Public Scholarship Student Projects for Introductory Environmental Courses

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Abstract

This paper presents a model project for introductory undergraduate courses that develops students as citizens contributing scholarship to public discussions of environmental issues. In this field-based project, students actively and independently engage with an environmental issue and present their project experience to a relevant public forum. In two implementations of the project, we find that the project succeeds at each of five goals: exposing students to public scholarship, connecting course material to environmental issues and students' lives, giving students experience with professional environmental work, building student enthusiasm, and, finally, providing the public with insights from students' scholarship.

Key Words: Public scholarship, civic engagement, environmental education

Introduction

The scale and nature of contemporary society's massive and burgeoning influence on the global environment raise myriad ethical and political issues. The complexity and urgency of these environmental issues demand an organized, intelligent, and ethically-grounded response by well-informed citizens. Education must play a central role in the development of such individuals. For this reason, there is strong interest in the development and successful implementation of environmental education programs oriented towards societal issues, as seen in the ongoing United Nations Decade of Education for Sustainable Development (Higgitt et al., 2005).

For educational programs to fulfill this needed role, pedagogical approaches must be designed from the ground up to include a component of civic or public engagement. Such a component can be termed *public scholarship* because it brings academic scholarship to bear on important public issues. Public scholarship pedagogy requires going beyond traditional lecture- and textbook-based classroom instruction. Traditional instruction effectively teaches many core concepts and basic facts but provides insufficient opportunity for students to develop as educated citizens confronting environmental issues. If society is to achieve the goals of organized, intelligent, and ethical response to environmental issues, then it must build public scholarship into environmental education curricula.

Introductory undergraduate courses present an important opportunity for students to develop as environmental public scholars. These courses commonly enroll large numbers of students from many different majors. For many students, the courses represent the only formal environmental education they will receive in their undergraduate studies and before being called upon to respond to environmental issues as a citizen-scholar. For other students, the courses can

inspire them to further their scholarship through additional environmental coursework or even a professional career responding to environmental challenges.

In this paper, we present a semester-long project for introductory undergraduate courses in which students engage with environmental issues as concerned citizens and public scholars. We have implemented this project in two different geography courses and also find that it could be implemented in environmental courses in other fields. In the project, students perform a hands-on activity related to an environmental issue and then present their experience to the public forum of their choice. The activity and the presentation both take place outside the classroom and are thus motivated by the pedagogy of fieldwork in addition to the pedagogy of public scholarship.

This paper extends the existing geography and environmental education literatures by presenting what is, to our knowledge, the only detailed description of a public scholarship project for introductory environmental courses. A public scholarship project with a different structure and for graduate students is presented in Nation (2008). Other societally-oriented environmental education programs documented in the academic literature include an undergraduate sustainability program (Brundiers et al., 2010), a public museum and meeting space (Hama et al., 2005), a suite of community and K-12 engagements through the arts (Clark and Button, 2011), professional workshops for adult learners (Martin et al., 2005), sustainability-oriented projects and curricula for design students (Lehmann and Fryd, 2008, Walker and Seymour, 2008), an interdisciplinary, international graduate student field experience (Fortuin and Bush 2010), service-oriented sustainability projects for undergraduates and community members at a campus farm and ecovillage (Sipos et al. 2008), and service-learning projects in advanced undergraduate and graduate geography courses in which students learn while creating positive change in a local field setting (Eflin and Sheaffer, 2006; Parece and Aspaas, 2007). Brundiers et al. (2010) also provide extensive discussion of motivations for and approaches to societally-oriented environmental education. Finally, there are undoubtedly other noteworthy examples that have not made their way into the academic literature.

In the following two sections, we review the two pedagogic frameworks that guided our project: fieldwork and public scholarship. Then, we present the goals and the design of the project. Finally, we describe the implementation and evaluation of this project in two introductory environmental courses taught in the Pennsylvania State University Department of Geography. The evaluation shows how this project succeeds in meeting its goals.

The Pedagogy of Fieldwork

Educators in geography and cognate fields have long seen fieldwork as an important component of a quality geographic education (see Sauer, 1956). These field experiences can take a variety of forms, from short field trips in the local area to extended tours or field camps in distant locations. Kent et al. (1997) identify two key dimensions in which field education projects may vary (see Figure 1). The first dimension classifies field experiences on a continuum based on the level of student engagement, from observational to participatory. In observational fieldwork, students learn by passively observing geographic phenomena, as on a typical undergraduate class field trip. In participatory fieldwork, students actively engage with geographic phenomena, gathering data to address specific research questions. The second dimension in which field education projects may vary is based on the relationships of student to

instructor, from instructor-led to autonomous. In instructor-led fieldwork, the fieldwork activity is led by the instructor with little student input. In autonomous fieldwork, the fieldwork activity is led by the student with a relatively hands-off instructor involvement.

