gender, race, age, etc.) played a role in learning the material or attitudes toward the instructor or course (see, e.g., Davis 2003).
[6] Complete questionnaire available upon request.

Second, anonymous surveys were administered at the end of the last day of class to assess student attitudes toward the activity. These surveys adopted a 4-item Likert scaling response ("Strongly Agree", "Agree", "Disagree", "Strongly Disagree"). The surveys also included space for students to write any additional comments that may not have been covered in the survey questions. Data from the knowledge assessment questionnaires and the anonymous surveys were entered into SPSS for analyses.

Results

Instructor Investment

The first research question addressed whether students believed the instructor was invested in their learning, based on the structure of the course. Table 1 shows all students agreed (21.4%) or strongly agreed (78.6%) that the food theme led them to believe that the instructor was invested in their learning. One student commented:

> The chicken wing survey was an excellent method for students. We had fun competing with one another and in turn we took more of an interest in making sure our survey results were … reliable and valid. Overall excellent lessons and excellent teacher.

Table 1. Student Satisfaction Survey: Percentage of Student Responses (*n*=14)

	SA[a]	A	D	SD
When we discussed "operationalization", using "good" chicken wings as an example helped me learn what "operationalization" is.	35.7	42.9	21.4	0
By participating in the "chicken wing cook-off", I now have a better understanding of the research process.	42.9	50.0	7.1	0
By applying the class content using chicken wings, I have a better understanding of the course material.	64.3	21.4	14.3	0
Based on the chicken wing cook-off, I felt the instructor was invested in my learning.	78.6	21.4	0	0

[a] SA= strongly agree, A= agree, D= disagree, SD= strongly disagree

Student Satisfaction

Does using a food theme increase student engagement? In short, yes. Most students liked the food theme, agreeing it made class fun. Students commented:

- "You should add this survey to all your classes because it truly did not feel like work."
- "The wings were easy to relate to because we all like chicken wings. Wings made the class fun for everyone. It is easier to construct a survey around something your [sic] interested in and enjoy."
- "By using the hands on method with the chicken wings, it gave a better understanding of the concepts."
- "… the content of the class was great. I have definitely grasped a better working knowledge when it comes to evaluating programs in the future."

Table 2 presents the quantitative results of the anonymous student satisfaction survey. All students agreed or strongly agreed that the chicken wing activity made learning about operationalization and survey development fun. Most (85.7%) students agreed or strongly agreed that research can be fun and are more interested in participating in research as a result of the chicken wing cook-off activity. All students agreed or strongly agreed that the activity made class more enjoyable. Overall, all but one student (92.8%) agreed or strongly agreed that the chicken wing activity improved satisfaction with the course.

Table 2. Student Satisfaction Survey: Percentage of Student Responses (*n*=14)				
	SA[a]	A	D	SD
When we discussed "operationalization", talking about "good" chicken wings made learning fun.	71.4	28.6	0	0
Developing a survey around the concept of "good" chicken wings made survey development fun.	57.1	42.9	0	0
Through the "chicken wing cook-off", I realized research can be fun.	57.1	28.6	14.3	0
I am more interested in research after participating in the "chicken wing cook-off" activity.	35.7	50.0	14.3	0
By incorporating chicken wings into class content, the instructor made the class more enjoyable.	71.4	28.6	0	0
The chicken wing cook-off increased my satisfaction with this class.	57.1	35.7	7.1	0

[a] SA= strongly agree, A= agree, D= disagree, SD= strongly disagree

Learning Improvement

The third research question addressed whether using food to introduce concepts improved learning. Overall, most students thought the use of the food theme facilitated their learning, specifically in overall class content, the research process, and defining concepts. For example, Table 1 shows that most students (78.6%) believed the example of a "good" chicken wing helped explain operationalization. Likewise, almost all (92.9%) students agreed or strongly agreed that they have a better understanding of the research process through the hands-on activity; 85.7% agreed or strongly agreed that the chicken wing "cook off" assisted in their understanding of the course material.

