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Bridging the Divides: Using a Collaborative Honors Research Experience to Link Academic Learning to Civic Issues

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Science, mathematics, and technology are defined as much by what they do and how they do it as they are by the results they achieve. To understand them as ways of thinking and doing, as well as bodies of knowledge, requires that students have some experience with the kinds of thought and action that are typical of those fields.
—Rutherford and Ahlgren, *Science for All Americans* (1990)

INTRODUCTION

The National Science Education Standards assert the vital importance of the inquiry process: "Inquiry into authentic questions generated from student experiences is the central strategy for teaching science" (National Research Council 1996). Yet students in U.S. high schools have highly variable laboratory experiences, and attempts at inquiry-oriented learning are often "cookbook" activities isolated from the larger flow of science and mathematics learning (Singer et al. 2006). In the higher education environment, it is similarly uncommon for students, particularly first-year students in science and statistics classes for non-majors, to have the opportunity to practice authentic research from formulation of a research question through design and execution of an experiment, analysis of data, and presentation of results. In fact, many science courses for non-majors no longer require a laboratory component. In many such courses, the emphasis is on appreciation rather than practice of the process, and courses at this level, even if they introduce students to the entire research process, focus on the component covered in the course. If, as Rutherford and Ahlgren (1990) assert, "People learn to do well only what they practice doing," how can students be literate in the practices of science and statistics if they do not practice them?

In the fall of 2008 we sought to immerse Longwood University Honors Program students in a rigorous, relevant, and cross-disciplinary research project.

We wanted this project to serve as a unique and powerful learning experience and also as a means of academically engaging our campus's two-year "sustainability" theme, which we discuss below in detail. Our project had several distinctive features. First, it was a collaborative effort between two lower-level honors classes, one in science and one in statistics. Second, during the course of one semester the students in these two classes engaged in the entire research process: they formulated their own research questions, designed and executed experiments to collect data, analyzed the data, and presented their results in a poster session. Third, this research was conducted by mostly first- and second-year students who were not majors in a scientific or mathematical field. And last, the project tied the students' research to the larger issue of sustainability and challenged the students to consider this issue as engaged citizens.

Most of our previous research experiences with undergraduate students followed the Council on Undergraduate Research model wherein undergraduate research is considered "an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline" (Council on Undergraduate Research 2008). Thus we have tended to work with upper-level students who are majoring in the sciences or mathematics and to focus on a research question specific to our disciplines. For this project we had an opportunity to work with first- and second-year students who were not majors in our fields and whose research question would be tied to a broad civic issue. Specifically, we wanted our honors students to become more informed about sustainability issues, especially as related to water, and we wanted them to consider these issues both as students of science and statistics and as engaged citizens. These broad goals are significant to us because of their clear connection to our institutional mission, which guides all teaching, learning, and service in our honors program: "the development of citizen leaders who are prepared to make positive contributions to the common good of society" (Longwood University Office of the President 2008).

THE SUSTAINABILITY THEME

In 2006, Longwood University President Patricia Cormier established the Committee for a Sustainable Environment, saying:

> In a world of increasing demands and diminishing resources, it is imperative that we, the academic community, do our part to ensure that future generations have opportunities equal to those afforded us. Regardless of the positive strides already taken, it is time for Longwood University to develop its own guidelines for environmental sustainability . . . As Citizen Leaders, it is imperative that we embrace our environment and walk boldly into a clean and green future. (Longwood University GreenCampus 2009)

President Cormier subsequently established sustainability as a two-year campus theme starting in the fall of 2008.

As part of this initiative, Longwood has adopted the widely used Brundtland Commission definition of sustainability: "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987). Campus sustainability efforts are conceptualized as the intersection between three overlapping spheres of environmental, economic, and social justice issues. One of the two courses in our honors project has a specific focus on water issues, and as such we wanted the collaborative project to examine that three-way intersection by focusing on the consumption of bottled water. We used that rather narrow focus as a gateway through which students would explore broader water-related sustainability issues such as worldwide access to safe drinking water, the quality of tap water in the U.S., the multi-dimensional costs of the bottled-water phenomenon, and the rich environmental and ethical considerations of water consumption.