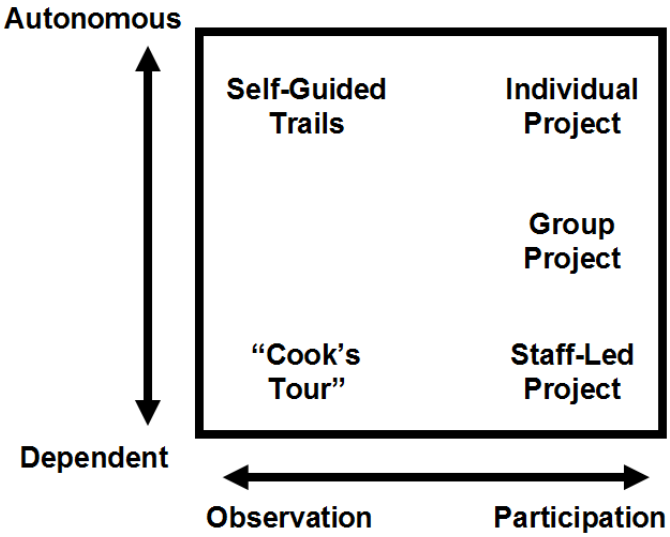

Figure 1: Fieldwork classification scheme featuring two dimensions: level of student autonomy and level of student participation. Adapted from Kent et al. (1997, p.317).

This framework highlights two central characteristics of the field education experience, but it omits other important aspects. Kent et al. implicitly assume that the goals of fieldwork are primarily cognitive—that is, the acquisition and mastery of a body of knowledge. But recent trends in geographic education indicate other possible purposes. For instance, Lai (2000) argues that the impact of fieldwork can be as much affective as cognitive. Students may experience excitement, joy, frustration, pain, or other affective responses in field experiences. In Lai's view, these impacts are central to the importance of field education experiences, but traditional views of fieldwork tend to overlook—and therefore fail to fully realize—these impacts, especially through a focus on a "hypothesis-testing" approach that prioritizes cognitive dimensions of the experience.

Another purpose of fieldwork relates to the ethical orientation of students toward their natural and social environments. For example, Gold et al. (1991) list the development of environmental ethics as one of seven goals of fieldwork (see also Kent et al., 1997; Stoltman, 2000). We concur with these arguments that fieldwork can change, often profoundly, a student's makeup as an ethical being by affecting how she views and relates to the world, as well as how she makes decisions. For instance, Oberhauser (2002) discusses how fieldwork can lead to students reevaluating their relationship to societal conditions of inequality and oppression. For fieldwork in general, to the extent that ethical goals are explicitly engaged, fieldwork can support educational efforts to advance ethical objectives.

Following these newer developments in the use of fieldwork in geographic education, our project aims to engage students in affective and ethical ways as well as cognitive ways. Rather than using the Kent et al. (1997) continuum of observation-to-participation, therefore, following Israel (2009), we conceptualize the field experiences in terms of their intended impacts upon

students within a space defined by three domains: cognitive, affective, and ethical (figure 2).[1] As discussed in detail below, our project aims explicitly to create field experiences that integrate cognitive impacts (knowledge acquisition), affective impacts (moving experiences), and ethical impacts (a changed personal stance toward the world that supports changed future behavior).

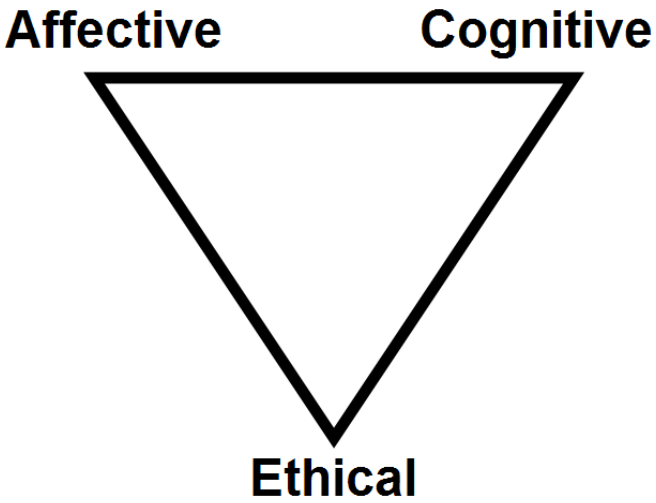

Figure 2: Figure 3: Schema of three types of impacts of field projects on students. Adapted from Israel (2009, p.36).