Objective analyses also indicate a modest but significant increase in student learning. The average number correct improved from 12.8 on the preliminary knowledge assessment to 16.9 on the post-knowledge assessment (t=6.3, $p<0.001$). The McNemar test is appropriate for assessing pairs of dichotomous variables such as these (Bennett and Underwood, 1970). The

percentages of students who responded correctly to related items on each knowledge assessment are presented in Table 3. While there was improvement on all items, there was a significant increase in proportion of correct responses on the item assessing ability to define the term "operationalization". Similarly, a significant improvement was found in the proportion of students who were able to identify convenience samples. While half of the students were able to identify a dependent variable at the beginning of the course, almost two-thirds could do so by the end of the course; this is not a statistically significant improvement. Further, only a few students were able to identify "good" survey questions; there was not a statistically significant improvement on this item, either.

Table 3. Knowledge assessment before and after activity (% correct[a])

	Pre-activity	Post-activity
Identifying dependent variable	50.0	64.3
Defining operationalization	21.4	78.6*
Identifying convenience samples	28.6	71.4*
Identifying "good" survey question	7.1	14.3

Notes:
[a] McNemar test used, as it is appropriate for assessing significant change in pairs of dichotomous variables
* $p<0.05$

Discussion and Conclusion

Courses covering research methods and statistics in graduate education can be a source of anxiety for students and can impede their learning. However, by using food in the classroom, instructors can bridge the gap between informal and formal learning, decreasing student anxiety and increasing intrinsic motivation. Overall, this study found that students enjoyed using food to learn course concepts and felt that the instructor was invested in their learning. Arguably most important, students *learned*, as measured by the knowledge assessment.

Of course, this research has limitations. Most notably, there is no comparison group (i.e., another section of the course using traditional methods). Perhaps students would have learned the material without the activity. Given the small increase in proportion of correct responses between the preliminary and final knowledge assessments, this may be the case. However, the evidence suggests students were engaged with the course and the material. This, in itself, may impact learning. In short, despite the lack of a comparison group, the activity described here has benefits for students.

Another limitation is the small sample size (n=14), so caution should be used when interpreting the results. More research is needed with a bigger sample before generalizing. Perhaps the small class size itself contributed to student learning (Gordon, Barnes & Martin, 2009), which was not controlled here, since this study is based on only one class. We strongly recommend more research in other class sizes and settings with other instructors. `Despite the small sample size, this study demonstrated that students can be engaged in class projects. While not measured, there is something to be said about "breaking bread" with one another – having lunch with classmates and the instructor has meaning beyond learning. Further, students seemed to invest in the instructor – when students feel as if the instructor cares about them and their success, they may be more invested in what the instructor has to say and, consequently, learn more.

When replicating this activity, the type of food used can vary. To decrease the preparation time and to reduce cleanup afterward, a similar "challenge" can be held with cookies or other foods. In an anonymous student satisfaction survey, one student commented that "Chili would also be good to research." Another student intimated that s/he would prefer having input

on the type of food used. Given that student engagement involves student ownership of the material, allowing student choice in the type of food may be beneficial.

While students demonstrated improvement in knowledge of the course concepts through the activity, the activity may have had greater impact on concept retention if grades were included as an added incentive, since teachers commonly believe that grades are perhaps the greatest student motivator. A graded final exam instead of an ungraded, voluntary final knowledge assessment may have motivated students to take a greater stake in course concepts. Perhaps as an alternative, prizes may replace grade-based motivation to learn.

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Jennifer C. Gibbs is a doctoral candidate at the University of Maryland, College Park. Her research interests include policing, terrorism, violence against women and the scholarship of teaching and learning.

Amanda J. McIntosh is a Student Services Specialist at Montgomery College in Germantown, Maryland. Her research interests include higher education policy, access and equity in higher education, teaching and learning, and non-traditional student issues. She earned a Master of Arts in Higher & Postsecondary Education at Columbia University.