PROJECT GOALS

In engaging students in this endeavor, we had a number of goals for participating students. Specifically, we structured an experience that would involve students in:

- Formulating research questions that would link to Longwood's two-year sustainability theme by addressing issues related to bottled water;
- Conducting a real research project from beginning to end, including development of the research questions, design and implementation of a study to address the questions, and analysis and interpretation of the results;
- Enriching their understanding of the content presented in their course by linking it with the civic issue and adding to it some of the content from the other course;
- Working collaboratively and sharing knowledge and skills developed in their respective courses;
- Presenting their results in a professional setting; and
- Reflecting, as researchers and as engaged citizens, on the results of their study and the larger issue of bottled water and sustainability.

In addition, we wanted to assess our students' experience during the project, in terms of both the process and the learning outcomes so that we could evaluate how well this project worked and improve future implementations of such collaborative research projects. To that end, we used an end-of-project evaluation form (Appendix A). Student remarks on this evaluation greatly informed our reflections on this project, which are detailed in a later section.

Clearly our goals were ambitious, particularly since most of our students were first- and second-year students (50% and 38%, respectively) and most were not natural science or mathematics majors (77%). In hindsight, we note that we did not appreciate some of the special challenges we would face when trying to facilitate collaborative research among students at this level.

STUDENT PARTICIPATION AND COURSE CONTENTS

Students in our University Honors Program are largely recruited as incoming freshmen based on both SAT score and high school grade point average (GPA). Students enter a wide range of majors across the university's three colleges although most are liberal arts and science majors. Currently the honors program, which is in the process of transitioning to the Cormier Honors College for Citizen Scholars, has a student body of approximately 220 (or about 5% of the total undergraduate enrollment). Students in the program must complete at least eight honors courses and meet GPA requirements to graduate with university honors. The program offers a range of honors courses taught by faculty in departments across the campus. Many students also create individual enhancements for courses (i.e., contract courses), and some opt to complete a senior honors thesis.

Our project bridged two honors classes offered in the fall semester of 2008. Each course had a track record both as a successful component of our campus's general education program (Longwood University General Education 2008) and as an offering for our honors program. We believed that these two courses were a natural fit for a collaborative research project for several reasons. First was the pre-existing pedagogical overlap of an emphasis on the scientific method. Second, both professors' teaching philosophies included an active-learning approach with hands-on activities and group reflection to enhance learning. In addition to being a nice fit with our existing teaching philosophies and course formats, we also believed the collaborative project would provide a real-world out-of-class learning experience for our students. Below we describe each course and the broad philosophies that guide our teaching of the courses as well as any specific implementation issues for the honors sections we taught the fall of 2008.

GNED 261—Exploring Science in Our World

This four-credit lab science course was designed to be an interdisciplinary, topic-driven option for the natural science goal in our general education program. This course was developed as part of the national SENCER program (Science Education for New Civic Engagements and Responsibilities; SENCER 2008a). The conceptual framework of the SENCER program is articulated in the SENCER Ideals (SENCER 2008b), which include:

- SENCER robustly connects science and civic engagement by teaching 'through' complex, contested, capacious, and unresolved public issues 'to' basic science.
- SENCER shows the power of science by identifying the dimensions of public issues that can be better understood with certain mathematical and scientific ways of knowing.
- SENCER conceives the intellectual project as practical and engaged from the start, as opposed to science education models that view the mind as a kind

of 'storage shed' where abstract knowledge may be secreted for vague potential uses.
- SENCER locates the responsibility (the burdens and the pleasures) of discovery as the work of the student.
- SENCER, by focusing on contested issues, encourages student engagement in 'multidisciplinary trouble' and with civic questions that require attention now.

GNED 261, which is taken only by non-science majors, is offered with different bylines. In nearly every semester since the fall of 2003, it has been offered with "The Power of Water" byline (POW), but more recently additional focal topics have been added. POW is a national model course for the SENCER project, and a complete course portfolio can be accessed online through the SENCER website. In the semester of this project, the honors section of POW was paired with a non-honors section. Students from both sections met together for lecture meetings, but each section had a separate lab meeting. In keeping with the honors program mantra, "different work not just more work," the students in the honors section participated in this collaborative project, and the students in the other section pursued a different assignment.