Toward this end of integrating cognitive, affective, and ethical impacts, our course project uses a public scholarship framework. Public scholarship goes beyond a traditional view that sees the purposes of education (classroom- or field-based) as solely related to learning outcomes for students, instead arguing that educational programs themselves can and should participate directly in making a better world. As noted above, public scholarship can play an important role in addressing environmental issues. Since most environmental problems are long-term in nature, teaching students how to engage directly with environmental issues today can effectively prepare them for more informed and engaged participation in the future. For all these reasons, we believe that adding a public scholarship component to a fieldwork approach generates a powerful tool for engaging and educating students on environmental issues. The following section reviews the growing scholarly literature on public scholarship as a pedagogic framework.

The Pedagogy of Public Scholarship

As noted, our project is guided by recent developments in educational theory concerning public scholarship and civic engagement (Scott & Lawson, 2002; Colby et al., 2003; Westheimer & Kahne, 2004; Eberly & Cohen, 2006). These related educational movements argue that democracy is enhanced through greater participation by its citizens. Civic engagement calls for

[1] The cognitive, affective, and ethical domains may not always be mutually exclusive. For example, our ethical intuitions appear to have significant affective components (Greene et al. 2001). However, these three domains nonetheless play fairly distinct roles in fieldwork and are thus treated separately in this paper.

citizens to be actively engaged in democratic processes through a variety of means including voting, correspondence with elected officials, and deliberation on societal issues with other citizens. Public scholarship calls for scholars of all disciplines and backgrounds to contribute insights from their scholarship to public discussions of societal issues. The public scholarship movement is grounded on the premise that a successful democracy depends on a well-informed and engaged citizenry. This premise informs educational practices aimed at both drawing connections between classroom activities and conditions in the world beyond the classroom and making explicit students' (and teachers') ability and responsibility to impact those conditions. As Jarosz (2004, p.919) argues, "Public scholarship can enhance students' classroom study and research about global social issues such as poverty and equality through direct engagement with the problem at the levels of their communities in settings and situations outside the classroom." Geographers have been and remain actively involved in developing these approaches to teaching and learning (Mohan, 1995; Jarosz & Johnson-Bogart, 1996; Cohen and Yapa, 2003; Jarosz, 2004) and in broader public scholarship efforts and discussions thereof (Murphy et al., 2005; Murphy, 2006; Mitchell, 2008).

Public scholarship pedagogy has much in common with, and thus is worth comparing to, the pedagogy of service learning (e.g., Fearn, 2001). Both approaches grow out of a desire to make education relevant to societal issues in concrete ways. In a service-learning project, students perform some service to others and learn from the experience. This service typically involves isolated interventions often (but not always) through private organizations and thus does not have students directly engaged in public debates. Meanwhile, in education for public scholarship, students bring their studies into the public domain, sharing what they have learned and informing or even influencing public debate. Here the student is not a servant to those in need but a scholar engaged in advancing the success of a well-informed democracy. This public orientation is crucial in the context of environmental issues. While individual action to help the environment does make a difference and should not be discredited, we simply cannot count on enough individual action to meet the environmental challenges we face. If these challenges are to be successfully overcome, public action is needed, whether through government policy, collective citizen initiatives, or other means. Likewise, for effective and well-informed public action to occur, public scholarship is needed. Our course project thus prominently features public scholarship alongside individual action.

Educational curricula can promote civic engagement and public scholarship in several important ways. First, education can encourage and facilitate student engagement in democratic processes. This is done by emphasizing the importance of engagement, illustrating how engagement can occur, and offering direct opportunities for engagement. Second, education can help make students' engagements more scholarly, by emphasizing connections to societal issues in instructional content and by encouraging students to incorporate insights from their studies into their civic engagement. Finally, educators can serve as role models and formal or informal advisors for students as civically engaged public scholars. These educators can be both formal course instructors and community members who connect with students through projects and other activities.

In the long run, it is up to each student to remain informed and involved. However, during their studies, educators can play an important and influential role. Advocates of education for public scholarship and civic engagement argue that educators should play such a role because doing so enhances our democracies. We strongly agree with this argument. We emphasize that such education is important not only for the sake of democracy itself but also for the sake of the

issues democracies must address, not least of which are the major environmental challenges our society faces. It is with these public scholarship objectives – and fieldwork objectives – in mind that our course project was designed and implemented.

Project Goals & Design

Based on its orientation as a field-based public scholarship assignment, the primary goals for our project are as follows:

1. Expose students to various ways they can share what they have learned with others as public scholars.
2. Enable students to connect course material with societal issues and conditions in their everyday lives.
3. Allow students to directly experience the techniques used and material studied in field-based professional environmental occupations.
4. Build student enthusiasm for learning about and responding to environmental issues.
5. Provide the public with insights from students' scholarship that are relevant to contemporary environmental issues.

In order to meet these goals, we designed a semester-long project that features three assessed assignments. For each of the assignments, students receive a detailed description of formatting and content requirements along with a grading rubric in advance. Each assignment is graded individually with the combined total of all points making up the student's final project grade. In keeping with the amount of time and effort required by the student to complete all assignments (and the time-commitment required by the instructor to oversee the work), the project represents a significant portion (20 - 30 percent) of the student's final course grade.

The first assignment is due early in the semester. In this phase of the project, each student identifies a contemporary environmental issue that interests her and is relevant to the course. The issue can be salient at any scale from the local to the global. In consultation with the course instructor, the student also designs a hands-on activity that allows her to participate in, learn more about, or make a positive impact on a real-world situation connected with the issue (See Table 1 for examples). Lastly, the student chooses a public forum in which to present insights from her experience. Acceptable forums include newspapers, websites, public displays, and any other media capable of reaching a broad public audience. Once these choices are made, the student then submits a project proposal in which she describes the environmental issue that she will focus on, the activity that she will perform, and the forum she is considering. The instructor assesses the proposal to ensure that an appropriate issue-activity pairing has been chosen and provides feedback to the student. If an inappropriate pairing has been chosen, the instructor asks the student to choose a new pairing and provides assistance if needed. After the project proposal has been approved by the instructor, the student begins arranging and performing her hands-on activity. Since most activities require time to coordinate and perform, it is important that the proposal be completed early in the semester.

The second project assignment is due in the middle of the semester. At this time, each student submits a project update that presents her work to date on all project components and her

plans for completing work by the end of the semester. This assignment helps keep students on schedule with their projects and avoid procrastination. Additionally, the update offers the instructor an opportunity to provide feedback, to reinforce aspects of student work that are going well, highlight aspects of the work that are not going well, and suggest additional areas of work for the student to consider. Because this feedback is provided about halfway through the semester, the student has enough time to make even quite substantial adjustments and still complete the project by the end of the semester.

The third and final project assignment is due at the end of the semester, at which time each student submits a final presentation of the project work. This presentation includes a portfolio delivered to the instructor and an oral presentation of the project given to the class. The portfolio includes a report describing the issue and project activity and a final analysis of the student's work. The portfolio also includes evidence of their presentation to the public forum (e.g., newspaper clippings, website links). The public forum presentation itself is made towards the end of the semester, drawing on the student's experience from throughout the semester. For the class presentation each student describes her chosen issue and activity, shares her experience, and ties it back to the processes and material covered in the course. The class presentations occur during the final days of the course and thus serve as a review of course themes and content.

The hands-on activity and public forum presentation are central to the public scholarship nature of the project and thus merit closer attention. The hands-on activity gives students firsthand experience acting on or observing some aspect of a broader environmental issue. This experience provides a deeper understanding of the issue and helps students form opinions of how society should respond to the issue. Where students are acting on the issue, they are typically trying to make some improvement on it. To be sure, due to the complexity of environmental issues and the minimal background of introductory students, it is possible for students' activities to have unintended negative consequences, even despite instructor assistance. Such unintended consequences, when they are observed, offer important learning experiences. But perhaps the biggest consequences of the activity are the insights gained by the students and the translation of these insights into public scholarship.

The public forum presentation gives students the opportunity to add insights from their project experiences to public discussions. In doing so, students practice contributing meaningfully and substantively to key societal debates on how we can and should respond to environmental issues. Meanwhile, various groups outside the academy can learn from the students' experiences and consider the students' views – that is, unless student submissions for publication are rejected by editors.[2] Thus the public forum presentation directly situates students as a link between the scholarly realm of the course content and the broader public. To make this link, each student chooses to present the parts of the project that she deems to be most relevant to her public audience. In doing so, students must view their studies from the perspectives of various community members who have a stake in the corresponding issue. This ability to shift perspective can be important throughout the students' future civic and professional lives. All of these aspects of the public forum presentation combine to give students firsthand experience engaging environmental issues as public scholars.

[2] Student grades are not in any way penalized for their submissions being rejected since editorial decisions are made for a variety of reasons beyond submission quality.