MATH 171—Statistical Decision Making

This three-hour introductory statistics course is a non-calculus based introduction to basic statistics. The typical students at Longwood who take this course are liberal arts and social science majors. In recent years our teaching philosophy for this course has evolved to better reflect the American Statistical Association (ASA) endorsed Guidelines for Assessment and Instruction in Statistics Education (GAISE 2008):

1. Emphasize statistical literacy and develop statistical thinking;
2. Use real data;
3. Stress conceptual understanding rather than mere knowledge of procedures;
4. Foster active learning in the classroom;
5. Use technology for developing conceptual understanding and analyzing data;
6. Use assessments to improve and evaluate student learning.

In the semester of this project, the honors section of MATH 171 used a different textbook (Rossman et. al. 2008) than the regular sections (Moore 2007). Although both textbooks follow GAISE recommendations, the book for the honors section was specifically designed to incorporate an active-learning approach to the class material. Specifically, lecture was not the primary means of instruction and instead students worked in groups using data generated from in-class activities or from real-life studies to understand statistical concepts. Because of the small size of the honors class, we felt that this activity-based approach fit the honors program mantra "different work not just more work." As part of the general education requirements for the class, all students who take MATH 171 are required to do a "project," which usually varies by instructor. In the honors section of MATH 171, we saw the collaborative research project as an extension of

the teaching philosophy of the class, and pedagogically it offered us a unique opportunity to implement the GAISE guidelines in the context of an out-of-class semester-long project.

Of the 13 students in the honors POW section, 12 were honors students, 6 were first-years, 5 were second-years, and 2 (including the one non-honors student) were seniors. Of the 12 students in the MATH course, all were honors students, 7 were first-years, 4 were second-years, and one was a junior. One of the first-year students was enrolled in both classes. Two additional students participated in the project as part of an honors enhancement of another statistics course, MATH 270. This course is a more mathematically rigorous version of MATH 171 and is primarily taken by first- and second-year mathematics majors. One of these students was a first-year and the other was a second-year. Thus, in total, 25 Longwood honors students participated in this effort.

THE PROCESS FROM BEGINNING TO END

Project Development

Before the semester started, we met for breakfast and discussed our goals and a timeline for achieving them. At this early stage, several key ideas helped frame our development of the project. First, we knew we wanted the students to collect data at Longwood's annual Oktoberfest (in week 6 of classes) because that venue would afford easy access to a large number of potential research subjects. Second, we wanted the students to share their results in a poster session during the last week of classes (week 14 of the semester). Although we did not yet know the exact experiments our students would be conducting at Oktoberfest, we did anticipate that they would involve human subjects who would be consuming various types of water, so during this time we obtained permission from Longwood's Human and Animal Subjects Research Review Committee to conduct the as yet unspecified experiments during Oktoberfest.

We developed a "Project Description" handout for distribution to the students during the first week of class. This document (Appendix B) described the overall project goals and provided a tentative timeline for the completion of the project components, including required "co-meeting" dates (i.e., out-of-class meetings of all students in both classes). Little did we know that we were embarking on a journey that would be both exciting and frustrating at the same time.

Implementation

Outlining the Research Questions and Experimental Designs

Our first co-meeting with students from both classes occurred during the third week of classes. The purpose of this meeting was to formulate the research question(s) we would seek to address over the course of the project. Before this co-meeting each of us had spent time in class covering concepts of what constitutes a valid research question and what data need to be collected to answer

the question. At the co-meeting we tried to facilitate the process of developing research questions without giving ideas ourselves, our goal being to gently guide the students toward research questions and possible experimental designs that would be feasible to complete in a single semester.