Project Implementation & Evaluation

Our project was implemented in two introductory environmental courses – one on human-environment geography (HEG) and the other on physical geography (PG) – offered by the Department of Geography at The Pennsylvania State University. The HEG course (taught by Baum) is Geography 030, Geographic Perspectives on Sustainability and Human-Environment Systems. This course provides a holistic, systems-based perspective on human-environment interactions. The PG course (taught by Aman) is Geography 010, Introduction to Physical Geography. This course introduces fundamental physical geography concepts, including many environmental science topics which figure centrally in major environmental issues. Both courses are general education courses. While geography majors do take these courses, most of the students enroll in the courses to fulfill general education requirements; these general education students come from a broad range of majors and represent all class years.

Our project implementations occurred during the summer semester of 2009. Summer courses at Penn State have lower enrollments than the regular fall and spring courses. During the summer 2009, the HEG and PG courses had nine and 17 students respectively, whereas during the fall and spring semester, these courses generally enroll over 100 students.

The low enrollments of our courses enabled heightened instructor attention to each student. Providing comparable instructor attention with larger enrollments would mean more work for the instructor (and any teaching assistants). Or, there could be less individual attention for students. Our experience indicates that many students can succeed in this project with little attention. However, some students did have difficulty designing an appropriate project and might struggle without rapid and consistent feedback and suggestions for their plans.

On the other hand, larger enrollments present opportunities for collaboration and peer review. Students who select similar issues and activities could be grouped together for collaborative learning, such as to review one another's proposals and reports, resulting in valuable learning for all involved without much instructor input. Or, in a variation of the project model presented here, students could perform the project as a group, making consensus decisions about the project and submitting one multiple-author set of reports. This variation heightens interaction among students and reduces the total number of assignments to be graded by course faculty. Indeed, one of us (Baum) has since successfully implemented this group variation in an offering of the HEG course with 175 students (see Baum, 2009). Thus we are confident that a project such as this can succeed in courses with larger enrollments.

In our summer 2009 PG and HEG courses, activities and issues chosen by students in both versions of this project spanned the spectrum of environmental issues. In the HEG version, students changed their transportation habits, food choices, and water consumption. Other students produced environmentally-friendly goods such as local food and furniture made from reclaimed materials. Students connected these activities to a variety of issues including climate change, fossil fuel depletion, waste reduction, and deforestation. They also argued that their activities had a positive environmental impact using several different ethical views. Core views used include anthropocentric ethics, which emphasizes impacts to humans, ecocentric ethics, which emphasizes impacts to ecosystems, and non-anthropocentric utilitarianism, which emphasizes impacts to the wellbeing of all conscious, sentient animals, including but not limited to humans. In the PG version, students explored environmental issues ranging from habitat fragmentation to pollution to invasive species. They performed a variety of activities including photojournalism, direct involvement with scholars in the field, and volunteer work with local

groups addressing these issues. Table 1 presents some more of the projects that our students implemented.

Societal issue	Activity	Ethical View	Public forum
Climate change	Bicycling instead of driving	Anthropocentric & ecocentric hybrid	Email forward
Climate change	Conserving water	Anthropocentric	Email forward
Climate change	Living/eating vegan	Non-anthropocentric utilitarianism	Centre Daily Times
Climate change	Walking instead of driving	Anthropocentric	Bucks County Courier Times
Green design	Reclaimed building materials	Anthropocentric	Online forum
Local food	Community gardening	Anthropocentric util-itarianism	Facebook
Oil conservation	Bussing instead of driving	Anthropocentric	Online forum
Waste	Reusable water bottles	Anthropocentric	Interaction with high school students
Deer overpopulation	Interview with local park con-servation personnel	n/a	YouTube video
Habitat fragmentation	Photojournalism documentary of roadkill	n/a	Informational poster
Honeybee Colony Collapse Disorder	Tour of entomology facilities, interview of field researchers	n/a	Letter to state represen-tative
Invasive species	European water chestnut re-moval	n/a	Informational poster posted at city hall
Lawn pesticide use	Interview of golf course groundskeeper	n/a	Informational handout
Plastic bag waste	Tour of waste treatment facili-ty	n/a	Informational webpage
Solar energy	Tour of model solar home	n/a	Informational poster
Stormwater runoff	Accompanying graduate re-searcher on test site visits	n/a	Cleaning/polishing storm drain dumping signs

Table 1: A sample of project activities performed in both of our versions of the project. The first eight (those listing an ethical view) are from the HEG version. The last eight are from the PG version; these do not list an ethical view because the ethical view was not part of the PG project design.