Our students were not accustomed to posing their own research questions, so most of them were engaging in this part of the scientific process for the first time. Many of them realized it was much harder than they had assumed to develop questions that were specifically and deliberately worded and that would guide the rest of their work together. By the end of this brainstorming session the students had decided on two research questions:

1. Do members of the Longwood community prefer bottled water to tap water?
2. Does brand name affect Longwood community members' preferences for various types of bottled water?

At this first meeting we also discussed two potential experiments to address these research questions. To address the first question the students proposed a double-blind taste test that would include bottled and tap water, hereafter referred to as the "double-blind taste test." To address the second question, the students proposed a taste test in which subjects would taste water samples poured from brand-name containers that in reality held the same type of water. We referred to this as the "deceptive test." In both taste tests the subjects' preferences would be recorded.

In addition to collecting these preference data, the students decided to collect demographic data that would not only help them determine if they had a representative sample from the Longwood community but would also enable them to answer more detailed derivations of the research questions (e.g., "Is water preference associated with gender or is it independent of gender?" or "Is preference associated with the type of water the subject normally drinks?").

After our initial brainstorming session in which the large group identified research questions, basic experimental approaches, and demographic data to be collected, we divided our classes into six teams, each composed of equal numbers of students from each class. Each team was to devise a detailed experimental design for one of the two taste tests. Their description of the experimental design was to be specific enough that a person not on their team could conduct the experiment and obtain the same data. The students were to hand in these designs within a week and then use the following week to review all of the designs before our next co-meeting.

Planning and Preparing for the Experiments

The next co-meeting took place in week 5 of classes, less than two weeks before the experiments were to be performed. At this meeting we discussed the experimental designs submitted by our student teams. As expected, the designs were not entirely explicit. Important details, such as using new cups for each subject, were missing from most of the designs. We believe it was a major

learning experience for our students to have a discussion about the flaws in their experimental designs and how to improve them. Building on that discussion, the large group then worked out the details of each experiment, and we proceeded to assign individual students to specific tasks (e.g., preparation of the experimental water jugs, development of a questionnaire for researchers to record demographic data, volunteering to conduct the experiments at Oktoberfest, etc.). At the end of this co-meeting we began to detect some real excitement among the students regarding the project.

The next week we met with the subset of students who were doing the preparatory work. Prior to this meeting, one of our departmental administrative assistants purchased all necessary supplies using a student lab fee budget associated with the POW course. Student work in this preparation session included preparing the jugs of water for the double-blind taste test by pouring brand-name water and tap water into jugs labeled with only letters so that the research students at Oktoberfest would not know which type of water the subjects were tasting. They also filled the brand-name bottles with a generic drinking water, hence implementing the "deceptive" part of the deceptive test. Other students worked on the data collection form that was to be used during the experiments.

Data Collection

Oktoberfest quickly arrived and fortunately for us it was a beautiful day. Longwood's Oktoberfest includes a large number of "booths" run by student organizations, and we had arranged to have a booth located in the center of activity. The student researchers ran the experiments and collected data using the data collection sheets designed by their peers. Part of running the experiments required our students to obtain a signed informed-consent form from each subject; this meant the students needed to explain what they were doing without compromising the experiments. Our students seemed to have fun conducting the experiments. As one student said on the evaluation form, "I loved working the project at Oktoberfest with real people as the subjects." We were very pleased to get sample sizes of at least a hundred for each of the two experiments.

Data Analysis

After Oktoberfest, one of our departmental administrative assistants entered the data into an Excel spreadsheet so that the students could conduct the necessary data analysis. Students then started work in new four-person teams, with equal numbers of students from each class. These teams would work together through the end of the term. During this phase of analysis and poster development, the two students from the MATH 270 course served as "quantitative consultants" who could be called on by any team. In our post-project assessment, most students cited data collection and analysis as the most interesting components of the project.

Our students obtained significant results in both experiments. First, they found that members of the Longwood community definitely preferred bottled water over tap water in the double-blind taste test. Many students were both

surprised and disappointed by this result because it seemed to collide with the sustainability issues emphasized in the project. However, we think it made the students think harder and more creatively about how to resolve sustainability issues given consumer preferences. Second, in the deceptive test, the students found that there was a label effect on preference with a higher-end brand of water being more likely to be preferred over a lower-end brand of water. Finally, they were able to determine that these preference results were independent of gender and the type of water the subjects regularly consumed.

Poster Development

Parallel to completion of the statistical analyses, preparation of the poster presentations began in earnest. Instead of having each team present the entire project on its poster, we opted for a multi-panel series of posters that would tell the whole story. To that end, we assigned each team responsibility for creating a poster in one of six areas: project context (i.e., introduction and sustainability), experimental designs, data collection, basic outcomes of the double-blind taste test, basic outcomes of the deceptive taste test, and conclusions (i.e., key points and reframing the sustainability issue).

To facilitate this poster development stage, we used a shared Blackboard site as a tool for communication as the students worked on their posters. Each poster team had its own "group page," allowing students to email each other directly, communicate with their own discussion board, and share files with a safe file-sharing "drop box." Additionally, we used the whole-class discussion board as a venue for posting our reviews of poster drafts because we thought this would promote students' critical reflection on the progress of all posters.

Working on the posters was undoubtedly the hardest part of the project for both the students and us. In the post-project assessment, over half of the students cited poster preparation as the hardest part of the project. As one student noted, "I learned that it takes a lot of team effort to produce something like a collaborative poster, and it is not easy, but it is doable." Although we gave our students guidelines on how to write a poster (including a useful excerpt from McMillan 2006), the initial poster submissions we received from each team were, as we jokingly like to say, definitely not ready for primetime. Thus began an iterative process by which we would provide detailed comments regarding each team's poster. Teams would then revise the poster, and we would review it again. As instructors, we found this part of the project to be the most time consuming. We did not realize how much more guidance our first- and second-year students would need in comparison to upper-level students. The evaluation forms revealed that this part of the process was labor-intensive for our students as well: "The worst part was going through revision after revision of the poster but it really did help to make it the best it could be in the end."

Sharing the Results

The day of the poster session arrived, and miraculously all six posters were ready to go. We know the students very much enjoyed the poster session and

were proud of the hard work they had done to get there. The evaluation forms contained several student comments such as this one: "The best thing about the project was being at the poster session and realizing all the work we had done to get to that point and being able to show it off."

Concluding Reflections and Suggestions

In reflecting on this project, we have formulated several pedagogical take-home points, informed by student comments submitted on the end-of-project evaluation forms, that we will consider in reframing our project and our other teaching activities. We think these points will also be useful to other faculty planning collaborative honors experiences for students.

The Logistics are Challenging

An obstacle that we underestimated in our planning was the timeline of the project. One student noted that the team was always working on fixing things rather than struggling with what it all meant, a problem that arose from end-loading the analysis work. Not until late in the term were the data collected and compiled, and only then did the MATH 171 students start learning analyses like those needed to work through the data. Thus, the analysis part of the project was rushed. The orientation toward those final deadlines left little opportunity for students or faculty to stop and think about what it all meant or to evaluate how well concepts were understood. This issue is difficult to resolve, particularly in a one-semester project, but this logistical challenge requires further consideration.

Other logistical issues affected students, some of whom struggled with time management during the project. The student comment that best expressed this struggle was: "I like the idea of a collaborative project more then I liked the actual process." Several students noted that it was hard to coordinate schedules and get everyone together, especially since the two classes shared no common meeting time. Additionally, students cited difficulty in communicating with group members despite the shared Blackboard site with dedicated "group pages." As a way of addressing this issue in future semesters, we plan to work with the honors program and registrar to schedule an overlapping meeting time, perhaps called an "Honors Link" meeting, which would be akin to a weekly or possibly bi-weekly recitation period. This dedicated block of time on each student's official schedule could be used to facilitate both large- and small-group meetings.

Effective Collaboration Takes Practice

We encountered several issues related to student collaboration that brought home the importance of group process skills. The two key process skills that affected the project were peer-to-peer transmission of knowledge within the groups and management of group interactions, planning, and workload division.