In implementing this project we attempted to maximize the cognitive, affective, and ethical impacts on students by harnessing the pedagogical power of fieldwork and public scholarship approaches. In doing so, the project successfully met each of the five goals listed above.

GOAL #1: Expose students to ways they can share what they have learned with others as public scholars.

Developing students as public scholars is a core goal of this project. The project was designed to give students firsthand experience in performing public scholarship. In addition, students learn different means of public scholarship from the experiences of their classmates as well as from the instructor. This exposure provides students a basis for further engagement throughout their lives as public scholars.

This goal of student public scholarship is met in our project mainly via the students' public forum presentation. For this presentation, students reflect on their project experiences and then present the experience to the public forum of their choice. Chosen forums include newspapers (see Ferry, 2009; Roseman, 2009), community discussion websites, the Facebook social networking website, the YouTube user-generated video website (see Roethel, 2009), and email distribution lists. (Table 1 contains a complete list.)

The success of the project at developing students as public scholars can be seen in the public scholarship itself. For example, one HEG student wrote the following in a letter to the editor of the Bucks County Courier Times:

> "After doing some research on greenhouse gas emissions I decided I would not drive for two weeks... Living in an area where things are fairly close benefited me... Not having a car is not without its problems however. One day I had an appointment 43 miles away and only had a short time to make it there. Since there were no buses at the time I needed, and because biking and walking were out of the question, I had no choice but to drive.… Not only is walking healthier for you, it also saves our environment. If everybody chose even one day a week not to use their cars, we would be emitting less CO2 into the atmosphere, thus helping our environment and mankind" (Roseman, 2009).

In her account, this student makes a set of observations and arguments that reflect, in a concise and accessible fashion, core ideas taught in the HEG classroom and further insights gained from the project experience. The student discusses classroom material on the influence of the form of the urban area we live in on our choice of transportation modes (for example, walking is more appealing when destinations are nearby) and the impact of transportation mode choice on our health and on the environment. The student also shares insights from her project experience by describing the challenge of making an appointment 43 miles away. This sort of personal anecdote can be very effective in conveying to the public what it is actually like to take an action like reducing automobile usage. A classroom lesson can describe the existence of this sort of phenomenon, but it is much more powerful when the student can speak from her own experience.

Project success can also be seen from student feedback. For example, a PG student, who studied the Great Pacific Garbage Patch and met with an on-campus student recycling organization, wrote in the project progress report:

> "Throughout the semester, I have been working with the student group Helping Across the Community (HAC)… While working with [HAC] I have also learned new ways to raise awareness, and have been given the tools to inform my friends and family about being responsible for our environment."

Taken together, these comments indicate that at least some of the students are both learning how to act as public scholars on environmental issues and becoming motivated to continue such action throughout their lives as students and citizens.

In general most students in our courses seemed to appreciate the opportunity to share their experiences with others. Since a goal of public scholarship and of this project in particular was for students to acquire the habit of being engaged citizens beyond the context of this course; the practical experience provided by this project was invaluable.

GOAL #2: Enable students to connect course material with societal issues and conditions in their everyday lives

The course project allows students to make connections between the topics covered in the course and the circumstances of their daily lives. To support these connections, the project must be well integrated with the rest of the course. Connecting the project to the rest of the course can serve several purposes. Insights from the project can help students learn other course content. Likewise, insights from other course content can be drawn on for the course project, including for the hands-on activity and the public scholarship presentation. By making these connections, students enhance both the public scholarship nature of the project and the traditional classroom learning that is meanwhile taking place.

This goal is achieved both through careful selection of project topics and through broader efforts to integrate the project into the rest of the course. For project topic selection, students have considerable autonomy to select topics of personal interest and relevance. In the HEG course, one student began to build a bookshelf out of a reclaimed door (reclaimed from a building being torn down) because this relates to her architecture major. Another student chose to be vegan for a week because she was already interested in societal issues related to food. In the PG course, one student chose the impact of plastic grocery bags on the environment because he noticed that more and more people were using reusable grocery bags and he was curious as to the positive impact this trend may have. Another student chose the topic of invasive species and connected with a local Boy Scout troop from his hometown to help remove invasive European water-chestnut from a local river system.