Peer teaching was an integral component of the group work. We expected the students from each class to be teachers within their groups and share information about the content and process. Student comments indicated that the peer-teaching process was not effective in all cases. While the POW students were able to engage effectively in the peer-to-peer teaching process, the statistics students struggled to transmit their knowledge. Thus we think the POW students were not able to take away as much statistical knowledge from the project as we would have liked. In instituting the "Honors Link" meeting, we hope to move the peer teaching into a structured co-meeting time for all students, thus helping with the transfer of knowledge across classes and providing time to engage the entire group in reflection about the big picture of the project.

Group management was another challenge cited in the student evaluations. Other than advice in specific situations, we provided no specific guidance for managing group efforts. In hindsight we understand the need to provide each student with a "tool kit" for group management, and in future iterations of a collaborative project of this nature we will play a more direct role in managing group work. Honors students are smart, but a freshman is a freshman. Based on our observations and anecdotal information from students, our most efficient team—the one that responded most effectively to feedback—was led by a strong upperclassman. First- and second-year students would benefit from guidelines for managing groups (e.g., assigned roles, effective communication strategies, and shared expectations for contributions). Suggestions offered by students on the evaluation form, such as "Have someone write up the specifics of each decision arrived at during the meeting and distribute it to everyone to keep everyone on the same page," highlighted this need.

Students also cited concerns about disproportional division of labor and "social loafing." Each student evaluated his/her teammates but only once at the end of the project. We and at least some of our students arrived at the same conclusion: "Make consequences along the way to make group members work." In future iterations, we will incorporate early feedback to try to identify problems and motivate loafers before the end of the term. We also think it would have been better for students to work in one group throughout the project instead of changing groups between the experimental design and poster development. Additionally, when choosing students for each group, we will attempt to take into account the schedules of students to maximize an overlap in free time in the group.

Faculty Workload is an Issue

On our campus, the benefits of teaching honors sections of general education courses include having a much smaller class cap than a non-honors course (e.g., 15 vs. 35 for MATH 171) and working with students who are generally among the best and brightest. However, in undertaking this project we substantially added to our effective workloads in ways not included in the calculation of our official workloads. Extra time was required to manage and coordinate the project and to meet with students outside of class, especially during

the preparation of the posters. Faculty undertaking this kind of effort should be aware that these issues are inevitable; collaboration takes extra effort from faculty as well as students, and it takes significantly more time.

A Viable Model for Faculty and Student Collaboration is Crucial

Scheduling an "Honors Link" will make pairing courses in different disciplines more viable in future semesters. We benefited from a natural pairing between the sciences and statistics, but interested faculty across the disciplines could create pairings based on pedagogical approaches, connections in content, or interesting contextual links and could implement a similar scheduling approach (i.e., "Honors Link") to facilitate course management. The sustainability of such efforts benefits from support of the university administration. In our case, the provost and deans attended the poster session, and Geoffrey Orth, Director of the Honors Program, noted, "We want to have the Honors College serve as a laboratory for curricular innovation and especially promote linked courses and interdisciplinary ventures to reinforce among the students a sense for the interconnections inherent in academics." Thus, we are optimistic about the potential for future collaborations, and we intend to repeat this particular project in the spring semester of 2010.

The Final Assessment

Despite the challenges detailed above, overall we concluded that our collaborative research project was a success, well worth the effort. Many of our colleagues attended the poster session and were impressed with our students' work. Based on the comments from the student evaluations, we think that most of our students also thought the project was a success.

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APPENDIX A

End-of-Project Evaluation Form

1. Did the project contribute to your understanding of issues associated with sustainability? Please explain.

2. Did the project contribute to your knowledge of statistics and how statistics can be used to answer research questions? Please explain.

3. This project had several components: determining the research questions, designing the experiments to address the questions, preparing for the experiments (i.e., pouring water, labeling jugs for the double-blind test, etc.), running the experiment and collecting the data at Oktoberfest, analyzing the results, preparing the posters, and presenting your results at the poster session. Of these which did you find:

   a. The most interesting?

   b. The least interesting?

   c. The hardest?

   d. The easiest?

4. Please comment on how this project contributed to your overall understanding of the material being taught in your class (i.e., Power of Water or Statistical Decision Making).