Meanwhile, instructor approval ensures that the topics chosen are feasible and appropriate for the course. For example, one HEG student proposed having class outside on a sunny day to conserve classroom energy. Though creative and relevant to course material, this proposal did not fit with existing classroom plans. Thus, upon instructor request, the student selected a different activity. In the PG course, a student who initially chose to explore the issue of land pollution proposed picking up trash at a local nature reserve as her activity, however it was clear from her proposal that she had not completed the necessary research to ensure that this was an appropriate match of topic and activity. For example, she offered no evidence that pollution is an issue at that particular location, leading the instructor to believe that her choice was more about personal convenience than fulfillment of the project goals. In general however, these cases were the exception: despite having relatively little background in environmental education (as is typical for introductory courses), most students embraced the project and were fully capable of autonomously identifying, designing, and implementing projects that proved not only feasible and appropriate for the course but also creative and challenging.

In addition to the pedagogical benefits of students connecting the project to their personal lives, the project also enhances traditional classroom instruction. For instance, we observed that

individual students looked forward to specific lecture topics and class activities that related to their project. When lecture material touched on their topic, students perked up in class and were especially active note-takers, asking pertinent and sometimes pointed questions about material presented. Furthermore, as students began to complete their project activities, they became valuable sources of information for their peers, serving as a dynamic complement to instructor-provided material.

Finally, the project was incorporated into other aspects of the course, including quizzes and exams. For example, the HEG course included an essay question on the final exam that asked students to discuss the overall sustainability of humanity drawing on insights from the course project as well as insights from classroom content. The resulting student essays demonstrated a sophisticated ability to connect their personal lives, classroom content, and major environmental issues.

GOAL #3: Allow students to directly experience some aspects of professional environmental work

One important role of introductory courses is to help students decide which scholarly fields and careers to pursue. Our project thus was designed to expose students to some aspects of professional environmental work, so that students can make better informed decisions about their directions of study and careers. While this exposure can be especially useful for students choosing environmental fields and careers, it is nonetheless useful for all students in their capacities as educated citizens engaged on environmental issues.

To accomplish this goal, our project gives students an experience resembling the design and execution of many professional environmental projects. For instance, students are required to identify an environmental issue, choose an activity that relates to the issue, and justify their choices in the form of a proposal reviewed by the instructor. During the course of the project, students submit several reports on their progress on performing the activity and analyzing the issue. Finally, by the end of the semester, students must produce project deliverables in the form of reports to the instructor and their work of public scholarship, regardless of obstacles that they encounter along the way.

To provide students with further insight about professional work, students in the PG course had the opportunity to reach out to environmental professionals in a variety of settings, including those on campus. One student accompanied a graduate student as she collected field data for her dissertation work on flood control systems in the area around campus. Another student talked at length with researchers studying honeybee colony collapse disorder and was encouraged by those researchers to write to her state representative in fulfillment of the public forum portion of the project. One student commented that the project gave her a unique opportunity to interact with professors and graduate students outside of their teaching capacities, and that the researchers' passion for their chosen topic helped to bring the project's societal issue to life.

Finally, it should be noted that students' experiences imitating and interacting with professionals had strong affective impacts. Students experienced the frustration of not being able to reach important contacts, of having initial project ideas fall through, and of not being able to accomplish as much as they initially hoped in the available timeframe. Students complained of sunburns, sore hands, and soggy shoes. On the other hand, students also experienced the surprise and excitement of the process – from meeting people who are passionate about addressing

environmental problems, to discovering how complicated and varied the research process can be, to sharing stories of their work with friends and classmates. These affective impacts are important experiences in that they give students a fuller appreciation of what professional environmental work is like.

GOAL #4: Build student enthusiasm for learning about and responding to environmental issues outside of the classroom.

Student enthusiasm can help inspire students to remain engaged as environmental public scholars beyond the course. Without any enthusiasm, they are likely to continue with their lives just as they would have without the project. Thus it is important for coursework to not just ask students to respond to environmental issues, but also to have students do so in a way that leaves them interested in doing more. In terms of the Israel (2009) schema (Figure 2), this goal is primarily affective as opposed to cognitive or ethical.

To achieve this goal, a great deal of organization and communication is required on the part of the instructor. In both our classes, we took great care throughout our project to communicate expectations in a clear and detailed manner, including our expectations around student effort, creativity and risk-taking. Additionally, in the PG version of the project, up to twenty percent of each project assignment grade was devoted to effort and creativity. The purpose of this emphasis was to encourage students to become emotionally invested in their project. This investment would in turn build motivation and enthusiasm for the project and by extension environmental topics more generally.

Based on our various interactions with students in both courses, we believe this approach was largely successful. We observed student enthusiasm for the project throughout the semester. For instance, an HEG student wrote in the final project assignment:

> "Overall, it was a good and educational experience. I feel proud that I was able to stick the activity the whole time. I also feel good knowing I was helping animals and the planet."

Likewise, one student in the PG class who ultimately chose to study flood control systems sent the following email:

> "The idea of researching Pennsylvania's major threat of a natural disaster really interests me...I think I could really gain some good insight into this and I look forward to getting started. Thanks so much for getting me off on the right foot."

Although the activities performed and levels of investment differed among students in our courses, we were pleased to find that many students reported similar experiences and feelings, suggesting that the project largely achieved our goal of building enthusiasm.

GOAL #5: Provide the public with insights from students' scholarship that are relevant to contemporary environmental issues.

Last but not least, the project aims to have at least some impact on the public through the students' public scholarship activities. Central to our project design is the conviction that

students have something valuable to contribute to public discourses on environmental issues, even students at the introductory level. By including student participation in public deliberations as a core component of the project, we aimed to make these deliberations more educated and inclusive of more people and perspectives.

The public gains insights from the project mainly via the students' public forum presentations. As people read students' emails and letters to the editor, or watch their videos, or view their informational posters, they learn from the students' experience about the issue at hand. Because students are specifically asked to present those aspects of the project that they consider to be most relevant to public discussions, these presentations may contribute valuable insights to such discussions, at least to the extent that students succeed in communicating effectively.

Given the diffuse nature of public interactions with the public forum presentations, our ability to assess the presentations' impacts on the public is limited. We in general do not know which people encounter any given public forum presentation, let alone how the presentation impacted them. A detailed study of people who were vs. were not exposed to the presentations could be informative but is beyond the scope of the present study.

That said, evidence does indicate that the students' presentations have been encountered by members of the broader public. For example, the YouTube website lists the Roethel (2009) video as having generated 139 views between its initial posting on 9 August 2009 and 26 May 2011, and the Bucks County Courier Times showed 19 comments submitted by readers of the Roseman (2009) letter to the editor (as of 8 July 2009). In both cases, while we do not know the impact of the presentation on viewers or readers, we can see that it has been seen by an audience outside the classroom, and therefore has much more potential to impact public discussions than traditional course projects that do not involve public scholarship.

Conclusion

Undergraduate education has an important role to play in addressing urgent environmental issues by preparing citizens and professionals to respond constructively to them. The tradition of field education in geography and cognate fields provides a powerful tool toward this end, by engaging students directly with local environmental issues. But independent, creative field projects are typically reserved for upper-division major students. Furthermore, these field projects often do not connect students' environmental instruction to societal issues. Meanwhile, geography's participation in the public scholarship and service-learning movements (and the re-vision of fieldwork along those lines) also is helpful, but has again been largely restricted to senior students.

In this paper, we have presented a course project for introductory environmental courses suitable for geography and other fields that teach about various aspects of environmental issues. The project prepares the broad range of students in these courses to be productively engaged with environmental issues as both professionals and citizens. But the project is not only preparation: it involves real-time, active engagement between the student, the public, and the world at large. Our experience shows that introductory geography undergraduates can handle sophisticated, independent projects, and that these students can benefit greatly from such an experience. Therefore, this project shows one significant way that undergraduate education can play a role in helping society respond effectively to environmental issues. In doing so, the project offers an important innovation in environmental pedagogy.

In the two courses for which we implemented the project, we found that the project successfully met its five core goals. Through the project's public forum presentation, students learned ways in which they can act as public scholars, and the public also gained some insights from the students' experience. By selecting project topics of personal and professional relevance, students we able to use the project to identify connections between course content, societal issues, and their personal lives while gaining some firsthand experience in environmental professional work. Finally, the creative nature of the project allowed students to become enthusiastic for learning about and responding to environmental issues. To be sure, we have only implemented this project in two courses and have not studied the impacts of the project in exhaustive detail. However, the initial evidence presented here indicates that the project contributes to the goal of developing students as environmental public scholars.

As we have discussed in this paper, the field of public scholarship is continuing to grow, and educators are exploring new ways of incorporating public scholarship components in their courses. In terms of environmental education, much future research remains to better understand how course projects can facilitate public scholarship on environmental issues. At present, we have relatively little information on how this sort of project affects students, the public, and the environment; however, we believe the pressing nature of today's environmental problems requires a creative, aggressive, immediate response from all levels of educational instruction. With its rich history of synthesizing human-environment interaction and incorporating fieldwork into instruction, geography is well-positioned to contribute positively to a multifaceted educational response. We have presented our project as an example of how these components can be incorporated into introductory geography classes, but ultimately we hope that our experiences can be generalized to related courses in ecology, environmental studies, ethics, geology, political science, and others. The responsibility of informing and preparing society to respond to environmental concerns is best shared among many, as ultimately, environmental issues affect us all.

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