5. Please comment on the collaborative nature of this project (i.e., the link between the mathematics and science courses). What was good about doing the project collaboratively? What was not so good about doing the project collaboratively?

6. What was the most important lesson you learned from doing this project? Please note that this lesson may or may not be related to course material.

7. What was the best thing about this project? What was the worst? What suggestions do you have for improving the project?

8. Any additional comments?

APPENDIX B

Project Description Handout

Not a drop to drink?
A Longwood "Tap Project"

What comes to mind when you think of an Oktoberfest celebration? Beverages? Taps? This semester you will participate in planning and executing a project that examines beverage choices by Oktoberfest celebrants—but the beverages will not quite be of the variety you might have first imagined.

Did you know that over 1.1 billion people live without access to safe drinking water (WHO statistics, 2005)? As a result, each year over 2 million people die from waterborne diseases, and over 90% of those people are children under age 5 (WHO statistics, 2005). In our community, we are privileged to have more clean drinking water than we could ever hope to drink. When we turn on the tap, good safe water comes out every time. Despite that, many people opt to pay to drink water from little plastic bottles of a dozen different varieties. Why is that? Is it safer? Is there a difference in how the water tastes? How do those simple questions relate to broader issues, like the sustainability of putting small volumes of water into plastic bottles and shipping them around the world?

This semester the Honors students from one science and two mathematics classes will work together to consider this interesting issue of bottled water. The students involved in this interdisciplinary collaborative project are enrolled in the following courses:

GNED 261—Exploring Science in Our World, Section 50,
with Dr. Alix Fink

MATH 171—Statistical Decision Making, Section 50,
with Dr. M. Leigh Lunsford

MATH 270—Introductory Statistics, Honors Enhancement,
with Dr. M. Leigh Lunsford

The key academic purpose is straightforward: to conduct a research project from beginning to end. Meeting that goal requires the development of a research question, design of a study to address the question, collection of data, and analysis and interpretation of the results. Additionally, the research question(s) should provide linkages to Longwood's two-year sustainability theme and should address issues of bottled water versus tap water. For instance, student researchers may seek to conduct a taste test to see if consumers have a measurable preference for tap or bottled water.

Successful completion of this project will require students to work collaboratively and to share knowledge and skills developed in their respective courses. There is an expectation of at least two formal joint meetings to be held in

the evening, and additional collaborative work will be required outside of class. Each faculty member will provide information to her class to make clear how this project is part of the final course grade. Additionally, your professor will give you a grading rubric for how you will be assessed for this project; assessment will include a participation component as well as credit for completion of specific tasks.

Project Timeline

Date	Event	Goal
Week of September 8 (3rd week of classes)	Required evening meeting	Discuss ideas for project including possible research questions and corresponding study designs. You should come to this meeting having already considered some of the key issues and prepared to share your ideas.
Time between required evening meetings	Small group meetings as needed	Finalize study design including a clear statement of research questions and details of how data will be collected.
Week of September 22 (5th week of classes)	Required evening meeting	Presentation of final study designs. Choose at least two studies to conduct and create a clear plan to carry out studies (e.g., who will do what).
Week of September 29 (6th week of classes)	Small group meetings as needed	Prepare for data collection (e.g., collect water, get cups, develop data sheets, create signs for advertising, etc.).
Saturday, October 4	Oktoberfest	Conduct the studies and collect data.
Week of October 6 (7th week of classes)	Small group meetings as needed	Enter data into computer and disseminate to all students.
October and November	Small group meetings as needed	Data analysis and interpretation.
November	Small group meetings as needed	Prepare for poster session.
Week of December 1 (tentative)	Public poster session	Share results with the Longwood community.

Online Resources

The links below have some general information on tap water and bottled water, including some taste tests that have been performed.

<http://www.thirstthemovie.org>

<http://www.lib.berkeley.edu/WRCA/WRC/pdfs/tastetest_21Apr07.pdf>

<http://www.citizen.org/cmep/Water/us/articles.cfm?ID=11094>

<http://chechekonnen.terc.edu/WTT.html>

<http://www.tapproject.org>